JAPAN INTERNATIONAL COOPERATION AGENCY
(DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA)
(MINISTRY OF FORESTRY, IRRIGATION AND MAHAWELI DEVELOPMENT)

BASIC DESIGN STUDY REPORT

ON

RURAL INFRASTRUCTURE IMPROVEMENT PROJECT

IN WALAWE LEFT BANK AREA

IN

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

DECEMBER 1993

NIPPON KOEI CO., LTD.

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PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a basic design study on Rural Infrastructure Improvement Project in Walawe Left Bank Area and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team headed by Mr. Narihide Nagayo, Agricultural Development Specialist of JICA, and constituted by members of Nippon Koei Co., Ltd , from July 22 to August 19, 1993.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Sri Lanka in order to discuss a draft report, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the teams.

December 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

December 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

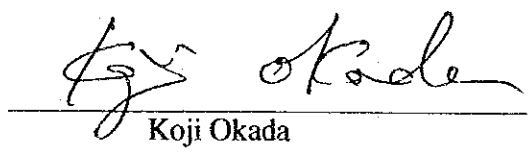
We are pleased to submit to you the basic design study report on the Rural Infrastructure Improvement Project in Walawe Left Bank Area in Democratic Socialist Republic of Sri Lanka.

This study has been made by Nippon Koei Co., Ltd. under a contract to JICA, during the period from July 20, 1993 to December 17, 1993. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA and the Ministry of Foreign Affairs. We also wish to express our deep gratitude to the officials concerned of Mahaweli Authority of Sri Lanka of Ministry of Forestry, Irrigation and Mahaweli Development, JICA Sri Lanka Office, and Embassy of Japan in Sri Lanka for their close cooperation and assistance during our field survey.

Finally we hope that this report will contribute to further promotion of the project.

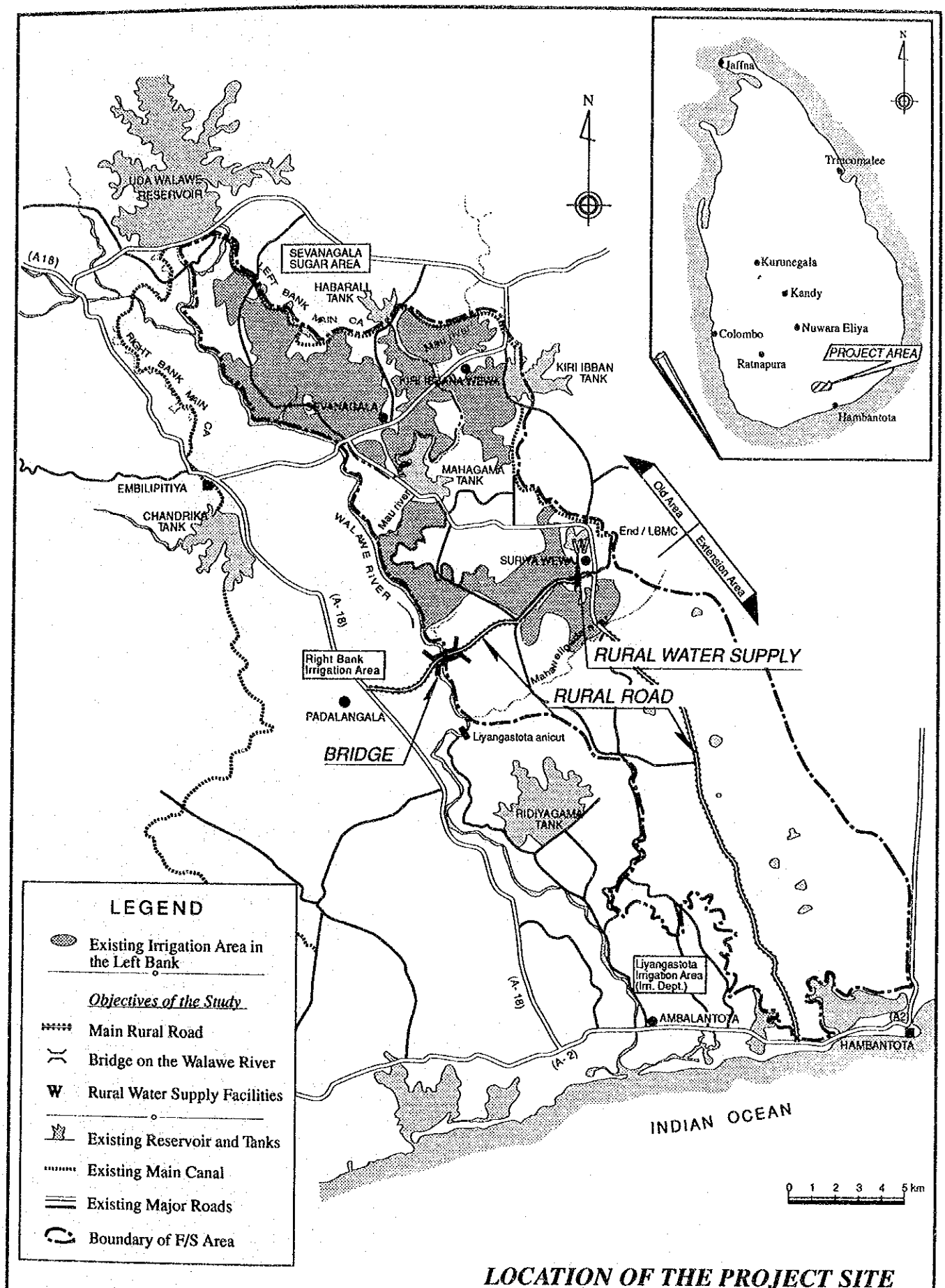
Very truly yours,



Koji Okada

Project Manager,
Basic design study team on
Rural Infrastructure Improvement Project in
Walawe Left Bank Area

Nippon Koei Co., Ltd.



LOCATION OF THE PROJECT SITE

BASIC DESIGN STUDY ON
RURAL INFRASTRUCTURE IMPROVEMENT PROJECT
IN WALAWE LEFT BANK AREA

SUMMARY

Summary

Sri Lanka is an island country with an area of 65,610 km^2 and a population of 17.2 million in 1990. The population growth rate during the last decade was 1.5% and Gross National Product (GNP) per capita in 1992 was US$ 553.

In the Public Investment Programme (PIP), there is a greater focus on the agricultural sector than in the past. It covers almost a quarter of Sri Lanka's GDP and agricultural development is expected to play a pivotal role in keeping the cost of living down, enhancing rural incomes and saving, providing raw materials to the industrial sector, and reducing pressure on migration to urban areas. The rural population which is 75% of the national population is mainly engaged in the agricultural sector. Provision of adequate infrastructure to meet the growing demands of industry, agriculture, and an expanding population, will be one of the main planning concepts of PIP. However, due to the financial constraints on the Government, as well as the policy of promoting greater private sector participation in the development activities, the main focus will be on attracting private capital, mainly foreign investment, to undertake tasks.

Road transportation accounts for over 80 % of transportation in Sri Lanka. The country has a road network of approximately 86,000 km, of which about one-third is paved by asphalt. The road improvement projects covering A and B class roads are being undertaken with the financial assistance of the Asian Development Bank (ADB) and International Development Association (IDA) . On the other hand, the improvement and construction of rural roads are nonexistent due to the inadequacy of funds.

Sri Lanka has achieved an overall coverage of 20 % on average throughout the country, of which 60 % is urban population and 10 % rural population, in relation to pipe borne water supply facilities which are safe for drinking water supply. The Government has adopted the ambitious international target of providing adequate water supply and sanitation facilities to the total population by the year 2000. However, provision of water supplies in rural areas is still very slow due to financial constraints on the Government. The Government has been making real efforts to provide safe water to the total population by employing the financial assistance of international agencies and foreign countries.

The Government of Sri Lanka began the Uda Walawe Project in 1963, which aimed at irrigation development and transmigration in the southern area. The right bank area was developed in the 1970s and 1980s with the financial assistance of ADB, while the left bank, with a gross area of 30,000 ha, was only partly developed. The Government of

Sri Lanka decided to further develop the left bank and complete the Uda Walawe scheme as originally planned. In response to the request of the Government of Sri Lanka, the Japan International Cooperation Agency (JICA) conducted a feasibility study on this left bank development project in 1991 and 1992.

The feasibility study report proposed an agricultural development plan including (i) rehabilitation and improvement of the existing irrigation facilities; (ii) irrigation development in new areas; and (iii) improvement and construction of rural infrastructure. The report judged that rural infrastructure in the existing irrigated areas was at an acceptable level. However, rural infrastructure in the non-irrigated areas, like on the left bank of the Walawe river, was seriously lacking. The report emphasized the provision of road network and water supply facilities in the area.

In February 1993, the Government of Sri Lanka requested Grant Aid from the Government of Japan, for the implementation of urgently required components of rural infrastructure development to fulfil basic human needs. In response to the request, the Government of Japan decided to execute a Basic Design Study, and JICA sent the Study Team (the Team) to Sri Lanka. The field survey was conducted by the Team in a period of 29 days from July 22 to August 19, 1993.

The Mahaweli Authority of Sri Lanka (MASL), Ministry of Forestry, Irrigation and Mahaweli Development, will be the executing agency for the Project, and will coordinate all activities with the other government agencies. Two agencies of MASL, namely the Mahaweli Economic Agency (MEA) and the Mahaweli Engineering and Construction Agency (MECA) will be the channels through which MASL will carry out the Project. MECA, which specializes in engineering and construction, will assist with the civil works component. At present MECA is supervising the Right Bank Rehabilitation Project funded by ADB. MEA will be responsible for the provision of necessary administrative services during the construction stage and operation of the project facilities after the completion of the Project, until they are handed over to the line agencies.

MASL intends to hand over the Project's facilities to the Road Development Authority (RDA), the state agency responsible for maintaining roads falling within the national network of roads, and to the National Water Supply and Drainage Board (NWSDB), the state agency responsible for maintaining water supply schemes in the country. It is anticipated that the procedures, which include confirmation by RDA and NWSDB that the facilities have been designed and constructed according to their standards, will take about two years for completion. During this initial period, MEA will operate and maintain the

project facilities. The fund for the operation and maintenance (O&M) will be provided in the annual budgets of MEA/MASL. After the handing over of the facilities, they will be operated and maintained by both RDA for routes A-2 and A-18 and NWSDB for one of the water schemes managed by NWSDB.

The objective of the Project is to upgrade the living standards of the settlers in the Project area through the improvement of 2 rural main roads, 31.2 km long in total and construction of a bridge across the Walawe river. The Project will improve the rural road network in the Walawe area and contribute to the realization of the Southern Area Development Program. In addition, the Project also aims to provide safe drinking water through the construction of water supply facilities including an intake structure, purification plant, distribution tank, pipeline between the purification plant and distribution tank, public taps, and the procurement of water tankers. The Project will contribute to the rural water supply program in the country and southern area development of the Government.

The Project consists of two components : (i) improvement of main rural roads to upgrade living standards and activate local economic activities ; and (ii) provision of water supply facilities to supply safe drinking water to Suriyawewa town and its surrounding area. The prospective stretches of the road improvement are 31.2 km long in total consisting of the East-West (E/W) road of 12.4 km and North-South (N/S) road of 18.8 km. On the E/W road, one bridge, 90 m long across the Walawe river, will be constructed to connect the right and left bank areas. The treatment capacity of the water supply facilities will be 1,200 m^3/day and their design population will be about 57,000. The implementation of the Project will be carried out in two stages taking into account the scale of the construction works, work quantity, time required for the completion of the work, and climatic conditions of the Project area. Facilities and equipment which will be constructed and purchased under the Project are tabulated below:

Item	Stage I	Stage II	Q'ty
A. Main Rural Road			31.2 km
Work	N/S road (18.8 km, construction up to the base course)	E/W road (12.4 km, construction up to the pavement) Asphalt pavement for N/S road (18.8 km)	
Main features	Effective width of 6 m with an asphalt pavement (total width of 10 m) Related structures : 14 nos.	-do as left- Structures : 40 nos.	
B. Bridge across the Walawe River		Total length of 90 m Total width of 9 m PC girder type	1 no.
C. Water Supply Facilities			
Intake	At the Gal tank		1 no.
Purification plant	Capacity of 1,200 m^3/day		1 no.
Distribution pond	Overhead tank of 600 m^3		1 no.
Pipeline	DCIP (150 mm)		1.2 km
Public taps	Within Suriyawewa town		11 nos.
D. Procurement of Equipment	Spare parts for the purification plant Purification chemicals for one years use	Water tankers, 6,000 lit. Spare parts for the tankers	4 nos.

The direct benefit expected by the implementation of the Project is the improvement of the living standards in the rural areas and the indirect benefit expected is the activation of social and economic activities in the areas. Problems faced, countermeasures under the Project, and benefits expected by the Project are as follows:

Improvement of the main rural roads

The E/W road which connects, by the shortest distance, Suriyawewa and the right bank area, where social infrastructure has been developed, is in poor condition

with narrow and bumpy stretches and sections that cannot be passed by jeeps. Since there are no road bridges on the Walawe river, only pedestrians can cross the river on foot during the dry season. The N/S road, which is located in the southern part of the left bank area, connects Suriyawewa and Mirijjawala by route A-2. The road is in a very unsatisfactory condition, especially in the rainy season, because it is unpaved. Due to the poor condition, inhabitants in the area have faced difficulty in their daily life in relation to medical treatment, education, and transportation of agricultural products and inputs.

The Project will upgrade the living standards of the inhabitants in the left bank area through the improvement of the 2 rural main roads, 31.2 km long in total and construction of a bridge across the Walawe river. Due to the improvement of the rural road network in the Walawe left bank area, it is expected that agricultural activities in the area will be activated and accessibility to the right bank area and capital city of the District will be improved. It is estimated that about 30,000 people along the roads will receive direct benefit from the Project and about 100,000 people will receive indirect benefits.

Water supply facilities

The Government policy toward water supply is to supply safe water to the whole population by the year 2000. Raw water in the irrigation canal from the Uda Walawe reservoir, which is turbid and polluted by coliform bacillus, has been supplied without treatment to Suriyawewa town and its surrounding areas. The present service population of the existing supply system is estimated at 1,400 people. Most of the farm families and inhabitants who are not connected to the pipe network of the system have private shallow wells. However, groundwater is unsatisfactory in terms of water quality and yield, especially in the dry season. The Project will provide water supply facilities to supply safe water to the area. Beneficiaries of the Project are estimated at about 57,000 people comprising 2,240 through house connection to the pipe network, 14,560 through public taps, and about 40,000 through supply by water tankers.

It is concluded that the implementation of the Project under Japan's Grant Aid is justifiable from the following points of view:

- Numerous direct and indirect beneficiaries, at least 30,000 people;

- The rural infrastructure of the area has remained untouched due mainly to the delay in irrigation development. To improve living conditions and public welfare in the southern part of the left bank area, the implementation of the Project is urgently desired;
- The O&M system of the Project facilities is judged to be reliable because MASL, RDA, and NWSDB are the state line agencies for development and have sufficient experience and staff. MASL and other agencies will smoothly implement and operate and maintain the Project facilities;
- The Project will significantly contribute to the improvement program of social infrastructure of the on-going Southern Area Development Program as well as the national development plan of the Government.

Through the field surveys and subsequent analysis and studies in Japan, it was clarified that the Project would significantly contribute, directly and/or indirectly, to the promotion of rural infrastructure improvement in the Walawe left bank area as well as in Sri Lanka. Further, it was confirmed that the Government of Sri Lanka strongly intends to implement the Project and will make appropriate arrangements for the implementation, and O&M of the Project facilities. Therefore, early implementation of the Project is eagerly desired.

To ensure the smooth implementation of the Project and the proper O&M of the Project facilities, the following recommendations were made to the Government of Sri Lanka:

1) To secure and clear the land necessary for the construction of the Project facilities prior to commencement of the construction;
2) To provide the land for temporary site offices and works, quarrying stone materials, and borrowing and disposing of soils;
3) To execute construction works necessary for the Project implementation including land clearing of the site for the purification plant, fencing of the purification plant yard, and extension of the electricity supply line to the purification plant site;
4) To arrange the necessary budget for the implementation of the Project, O&M of the constructed facilities, and to establish the organization of the Project facilities.

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CHAPTER 1
INTRODUCTION

1. INTRODUCTION

The Government of Sri Lanka (GOSL) regarded the Walawe left bank area as one of the top priority areas and requested technical assistance from the Government of Japan in undertaking a feasibility study on the Walawe Irrigation Upgrading and Extension Project (Left Bank). In response to this request, JICA conducted a feasibility study on this project in 1991 and 1992. The Study Team, in compliance with the policy of GOSL, proposed an agricultural development plan including (i) rehabilitation and improvement of the existing irrigation facilities; (ii) irrigation development in new areas; and (iii) improvement of rural infrastructure. In February 1993, GOSL made a request for Grant Aid assistance to the Government of Japan for the Rural Infrastructure Improvement Project in the Walawe Left Bank Area (the Project).

The Ministry of Foreign Affairs deemed the Project's objective roughly appropriate for the Japanese Grant Aid program and decided to hold a study to examine the viability of the Project. JICA, the government organization in charge of international cooperation with developing countries, decided to conduct a Basic Design Study (the Study) and sent the Study Team (the Team), headed by Mr.Narihide Nagayo from JICA to Sri Lanka from 22 July 1993 to 19 August 1993. The Team had discussions with the executing agency of GOSL, and investigated and surveyed the Project area to clarify the present rural infrastructure conditions, and confirm the background and contents of the Request, organization of the execution body, and O&M plan of the Project.

The request was examined and discussed by the ministries concerned in Japan prior to preparation of the Inception Report. The necessity of urgently implementing the requested components has been recognized. However, it was judged that the requested road from Suriyawewa to Mirijawila (N/S road) was not appropriate as a grant aid project, since (i) the number of people who would profit from the N/S road would be small; and (ii) there is the possibility that the improvement of the existing road would accelerate and/or encourage encroachment on the Extension area of the Walawe Left Bank Irrigation Project which was scheduled to be implemented by the GOSL in the near future. It has been decided that the requested contents except for N/S road would be the subject of the Study. However, through the series of discussions with the executing agency (MASL, Ministry of Forestry, Irrigation and Mahaweli Development) of GOSL and field reconnaissance surveys, the Team recognized the necessity for and background of the improvement of the N/S road. Therefore, it was judged by the Team that all the items requested by GOSL should be the subject of the Study. It was agreed between

and the Team that the Study would cover: (i) improvement of the main rural roads of 31 km; (ii) construction of a bridge across the Walawe river; (iii) provision of water supply facilities with a capacity of 1,000 m^3/day at Suriyawewa town; and (iv) procurement of equipment including water tankers. The Minutes of Discussion are attached in Appendix-1.

The itinerary of the field survey in the country and members of the Team are given in Appendixes 2 and 3,.and a list of personnel contacted is given in Appendix-4.

After full utilization of the results of the field investigations and discussions, the Team examined the rationale and viability of the Project and carried out the Study, including selection of required equipment and materials, estimation of the implementation cost, and formulation of a basic plan for O&M of the Project. This report presents the comprehensive results of the Study.

CHAPTER 2
BACKGROUND TO THE PROJECT

2. BACKGROUND TO THE PROJECT

2-1 Background to the Project

Sri Lanka is an island country with an area of 65,610 km^2 and a population of 17.2 million in 1990. The population growth rate during the last decade was 1.5% and Gross National Product (GNP) per capita in 1991 was US$ 526.

The target economic growth during the period 1993-1997 in the Public Investment Programme (PIP) has been set at an average annual rate of 6.4 %. According to PIP, this target is an attainable target which will ensure a substantial reduction in unemployment and a considerable increase in the standards of living. There will be a continuing commitment to a liberal market oriented economy. In PIP, there will be a greater focus on the agricultural sector than in the past. It covers almost a quarter of Sri Lanka's GDP and agricultural development is expected to play a pivotal role in keeping the cost of living down, enhancing rural incomes and saving, providing raw materials to the industrial sector, and reducing pressure on migration to urban areas. The rural population which is 75% of the national population is mainly engaged in the agricultural sector.

Unemployment is one of the most serious problems in the country. In 1990, the total labor force in Sri Lanka was 7 million, of which 1 million or 14% was unemployed. The unemployment ratio was particularly high in the densely populated southwestern districts such as Colombo, Kegalle, and Hambantota. Special effort is being made by the Southern Area Development Program in order to accomplish employment targets.

Provision of adequate infrastructure to meet the growing demands of industry, agriculture, and an expanding population, will be one of the main planning concepts of PIP. However, due to the financial constraints on the Government, as well as the policy of promoting greater private sector participation in the development activities, the main focus will be on attracting private capital, mainly foreign investment, to undertake tasks.

Road transportation accounts for over 80 % of transportation in Sri Lanka. The country has a road network of approximately 86,000 km, of which about one-third is paved by asphalt. Road maintenance has not been adequately funded and periodic maintenance has been neglected. Hence, the highest priority recently has been given to the rehabilitation of roads and not to the construction of new roads. The construction, rehabilitation, and maintenance of trunk and main (A and B class) roads are the responsibility of the

Government, while the Provincial Councils assume responsibility for C, D, and E class roads. The road improvement projects covering A and B class roads are being undertaken with ADB and IDA assistance On the other hand, improvement and construction of rural roads are nonexistent due to inadequacy of funds.

The Government has adopted the ambitious international target of providing adequate water supply and sanitation facilities to the total population by the year 2000. Investment through the lead implementing agency, the National Water Supply and Drainage Board (NWSDB), was around 95 %. At the end of the Water Supply and Sanitation Decade, proclaimed by the United Nations in 1980, Sri Lanka had achieved an overall coverage of 20 % in the country in relation to pipe borne water supply facilities which were safe for drinking water supply, of which 60 % was urban population and 10 % rural population . In the Hanbantota district, a master plan of drinking water supply and sanitation was prepared by the Ministry of Planning Implementation in 1986. The plan proposed to implement 20 water supply schemes including the Suriyawewa scheme. However , higher priority was given to the coastal towns and the Suriyawewa scheme has never been started.

2-2 Outline of the Request

The Government of Sri Lanka began the Uda Walawe Project in 1963, which aimed at irrigation development and transmigration in the southern area. The right bank area was developed in the 1970s and 1980s with the financial assistance of ADB, while the left bank with a gross area of 30,000 ha was only partly developed. About 4,400 ha have been reclaimed so far in the northern half, but in the southern half thorn scrubland still remains where unproductive chena cultivation has been practiced on small patches of land. In order to recover the past investment and ease the ever increasing population pressure in the south of the country, GOSL decided to further develop the left bank and complete the Uda Walawe scheme as originally planned.

JICA conducted a feasibility study on this left bank project in 1991 and 1992. The Study Team proposed an agricultural development plan including: (i) rehabilitation and improvement of the existing irrigation facilities; (ii) irrigation development in new areas; and (iii) improvement of rural infrastructure. Although GOSL is willing to apply to the Government of Japan for loans for the majority of the Project, GOSL requested Grant

Aid from the Government of Japan, for implementation of urgently required development components to fulfil basic human needs.

Through a series of discussions with MASL, the contents of the request made by GOSL were confirmed as the following:

(i) Improvement of the main rural roads :

Improvement of 2 routes (N/S and E/W roads), 30.5 km long in total, having an effective width of 6 m with an asphalt pavement, including construction of one bridge across the Walawe river (90 m long) and other related structures;

(ii) Provision of a Rural Water Supply :
Construction of water supply facilities at Suriyawewa town comprising an intake structure, purification plant, and related structures with a design capacity of 1,000 m^3/day.

(iii) Procurement of water tankers, etc.:
Provision of 2 water tankers (6,000 lit. each) and miscellaneous items such as spare parts and purification chemicals, etc

2-3 Outline of the Project Area

(1) General conditions

The Walawe Left Bank Area (the Area) is located on the left bank of the Walawe river in the southern dry zone of the country about 180 km southeast of Colombo (approximately 6° North Latitude and 81° East Longitude). Two main routes connect Colombo with the Study Area: one is the A-2 which follows the west coast and enters the southern part of the Project area and the other is a combination of the A-4 and A-18 which passes Ratnapura.

The Area extends over about 30,000 ha of land comprising the Old area and the Extension area. The Old area occupies about 15,000 ha of the northern sector where an irrigation system has already been constructed and people are settled. There is one township, Suriyawewa, two village centers, and several hamlets which are interconnected by a network of main and secondary roads. The Extension area lies to the south of the Old

area also occupying about 15,000 ha. The total population of the Area is estimated at 95,000.

The administration of the Area comes under the purview of three organizations, namely, the holding company of Sevanagala Sugar Industries Ltd., Mahaweli Economic Agency (MEA) of MASL and the Southern Provincial Council/Government Agent (GA) Hambantota. The Walawe basin, managed by the River Valleys Development Board (RVDB), was declared a Special Area under the Mahaweli Act of 1979 and its administration, excluding the Sevanagala sugar cane area and the undeveloped Left Bank area, was brought under the purview of MEA of MASL under the Ministry of Forestry, Irrigation and Mahaweli Development from 1982. Administration of the Extension area was carried out by GA Hambantota through the Assistant Government Agents (AGA) of Hambantota, Suriyawewa, and Ambalantota. With implementation of the Provincial Government system, the AGA offices have been converted to Divisional Secretariats administered by the Provincial Secretary. The Central Government policy administration is retained by GAs.

The socio-economic survey of 1991 revealed that farmers in the irrigated area earned an average net income comparable to those in the right bank area. The lower average farm incomes of some farmers were compensated by off-farm income they earned from part-time work and so on. The farm economy survey of 1992 in the Extension area revealed that 62% of the inhabitants received Government subsidies, of which 35.6% were Janasaviya recipients, and 27.1% were on food stamps. 44% of the total annual income of the Janasaviya beneficiaries was derived from the assistance they received under the programme. The living conditions of the food stamp recipients were much lower than that of the Janasaviya beneficiaries.

(2) Natural conditions

The topography of the area is a mixture of undulating to rolling slopes and flat bottomed valleys. The altitude varies from about El.70 m in Suriyawewa town to nearly sea level (El. 7 m) in the south. A large number of natural streams and channels provide a fairly good system for surface drainage and most parts of the area are free from drainage problems.

The natural vegetation is of the Dry Zone Mixed Evergreen Forest type, with individual trees reaching a height of approximately 20 to 25 m, and some dense stands. In the

northern half of the left bank area, most of the forest was cleared when the area was developed. Most of the arable land is used for sugar cane with irrigation and paddy cultivation with irrigation . Whereas, the southern half is covered by secondary forest having been subjected to chena farming by means of shifting cultivation after clearance of the secondary forest over many years. Much of the forest contains trees which are less than 10 to 15 m tall with small crowns, forming a fairly open stand with light undergrowth.

The Walawe river originates in the mountain range west of Balangoda and drains into the Indian Ocean near Ambalantota. It is 105 km long and has a drainage area of 2,442 km^2. The major tributaries are the Weli river, Timbolketiya river, Hulanda river, and Mau river. The northern and western parts of the Walawe basin are mountainous areas and belong to the wet zone. The eastern and southern parts are plains and belong to the dry zone.

The Uda Walawe dam and Samanalawewa dam were constructed on the Walawe main stream. The two dams, having regulating capacities of 240 MCM and 218 MCM, and catchment areas of 1,152 km^2 and 338 km^2, respectively, provide regulated water for management of the Walawe river.

The Project area has annual rainfall of approx. 1,000 mm. Rainfall is concentrated in October - January (Maha season) and March - May (Yala season). A summary of the meteorological data at Angunakolapelessa observatory is presented in Table 1.

Monthly runoff at the bridge site is estimated based on the runoff data of the Timbolketiya river , since the Timbolketiya river is the main tributary of the Walawe river which flows into the river downstream of the reservoir. According to the estimate, the average monthly river runoff from May to September is less than 10 m^3/s and the maximum of over 30 m^3/s occurs in January.

Surface water of the Walawe river can be used for drinking and irrigation purposes. On the contrary, a majority of the existing deep wells yield small quantities of water and indicate a higher electrical conductivity and concentration of fluorides than specified in the WHO standards for drinking water.

The geological units that have occurred in and around the Area comprise the Highland Series (the Charnockite Series), the Vijayan Series of Precambrian age, and the

Quaternary sediments. The Area is covered mostly with the gneisses of the Vijayan Series and Quaternary sediments consisting mainly of sandy soils. There are considerable sand deposits along the Walawe river that could be used for concrete aggregate. The aggregate crushing values of the rock materials (gneisses) indicate that the materials are not hard enough to be used for high strength concrete, however, are hard enough to be used for other concrete. Charnockite of the Highland Series is conceived to be a good rock material, and can be designated as an alternative rock material, but it would be costly to use because of the long haulage distance. The road embankment will be mainly made of the Pleistocene deposits located near the road construction work site. The road metalling materials, however, shall be borrowed from the sources such as the charnockite of the Highland Series or gneisses of the Vijayan Series.

(3) Existing rural infrastructure

The Walawe irrigation area extends over both banks of the Walawe river and draws water from the Uda Walawe reservoir. Downstream of the Uda Walawe dam, two main canals serve the left and right banks of the lower Walawe basin through a mini hydropower generation station. The irrigation area of both banks of the Walawe river is estimated at 12,900 ha in total in the last 5 years, comprising a right bank area of 8,800 ha and a left bank area of 4,100 ha. The main irrigated crop in the system is paddy, covering 11,200 ha (87%). The other irrigated crops are sugar cane, bananas, and other upland field crops.

The main road in the Uda Walawe area is Route A-18 which is located on the right bank of the Walawe river running from north to south. This road is connected to the A-2 road at Nonagama. These two routes lead to Colombo. The Extension area has one main road which connects Suriyawewa and Mirijjawala. This road connects to the A-2 road at Mirijjawala, located in the southern part of the Extension area and the A-18 road at Embilipitiya via Suriyawewa. Internal roads are systematized for connecting tank to tank or village to village and villages are located near tanks. Another road which accesses the right bank area by the shortest distance is the E/W road. However, since there are no road bridges on the Walawe river, only pedestrians can cross the river on foot during the dry season. These roads are in poor condition with narrow and bumpy stretches and sections that cannot be passed by jeeps, this is especially true in the rainy season as they are unpaved.

No drinking water supply facilities are in existence in the rural areas. Public tube wells, private wells, and streams are the predominant sources of drinking water. Most farm families have private wells which are about 10 m deep with a water depth of 1.0 - 3.0 m. Some of them, however, dry up in the drought season. Though the public pipeborne water supply system is operated by MEA/MASL at Suriyawewa town, no water treatment facilities have been fitted to the system. Raw water diverted from the irrigation canal is supplied through the pipe network. The present capacity of the system is approx. 135 m^3/day and the service population is estimated at 1,400. Similarly, MAE/MASL has supplied untreated water as drinking water using water tankers to areas where neither distribution pipe networks nor irrigation canals exist. The target population of the water distribution by the tankers is approx. 40,000 and the unit supply amount is 18 lit/week at present. Due to a lack of tankers, water supply by tankers is unsatisfactory.

Power is generated by the hydropower station at the Uda Walawe dam. It is distributed to Hambantota and Tangalla. For distribution, the power is first reduced from 33 kv to 11 kv at Kiriibanwewa. Only 3 centers in the left bank area are provided with electricity: the sugar factory village and Kiriibanwewa, and Suriyawewa towns.

It is considered that the basic rural infrastructure in the Old area has been developed to a minimum level. However, the level of basic infrastructure is extremely low in the Extension area. The Feasibility Study Report stated that construction of most types of rural infrastructure was required, including a drinking water supply system and education, communication, health, and marketing facilities in parallel with the implementation of irrigation and drainage facilities.

CHAPTER 3
OUTLINE OF THE PROJECT

3 OUTLINE OF THE PROJECT

3-1 Objectives

The Project has two main objectives:

(1) Improvement of main rural roads

The objective of the Project is to upgrade the living standards of the settlers in the Project area through improvement of 2 rural main roads, approx. 31 km long in total and construction of a bridge across the Walawe river. The Project will improve the rural road network in the Walawe area and contribute to the realization of the Southern Area Development Program.

(2) Provision of a rural water supply

The Project aims to provide safe drinking water through construction of water supply facilities including an intake structure, purification plant, distribution tank, pipeline between the purification plant and distribution tank, and procurement of water tankers. The Project will contribute to the rural water supply program in the country and southern area development of GOSL.

3-2 Study and Examination of the Request

(1) Improvement of the main rural roads

One request by GOSL is to improve two main rural roads of approximately 31 km in total. One road (E/W road) runs westward from Suriyawewa town and reaches Route A-18 on the right bank after crossing the Walawe river. The other road (N/S road) runs southward from Suriyawewa and reaches Route A-2 on the coast. The basic dimension of the road requested is a 6 m effective width, with an asphalt pavement. The construction of one bridge across the Walawe river (approx. 90 m) and related structures are included. It is noted that a stretch of the N/S road of approx. 5 km where an asphalt pavement has been laid is excluded from the request. MASL is planning to hand over O&M of the roads and bridge, which will be improved and constructed under the Project, to RDA, the state line agency for road development and maintenance.

The requested effective width of 6 m is appropriate for two heavy trucks to pass each other on two lanes, referring to the design standard of RDA for Classes A and B roads. Since existing roads in the Project area are paved by the conventional tar pavement method which requires little initial investment, but a lot of periodic maintenance, it is judged that an asphalt pavement is the proper pavement for the Project which aims at reducing the budgetary burden and future maintenance work.

The bridge across the Walawe river will be an important structure in connecting the right and left bank areas. In general, the superstructure of the bridge is divided into concrete and metal types. Considering the (i) alleviation of future maintenance work; (ii) experience of concrete type bridge construction in the Project area; (iii) existence of reliable foundation layers at a shallow depth; and (iv) no earth quakes in the area, a concrete type bridge is adopted for the Project. A pre-stressed concrete (PC) type was selected through comparative study of PC and reinforced concrete (RC) types.

(2) Provision of a rural water supply

Another request by GOSL is to provide water supply facilities at Suriyawewa town with a supply capacity of approx. 1,000 m^3/day, including (i) an intake structure; (ii) purification plant; (iii) distribution tank; and (iv) conveyance pipeline from the purification plant, and (v) distribution tank. It was noted, as mentioned in the Minutes of the Meeting attached to this report, the extension work of the distribution network would be implemented by MASL, under its responsibility and its own budget, to meet the supply capacity of 1,000 m^3 within ten (10) years after completion of the construction.

Since the present water supply facility at Suriyawewa has no purification plant, raw water is supplied without any treatment. Water for the facility is diverted from the Gal tank, which is located about 1 km northward and its water is supplied from the Walawe Left Bank Main Canal. According to the results of the water quality analysis for the tanked water, some water quality indicators were in excess of the desired levels for potable water such as turbidity and coliform organisms. Purification of raw water is necessary to supply safe drinking water to the area. The minimum treatment facilities required are settling , filtration, and disinfection facilities.

The capacity of the facilities is estimated at 1,200 m^3/day, which is a little larger than the requested capacity of 1,000 m^3/day. The required capacity is estimated based on the

(i) future population of the Suriyawewa town; (ii) the movement of population into the town from the left bank area; (iii) unit water supply amount; and (iv) amount of water to be distributed by the water tankers. The provision level and grade of the facilities is planned by referring to the existing water supply facility in Embilipitiya on the right bank.

Though they are not requested by GOSL, public taps will be provided in the township area for increasing the beneficiaries of the water supply facilities which will be constructed under the Project at the initial stage and for the transition period from the completion of the construction to the completion of the extension work of the distribution network by MASL.

(3) Procurement of water tankers, etc.

Another request by GOSL is to procure (i) four water tankers with a 6,000 lit. capacity each to distribute safe water to the areas where neither distribution pipes nor canal networks have been constructed; (ii) spare parts for the purification plant and water tankers; and (iii) treatment chemicals such as calcium hypo-chilorite and alum for the initial operation.

It is judged that water tankers are indispensable equipment to distribute safe drinking water produced at the water supply facilities of the Project to the areas where distribution pipes have not been provided and the quality of groundwater is unsuitable for potable water. In addition, spare parts and treatment chemicals for the initial operation are also required for smooth and successful O&M of the Project execution.

(4) Impact on the environment

The Environmental Impact Assessment (EIA) for the left bank agricultural development project was carried out in the feasibility study stage. According to the assessment of the EIA, the area is covered by secondary forest, thus no important flora exists which should be protected. Regarding fauna, the conservation of elephants was issued in EIA report. However, this issue could be solved by provision of electric fencing and evacuation of elephants to more suitable areas such as national parks. Provision of rural roads and water supply facilities under the irrigation development project was welcomed in EIA report since the Project would improve living standards and upgrade sanitary conditions in the area. Study results on the environmental impact of the road improvement and

provision of water supply under the Project are summarized in the form of a check list as shown in Table-2.

3-3 Project Description

3-3-1 Executing Agency and Operational Structure

MASL will be the executing agency for the Project, coordinating all activities with the other government agencies. Two agencies of MASL, namely MEA and MECA will be the channels through which MASL will carry out the Project. MECA, which specializes in engineering and construction, will assist with the civil works component. At present MECA is represented in the Walawe area by a Resident Project Director who is supervising the Right Bank Rehabilitation Project funded by ADB. MEA will be responsible for the provision of necessary administrative services during the construction stage and operation of the Project facilities after completion of the Project, until they are handed over to the line agencies.

On completion of the roads and water supply facilities, they will be operated and maintained by MEA. MEA will maintain them through the management structure of the Resident Project Manager (RPM) of the Uda Walawe area. The RPM has a Deputy RPM (Engineering) in charge of O&M of the engineering works who has technical staff for these activities. The fund for O&M will be provided in the annual budget of MEA/MASL. MASL will then initiate action to hand them over to RDA, the state agency responsible for maintaining roads falling within the national network of roads, and to the National Water Supply and Drainage Board (NWSDB), the state agency responsible for maintaining water supply schemes in the country. It is anticipated that the procedures, which include confirmation by RDA and NWSDB that the facilities have been designed and constructed according to their standards, will take about two years for completion. During this initial period MEA will maintained the Project facilities.

3-3-2 Plan of Operation

The Project consists of two components, namely: (i) improvement of main rural roads to upgrade living standards and activate local economic activities; and (ii) provision of a rural water supply to supply safe drinking water to Suriyawewa town and its surrounding area. The prospective stretches of the road improvement are 31.2 km long in total

consisting of E/W road of 12.4 km and N/S road of 18.8 km. The pavement width of the roads will be 6 m and the total width will be 10 m including a shoulder width of 2 m on each side. On E/W road, one bridge of 90 m long across the Walawe river will be constructed to connect the right and left bank areas. The treatment capacity of the water supply facilities will be 1,200 m^3/day and their design population will be about 57,000 people.

3-3-3 Outline of Facilities and Equipment

The facilities and equipment which will be constructed and purchased under the Project are summarized below:

Item	Specifications	Unit	Scale
A. Improvement of the main rural roads			
1. Total length of two roads	Asphalt pavement	km	31.2
2. Width of the roads	Pavement width of 6 m, total width of 10 m		
3. Related structures	Culverts and short span bridges	nos.	54
B. Construction of one bridge across the Walawe river			
1. Length	3 spans	m	90
2. Width of bridge	Traffic way of 6 m, total of 9 m		
C. Water supply facilities at Suriyawewa			
1. Intake structure	At the Gal tank	no.	1
2. Purification plant	Capacity of 1,200 m^3/day	no.	1
3. Distribution tank	Elevated tank (600 m^3)	no.	1
4. Conveyance pipe	between the purification plant and distribution tank	km	1.2
5. Public taps	Taps and distribution lines	nos.	11
D. Procurement of equipment, etc.			
1. Water tanker	Capacity of 6,000 lit	nos.	4
2. Spare parts	For the water tankers and purification plant	LS	1
3. Chemicals	Water treatment chemicals for one year period	LS	1

3-3-4 Operation and Maintenance Plan

(1) Roads and bridge

Daily and periodic inspections of the roads and bridge will be made by the inspectors of RDA on the same manner as for the A-2 and A-18. Since the road surface is paved by asphalt, no maintenance will be required for several years, unless there is serious erosion of the road shoulder and/or specially heavy traffic passing such as caterpillar vehicles. Routine maintenance will be required for repairing the shoulder and dredging of the side

drain. The annual O&M cost of the roads and bridge is estimated at about Rs. 700,000 and its breakdown is shown in Table-3.

(2) Water supply facilities

Suriyawewa water supply scheme will be operated and maintained by NWSDB as it is one of the water schemes managed by them. The facilities will be operated and maintained by 12 staff comprising one manager, three operators, one accountant, five drivers of water tankers, and two watchmen.

The life of the facilities is estimated at 20 years. Considering the wear on the bearing and other mechanical portions of the plant, the supply of spare parts will be required. It is planned that chemicals will be provided for the treatment process for the initial operation period of one year and related spare parts will be available. The annual O&M cost is estimated at Rs. 2,047,000 and its breakdown is shown in Table-3.

3-4 Technical Cooperation

It is considered that the facilities and equipment to be provided by the Project are not special and complicated ones and will be maintained and managed in a good condition and in a routine manner by RDA (roads and bridge) and NWSDB (water supply facilities). It is judged that technical cooperation will not be required for O&M of the facilities.

CHAPTER 4
BASIC DESIGN

4. BASIC DESIGN

4-1 Basic Design Concepts

The gap between living standards in the right bank area and those in the left bank area is rather large. The former area already has a developed irrigation system but the latter area is still developing. The objectives of the Project are: (i) improvement of the road and bridge connecting both river bank areas and the road running from north to south in the Project area; and (ii) improvement of the safe and hygienic domestic water supply system in Suriyawewa town, which is the base town for development of the left bank area.

The Project area has little undulation but has gentle slopes with eroded valleys in some parts. Meteorologically, it is in the dry zone having an average annual rainfall of some 1,000 mm, but the rainfall is concentrated in two rainy seasons. Much attention was paid to the rainfall when deciding the construction plan, especially for the construction of the Walawe bridge.

The Project area belongs to the special development area covered by Mahaweli Law, and the development plan should be approved by MASL, the executing agency which manages the construction of facilities and operation in the initial stage after construction. The construction works and land acquisition will be expected to be carried out smoothly. In the right bank area, an irrigation improvement project has been implemented by ADB for more than a decade, and many skilled laborers have immigrated from outside areas. The skill brought by them is not transfered to common laborers, thus there are a lot of unemployed common laborers in the southern part of the left bank area and it will be easy to employ them for the Project. As the construction material available in Sri Lanka is limited to common civil construction material and the construction period is extremely tight, the water supply system, material for the bridge, and some construction machinery will be imported from Japan.

The construction of the main rural roads requires more than 100,000 m^3 of crushed stone and the construction period is short. Accordingly, a new crushing plant is proposed which will operate in parallel with the existing plant. A topographic survey, material test, and soil survey etc. necessary for the detailed design and construction supervision will be conducted by local firms under the supervision of the Consultant as far as judged through the basic design study.

Road projects and water supply projects are executed by Sri Lankan state agencies such as MASL, RDA, and NWSDB, but their finance is not sufficient. The Project facilities are designed so that operation will be economical and maintenance easy. The main rural roads in the Project area are designed as asphalt-paved ones taking into account that they will be the trunk roads in the Project area and the O&M work will be minimized. The water supply system is designed by referring to the scale and system of that in Embilipitiya, the major town in the right bank area, and in accordance with the water quality criteria of Sri Lanka.

The construction work covers various components such as the road improvement of 31 km, Walawe bridge, and water supply facilities in Suriyawewa, and the work volume is large. Accordingly, construction will be divided into two stages. The construction components in each stage are shown below:

Stage-I	Stage-II
Improvement of N/S road (19 km, up to the base course)	Improvement of E/W road (12 km, with pavement)
Water supply facilities in Suriyawewa	Pavement of N/S road
Procurement of water purification chemicals, etc.	Construction of the Walawe bridge
	Supply of four water tankers, etc.

4-2 Improvement of the Main Rural Roads

4-2-1 Study and Examination of the Design Criteria

(1) Design concept

In the Project, two (2) roads, such as E/W road and N/S road, will be improved. E/W road starts from Suriyawewa town, the base town for agricultural development in the Walawe river left bank area, and reaches Route A-18 national road which runs across the Project area from north to south, totaling 12.4 km. N-W road also starts from Suriyawewa and runs southward reaching Route A-2 national road, with a total length of 18.8 km. On N/S road, a stretch of 5 km from Suriyawewa has already been improved and will not be included in the Project. It is expected that E/W and N/S roads will connect Route A-2 and Route A-18 passing through Suriyawewa and the road network will contribute to local development.

(2) Condition of the main rural roads

In Sri Lanka, roads are classified into the following four (4) categories:

Class A	:	The first class national roads connecting big cities such as provincial capitals. Route A-2 and Route A-18 are also categorized in this class.
Class B	:	The second class national roads, connecting major cities such as district capitals
Class C	:	Paved provincial roads.
Class D	:	Other unpaved roads.

According to the criteria of RDA, the same design criteria is applied to Class A to Class C roads if the traffic is as light as less than 2,500 vehicles a day.

The planned roads in the Project will function as Class B roads connecting Embilipitiya and Ambalantota through Suriyawewa and the effective road width of 6 m can be applied in accordance with RDA criteria. As both the E/W and N/S roads are unpaved with clayish soil at present, the road surface becomes muddy and unpassable in the rainy season. To accomplish the Project objectives, the roads need to be all-weather and asphalt-paved. Considering that MASL will transfer the maintenance to RDA after construction of the roads, a certain grade (Class B national roads) will be required for the transfer and the roads can be well maintained in the future.

(3) Design criteria

In Sri Lanka, there are no proper design criteria and basically, British Standards (BS), Britain was the former suzerain, are being applied. In the Project design, RDA criteria is applied to basic values such as road width, design velocity, radius, and gradient in order to conform to the maintenance method and traffic running condition of the existing roads. On the other hand, Japanese standards will be applied to the asphalt pavement as requested by RDA.

(4) Route selection

E/W road runs from Suriyawewa on the left bank of the Walawe river and reaches Route A-18 which runs from north to south along the right bank of the Walawe river, incorporating the Walawe bridge crossing the Walawe river. The existing operation road

of the irrigation canal (Baddewewa branch canal) on the left bank will be improved and it will reach the Walawe bridge site. Villages already exist along the route. On the right bank, the road runs through the existing improved irrigation area. Two routes were studied such as the north route, utilizing the existing irrigation canal operation roads, and the south route. It was concluded that the north route would be 20 % longer than the south route and not economical, and it would be difficult to align smooth routes in the villages. Accordingly, the south route was selected.

As the existing N/S road in the southern part of the left bank area is well routed and has no topographic problems, the route will be adopted as it is.

(5) Design traffic volume

The design traffic volume was determined based on the traffic survey of Route A-18 and the existing N/S road because conducting a survey on the proposed roads was impossible. The survey points were: (i) the junction of Route A-18 and the proposed road; and (ii) the town boundary of Suriyawewa to N/S road. The survey was conducted for 14 hours from 6:00 a.m. to 8:00 p.m. every day for one week. The night traffic volume was estimated at 30 % of the daytime traffic volume as route buses make up some 60 % of the daytime traffic. The survey results for large size vehicles are summarized below;

Route A-18	Daytime (14 hours)	377	27 cars/hour on average
	Nighttime (10 hours)	81	
	Total (one day)	458	
N/S Road	Daytime (14 hours)	43	3 cars/hour on average
	Nighttime (10 hours)	9	
	Total (one day)	52	

According to MASL, who conducted the traffic survey, 30 % of Route A-18 traffic and 100 % of N/S road traffic will use the proposed road. Based on this estimate, the traffic volume of the proposed road will be as follows:

Traffic from Route A-18	458 x 30 % =	137
N/S road	=	52
Total	=	189

As the proposed roads are designed with two lanes, the traffic volume per lane will be 95 cars/day. In the design, the life of the road is set at 10 years and the average traffic volume during its life will be the design traffic volume. MASL forecasts that the traffic

volume will increase at a rate of 15 % annually. According to these conditions, the design traffic volume is 222 cars/day and the asphalt pavement will be designed for Class A traffic (more than 100 and less than 250 cars/day).

(6) Design surface elevation of E/W road in the left bank area

A 4.6 km stretch of E/W road in the left bank area runs along an irrigation canal. This canal is proposed in the F/S report to be improved and widened to increase the discharge. The surface elevation of the road will be designed taking into account the proposed canal cross section and water level of F/S report.

4-2-2 Basic Design

(1) Road cross section

The standard cross section of the proposed roads will be as shown below;

Gross road width	:	10.0 m
Roadway width	:	6.0 m
Shoulder width	:	2.0 m for each side
Cross slope	:	3.0 % for the asphalt-paved portion 5.0 % for the shoulder
Total Pavement thickness	:	0.55 m
Surface course thickness	:	0.05 m, asphalt concrete
Base course thickness	:	0.15 m, graded regulating crushed stone, modified CBR ≥ 80
Subbase course thickness	:	0.35 m, crusher run, modified CBR ≥ 30
Embankment shoulder slope	:	1.5 : 1, embankment less than 3 m
Excavation shoulder slope	:	1.0 : 1

Note CBR : California Bearing Ratio

(2) Road alignment

Road alignment was designed in accordance with Sri Lankan criteria (RDA standard) as follows:

Alignment/Condition	Flat area		Sloped area	
	Standard	Minimum	Standard	Minimum
Road category		Class B		
Design traffic volume (cars/day)		0 - 500		
Design speed (km/hr)	70	50	50	40
Minimum curve radius (m)	180	80	80	60
Maximum slope (%)	4	4	8	10
Minimum sight distance (m)	110	70	70	50

E/W road is considered flat for its whole length and undulating portions in N/S road are categorized as sloped areas. Minimum figures in the table are applied in populated towns.

(3) Thickness of the pavement

The thickness of the pavement is determined for Class A traffic and is based on the soil condition (CBR) of the base and subbase courses. Graded regulating crushed stone with a modified CBR of more than 80 will be used for the base course and crusher run with a modified CBR of more than 30 for the subbase course. For embankment of the subgrade, qualified soil available near the route with an expected design CBR of more than 3 will be used. The design CBR for the subgrade will be determined for each portion applying the equation shown below. CBR values of the original ground are listed in the table below and CBR of No. 3 in E/W road shows an extraordinarily high value. It is considered that this does not represent the prevailing soil character and it is discarded. Similarly, No. 5 in a paddy field shows an inapplicable value for the subgrade. However, it will be replaced with embankment material for more than 1.0 m which will be expected to have CBR of more than 3 and CBR of the embankment material is adopted.

E/W Road			N/S Road		
Point	CBR (%)	Remarks	Point	CBR (%)	Remarks
No. 1	4.1	Left Bank/Existing Road	T-15	4.9	Existing Road
No. 2	3.6	Left Bank/Existing Road	T-11	3.1	Existing Road
No. 3	24.6	Left Bank/near the Existing Road	T-12	3.8	near the Existing Road
No. 4	4.4	Right Bank/Upland Crop Field	T-18	5.8	near the Existing Road
No. 5	2.6	Right Bank/Paddy Field	T-22	4.9	near the Existing Road
No. 6	3.5	Right Bank/Existing Road (Embankment)			
Average CBR	3.72	Discarded No. 3 Replaced No. 3 with 3.0	Average CBR	4.50	

Though CBR test results on N/S road conducted in F/S were also available, the number of samples was only two (2) for the total length of 20 km. The results around the road were also taken into consideration this time. The design CBR values are as follows:

E/W Road : Design CBR = 3.72 - (4.1 - 3.0) / 2.48 = 3.3 → 3

N/S Road : Design CBR = 4.50 - (5.8 - 3.1) / 2.48 = 3.4 → 3

where, Design CBR = Average CBR for the Route - (Maximum CBR - Minimum CBR) / d_2

d_2 : Coefficient of the Standard Deviation = 2.48 (The number of data = 5)

On the basis of the above conditions, the thickness of the pavement is obtained as shown below. The required pavement thickness (TA) discussed here means the total thickness applying the surface course instead of the base course and subbase course.

Determination of pavement thickness

Design CBR	Required Pavement Thickness TA (cm)	Components of the Pavement (cm) Surface Course $a_1 = 1.00$	Base Course CBR ≥ 80 $a_2 = 0.35$	Subbase Course CBR ≥ 30 $a_3 = 0.25$	Remarks
2	21	5	25	30	1) Required pavement thickness is for Class A.traffic
3	19	5	15	35	
4	18	5	20	25	
6	16	5	10	30	2) Min. surface course thickness is 5 cm.

$TA' = a_1T_1 + a_2T_2 + a_3T_3 \geq TA$

where, TA' : coefficient of the equivalent value of the design section (cm)

a_i : coefficient of the equivalent value (cm)

T_i : thickness of each layer (cm)

TA : required pavement thickness (cm)

(4) Related structures

Related structures to be improved or constructed in the Project are as follows:

E/W Road

- Pipe Culvert	38 nos.	ø 300 - ø 1,200
- Box Culvert	2 nos.	2.5 m x 1.0 m - 2.6 m x 2.2 m (Twin)
- Lined Side Ditch	4.5 km	

N/S Road

- Pipe Culvert	12 nos.	ø 500 - ø 1,200
- Bridge (apart from the Walawe Bridge)	2 nos.	1-span, L = 10 m

4-3 Bridge across the Walawe River

4-3-1 Establishment of the Design Conditions

(1) Design criteria

In Sri Lanka, highway bridges are being designed, constructed, and maintained in accordance with BS, which are different from the requirements stipulated in the Specifications of Highway Bridges in Japan. The live loads stated in BS are HB load and HA load. HB load ranges from 25 units to 45 units, and the Walawe bridge is classified as a Class B road which is to be designed with 25 units of HB load in the category of RDA that is responsible for road maintenance.

In the Japanese specifications, the requirement of the ultimate limit state is stipulated, even though safety factors are different from those of BS. The design section forces at the center of the span which are caused by the first class truck loading, and HA with 25 units of HB loading are shown in the following:

Section forces	L-20	HA	HB (25 units)
Mmax (t-m)	1,196	1,232	713
(Max. bending moment)	(100)	(103)	(60)
Ra (t)	165	170	111
(Max. Shearing force)	(100)	(103)	(67)

The design section force of the former loading case is less than that of the latter case, because considering the bridge width and span length, HA and HB loads are never surcharged at the same time, and only one HB vehicle load can be surcharged on the Walawe bridge. Moreover, considering the load factor (γ_{fL}) of the ultimate limit state, the section force caused by HA loading is almost the same as the value caused by the first class truck loading of the specifications.

Thus considering the above reasons, and that the Walawe bridge will be constructed under Japanese Grant Aid, it is proposed that Japanese standards will be used for the rational design and construction.

(2) River characteristics

The total catchment area of the Walawe river is 2,442 km^2 and the bridge site is located 5 km upstream from the Liyangastota weir. The catchment area at the bridge site is estimated at 2,200 km^2 and the river is in natural condition with a river slope of 1/2,300. The rainfall pattern in the basin varies widely and is broadly divided into the rainy and dry seasons. The rainy season is called Maha and occurs from October to January, while the dry season, Yala, is from February to September.

Flow capacity of the existing river was estimated based on the river cross section survey, for a total distance of 5 km from the bridge site to Liyangastota weir, since there is no river improvement plan for the Walawe River. Based on the results, the river flow capacity at the bridge site is approximately 300-500 m^3 /sec, while the capacity at the site of the Moraketiya bridge located upstream and the Ambalantota bridge located downstream is about 405 m^3/sec and 700 m^3/sec, respectively.

Based on the influence assessment of the high water level due to backwater caused by the Liyangastota weir using nonuniform flow analysis, it is concluded that the high water level at the bridge site will not be affected by backwater, since the flood discharge will overflow 1-2 km upstream of the Liyangastota weir when the discharge is over 130 m^3/sec.

The design flood discharge at the bridge site is estimated at about 390 m^3/sec, having a 50 year return period and the high water level will be 26.60 m above sea level. Based on the field observation at the site, it is possible to contain floating debris and sediment load in the floods. Thus, it is prudent to provide a 1 m freeboard in addition to the high water level.

4-3-2 Basic Design

(1) Bridge width and alignment

The bridge width consists of a carriageway of 6 m and sidewalks of 1.1 m at both sides. Thus, the total bridge width is 9.0 m including the curbs at both sides.

The bridge is part of E/W road in principle, but the alignments of the bridge approach at both sides have not been fixed yet. Therefore, it is planned that a straight bridge will be built.

(2) Bridge length and span length

The river conditions at the site are natural as there are no man-made dikes and the width is about 90 m on average. In the bridge planning, it is important not to disturb the smooth river flow with river piers and abutments and not to affect river control. The clogging of bridge openings due to floating debris is a dominant cause of river disasters, thus span arrangements should be carried out properly. According to the Specifications for River Structures in Japan, it is recommended that a minimum span length of more than 4 times the length of an average piece of driftwood be provided. Span arrangements will be determined by taking into account the construction cost, job site conditions, and river characteristics.

If a 2 span bridge is applied, there will be no special problems concerning bridge hydraulics, but large-scale erection equipment would be required, hence it would not be possible to complete the work within a fiscal year. If a 3 span bridge, which was recommended in F/S, is applied, the span length would be 30 m with 2 river piers. Under these conditions, an adequate bridge opening for driftwood can be maintained and the erection equipment is also of an appropriate scale. Therefore, a 3 span bridge will be applied in the Study.

(3) Bridge type

In general, bridge type is divided into concrete bridges and steel bridges. The advantages of steel bridges are: relatively easy erection, light load to the substructures, reliable quality, etc. Concrete bridges have relatively high durability compared with steel bridges

and also they require less maintenance, because rust and corrosion prevention is not necessary for concrete bridges, though steel bridges need to be painted periodically.

For steel bridges with a 30 m span length, the applicable bridge types are: simply supported composite steel girders, simply supported non-composite girders, continuous steel girders. However, steel bridge types are discarded based on the following reasons:

- Reliable steel bridge fabrication factories are not available in the country;
- Marine transport is required;
- The inland transportation route is limited;
- Periodic maintenance is required;
- The bearing stratum is located beneath the riverbed and spread footing can be applied; and
- Seismic force is not considerable.

Concrete bridges are broadly divided into RC and PC bridges. For about a 30 m span length, applicable types are PC structures in general. Even though PC bridges require high strength concrete, this is easily produced at job sites compared with obtaining steel materials in Sri Lanka, and PC bridges can be fabricated at the site provided there is proper supervision. Moreover, PC bridges require less maintenance, hence they are superior to steel bridges. For a PC bridge with a 30 m span length, possible types are PC post tension, T section girder bridges and PC post tension, composite I section girder bridges from economic and structural view points. Out of these types, the latter will be used for the Walawe bridge design based on the following reasons:

- the girders are light weight and more stable during fabrication and erection;
- flexible bridge surface geometry; and
- many have been constructed in Sri Lanka.

The material strengths to be applied to the PC post tension, composite I section girder bridges are as follows:

Concrete

Main girders	400 kgf/cm^2
Cross beams	350 kgf/cm^2
Deck slabs	240 kgf/cm^2

Tensile strength of PC wire

7- wire standard	180 kgf/mm^2
PC wire	170 kgf/mm^2

(4) Type of substructures

The substructures in the study consist of 2 abutments at each bridge end and 2 river piers. An abutment shall be located beyond the intersection point between the high water level and bank slope in principle. However, the bank line at the site is not so clear, therefore bank protection with a slope of 1:2 is provided 15 m up and downstream from the proposed abutments. The embedded depth of the footing shall be determined to meet these both requirements: (i) an adequate depth to provide bank protection at the top of the toe of the footing; and (ii) the footing base embedded into the bearing stratum. Thus, the height of the abutment will be about 12 m and an invert T type abutment will be applied accordingly.

One pier will be located in the river. An embedded depth of 2 m from the riverbed to the top of the footing will be applied to the right bank side pier considering the local scouring effect. A pier height of 10 m, with an oval section, will be applied in the Study. The bearing edge width in the bridge seat is determined by the allowable punching shear instead of the requirement stipulated in the Seismic Design Specification. The material strengths applied in the design are as follows:

Concrete	210 kgf/cm^2
Leveling concrete	160 kgf/cm^2
Yield stress of the rebar	3,000 kgf/cm^2 (SD30)

(5) Foundation

According to the subsoil investigation at the bridge site, loose sand and silty sand, derived from weathered bedrock, with N values of less than 10 were encountered near the surface. Underlying those soils, about 3-5 m below the riverbed, weathered rocks such as Precambrian charnockite and granite with N values of more than 50 were found with a layer thickness ranging from 4 to 7 m. Below this layer, fresh charnockite rock was found. The weathered rock stratum could be utilized as the bearing stratum for the spread footing. The maximum bearing reaction of the weathered rock is estimated at 60 tf/m^2 referring to the Highway Bridge Specifications of Japan. The ultimate bearing capacity

considering the inclined load is also calculated for checking purposes in accordance with the Specifications.

4-4 Provision of Rural Water Supply

4-4-1 Study and Examination of the Design Criteria

(1) General

The water source for the Project is the Uda Walawe reservoir (effective storage volume of about 240 x 10^6 m^3), and the distribution system (left bank main canal) and supplementary tank (Gal tank) are already completed. The scope of the Project is the water supply system after the Gal tank. The water supply system comprises "supply facilities" including a purification plant and "distribution facilities" to supply water to individual beneficiaries. The supply facilities consist of a Gal tank intake, purification plant, pumps, and pipeline to the distribution tower. The distribution pipeline, public taps, and water tankers make up the distribution system.

The water supply system of the Project consists of intake facilities, public taps, and water tankers. After construction of the facilities, water will be distributed through the existing pipeline network, public taps to be installed under the Project, and water tankers. The expansion of the pipeline system, to suit the Project capacity, will be carried out under the sole budget of the Government of Sri Lanka within 10 years. Until the completion of the pipeline system, so that many people may receive the service, as many hydrants as possible will be installed. Public taps will be fitted in public places such as markets, plazas, schools, and municipalities, etc.

(2) Number of beneficiaries

The beneficiary area is limited to Suriyawewa town where the pipeline and public taps will be furnished and its suburb area where water tankers will supply water. The beneficiary population is estimated according to MASL's guideline (Guideline on Design Criteria of Water Supply Scheme, Mahaweli Engineering & Construction Agency) forecasting the population for the next 20 years. The rate of population increase in and around Suriyawewa town is estimated at 2 % per annum. The floating (or daytime inflow) population is estimated at 5 % of the total population in the left bank area

(excluding the sugarcane area) referring to the Dehiattakandiya Water Scheme, a similar on-going project. The results are summarized below:

Target Population

Period	Within Suriyawewa township area	Around Suriyawewa township	Floating population
Present (1993)	7,500	75,000	3,800
20 years later (2013)	11,200	111,300	5,600

(3) Unit water requirement

The daily unit water requirement is estimated in accordance with MASL criteria and the floating population in reference to the Dehiattakandiya Township Water Scheme Design Approach, 1987 as follows:

Category	Daily unit water requirement	Population
House connection	180 lit./day/person (40 gpcd)	20 % of town population
Supply through public taps	45 lit./day/person (10 gpcd)	80 % of town population
Floating Population	2 lit./day/person	5,600 persons

(4) Daily water supply requirement

The daily water requirement is estimated based on the consumption in Suriyawewa town, water supply by water tankers, distribution loss (10 %), and a safety margin (15 % of the peak factor). The water supply requirement is, therefore, estimated at 1,200 m^3/day as described below, assuming that 20 % of the population receive water through house connection and 80 % through public taps:

<Consumption in Suriyawewa>

11,200 psn x 80 % x 45 lit/day = 403	say,	405 m^3/day
11,200 psn x 20 % x 180 lit/day = 403	say,	405 m^3/day
5,600 psn x 2 lit/day = 11.6	say,	15 m^3/day
	Total	825 m^3/day

<Water to be Supplied by Water Tankers>

As described in the following section, water to be supplied through water tankers is estimated at 110 m^3/day.

<Daily Water Requirement>

825 x 1.1 x 1.15 =	1,044 m^3/day		
110 x 1.15 =	127 m^3/day		
Total	1,171 m^3/day	say,	1,200 m^3/day

(5) Water treatment

The results of the raw water quality test conducted in the field survey and water quality standard in Sri Lanka are shown in Table-4. The turbidity and colon bacilli and ammonia content of the raw water exceed the Sri Lankan standard and the iron content also shows a figure slightly higher than the standard. A treating plant (coherence and purification) is proposed for these items.

4-4-2 Basic Design

(1) Intake

The water resource will be Gal tank, the same as at present. The left bank of the bund will be cut open and water will be diverted through the concrete pipe (ø 600) for maintenance convenience. At the inlet, a gate (ø 600) for maintenance and intake at low water level, and an inclined sluice gate (ø 300) for normal intake will be installed. Outside the bank, a receiving pit will be constructed which will function as a primary sedimentation tank and a net screen will be installed there to trap trash and weeds.

(2) Water treatment facilities

The objective of water treatment is to lower turbidity, pH, ammonia, iron, and colon bacilli and the method of purification will be rapid filtering considering the objective and purification level in the neighboring area. A schematic diagram of the purification process is illustrated in Figure 3. Aeration will be of the fountain type taking into consideration the removal of iron and appearance of the plant. The coherence, sedimentation, and filter facilities will be manufactured in Japan as semi-products and will be transported to the site and fabricated there so that the elaboration will be kept high and time can be saved.

At the site the electricity voltage is unstable and it fluctuates ± 20 % from the specified 230 V. An electricity control panel will be installed for the safety of the equipment. In addition, a shed will be constructed in the purification plant which will avoid direct sunshine so that weeds do not appear in the tank.

(3) Operation & administration house

The operation & administration house will consist of an office, control and operation room, transfer pump room, chemical storage room, chemical dosing equipment space and treated water tank and will be a 2-floor building with total space of 400 m^2. The foundations will be directly on the clayish sand (N=33), 3 m below the original ground elevation.

(4) Distribution pipe

Treated water will be boosted by pumps to the water distribution tower through a pipe (ø 150) laid under the road shoulder. Ductile cast iron pipe was selected to separate distribution/supply pipelines, lower the replacement cost, and longer the life of the pipe. The total length is about 1.2 km and two (2) air valves will be installed.

(5) Water distribution tower

To supply water to the end beneficiaries by gravity, a water distribution tower will be constructed. The existing tower will be demolished and a new one will be constructed at the same place. The existing pipes will be connected inside the plant. The capacity of the tower will be 600 m^3 per 12 hours considering the frequent power failures, though the Sri Lankan standard prescribes required volume for 6 to 12 hours. The low water level of the tower is set at El. 93.0 m, 20 m higher than the original ground elevation, in reference to the water supply network plan (Urban Development Plan in Suriyawewa) of MASL. The substructure will be column shape and the superstructure will be a PC tank with a diameter of 14 m and an effective water depth of 4 m. The foundations will be directly on the weathered rock (N>50), 4 m beneath the original ground surface. Hydrant stands for water tankers will be constructed inside and the yard will be paved with asphalt.

(6) Public taps

Eleven (11) public taps will be constructed at the following places:

1. School	2
2. Market	4
3. Block Office	2
4. Bus Stop Square	1
5. Hospital	1
6. Police	1
Total	11

4-5 Procurement of Water Tankers, etc.

(1) Water supply area

Water is now supplied in the left bank area including Suriyawewa town by two (2) water tankers. The beneficiaries are some 40,000 people (half of the total population of the left bank area) according to the MASL site office, i.e. 18 lit/person/week (2.57 lit/person/day). However, the number of water tankers is not sufficient, they are old, and the water cannot be supplied to the target population.

The target population to be provided with water by water tankers is set at 40,000 at present.

(2) Daily water supply requirement

The daily water supply requirement is estimated at 110 m^3/day, based on the target population and design unit water supply volume as follows:

Target Population	:	40,000
Design Unit Water Supply Volume	:	2.57 lit/person/day
Daily Water Supply Requirement	:	40,000 x 2.57 /lit/person/day = 103, say 110 m^3/day

(3) Required number of water tankers

The required number of water tankers is estimated at four (4), assuming that one water tanker with a capacity of 6,000 lit supplies water 5 times a day and the existing 2 water tankers remain on standby for emergencies (110 m^3 / 6 m^3 / 5 times = 3.7).

4-6 Implementation Plan

4-6-1 Construction Condition

The executing agency of the Project construction is MASL as described in Chapter 3. A Japanese contractor, that qualifies through a tender, will construct the Project facilities under the supervision of a Japanese consultant.

Most of the common materials necessary for construction are available in Sri Lanka, but special materials such as those for the water treatment plant and its related equipment, ductile cast iron pipes, valves, steel of large sections, and deformed reinforcement bars will be imported from Japan. As for construction machinery, the majority is available in Sri Lanka. However, due to the limited construction period, the machinery, which will be critical in the course of the construction schedule (concrete batching plant, asphalt plant, crushing plant, and so on), will be imported from Japan considering the quality requirement of the products, construction progress, avoiding unexpected accidents, etc.

The average annual rainfall is around 1,000 mm and there are dry and rainy seasons. Even in the dry season, however, the rainfall amounts to about 50 mm a month. The rainy seasons last from April to May and from October to November and there is more than 100 mm of rainfall a month. Annual workable days are estimated at about 218 days (18 days monthly, a work rate of 60 % on average) taking into account holidays and rainy days. The Project consists of water supply facilities and main rural roads including the Walawe bridge. As two (2) piers and abutments will be constructed in the Walawe river, the substructure of the Walawe bridge should be constructed during the dry season when river discharge is small.

For construction, huge amounts of course material and aggregate will be needed for concrete structures. The existing crushing plant 8 km north of Suriyawewa is not capable of producing such amounts of aggregate and it is doubtful that it could supply the necessary amount of about 110,000 m^3 of crushed stone during the construction period. For the Project, a new crushing plant will be constructed near a quarry along N/S road and it will supply crushed stone in line with the existing crushing plant.

The local construction skills are sufficient for general civil works and small structures, but laborers lack experience in large-scale PC structures and water treatment plants required in the Project. Therefore, some engineers/technicians shall be dispatched from

Japan. The topographic survey and soil testing for the detailed design can be conducted by local firms and these will be fully utilized.

The construction works will be executed in two (2) stages considering the construction work items, scale, work volume, natural conditions and administrative system of the Japanese Grant Aid. The reasons for stagewise construction works are summarized below:

(i) The Walawe bridge will be constructed in Stage II because the substructure has to be constructed during the low water level season.
(ii) The water supply plant will be constructed in Stage I so that the water supply can be commenced as early as possible, because its construction is hardly affected by meteorological conditions.
(iii) Construction of the main rural roads requires two (2) stages due to the large work quantities such as about 110,000 m^3 of course material and about 190,000 m^2 of asphalt pavement. Stage I includes the preparatory works and the actual period for construction will be shorter than that of Stage II. Therefore, N/S road will be constructed in Stage I, which is easier than E/W road to be constructed, and its asphalt pavement will be laid in Stage II because the period is not long enough. Even the construction of the road without the asphalt pavement will be adequate to serve the minimum requirement of vehicles passing during the rainy season. In Stage II, the whole road will be paved with asphalt.

The construction work components for each stage are shown below:

<u>Stage I</u>

(i) Main rural roads (N/S road)
- Improvement : 18.8 km (construction of all courses except the pavement)
- Effective width of 6.0 m, Shoulders of 2.0 m each, Total width of 10.0 m
- Improvement of small bridges : 2 nos.
- Improvement of culverts : 12 nos.

(ii) Water supply plant

Water treatment plant : Daily treatment capacity 1,200 m^3, 1 unit (Rapid filtering)
- Purifier : 300 m^3 x 4 nos.
- Pumps : ø 80 x 3 sets and ø 65 x 3 sets
- Operation & Administration House : RC 2-Floor, 400 m^2 in total

- Land preparation : 3,200 m^2

Discharge pipeline : DCIP ø 150, L = 1.2 km

Water distribution tower : RC, PC type, Storage capacity of 600 m^3

(iii) Procurement of equipment

Purification plant : Spare parts for the plant and chemicals for purification

Stage II

(i) Main rural roads

N/S road : Asphalt pavement only, 18.8 km, width of 6.0 m

E/W road

- Improvement : 12.4 km
- Effective width of 6.0 m, shoulder of 2.0 m each, Total width of 10.0 m
- Improvement of culverts : 38 nos.

(ii) Walawe bridge : 90 m long

- Type : PC post-tensioned girder bridge
- Span : 30 m x 3 spans

(iii) Procurement of equipment

Water tanker : 6,000 lit x 4 and their spare parts

4-6-2 Implementation Method

(1) Local construction condition

The construction works will be carried out by local contractors under a Japanese contractor. In Sri Lanka, many civil works have been and are being constructed and there are no technical problems except in relation to special construction work. The construction workers work hard and good contractors are available.

The construction site is situated on both banks of the Walawe river. In Embilipitiya, the base town for the right bank area, social infrastructure is already provided and a site office of MASL, the executing agency of the Project, is located there. On the other hand in the left bank area, infrastructure such as the water supply and communication system has not been improved yet except for the power supply for the major villages such as

Suriyawewa. The offices of the consultants and the contractors are proposed to be sited in Embilipitiya.

(2) Considerations for construction

Improvement of the main rural roads

- In the harvest season, roads shall be kept passable for vehicles because the roads run through farming areas.
- The construction workers and inhabitants shall be protected from accidents as a lot of heavy machinery will convey a huge amount of crushed stone, etc.
- The roads shall not be closed if possible for the construction works and this should be carefully arranged in the construction work schedule. In addition, bypasses shall be proposed, if necessary.
- CBR tests for embankment material shall be conducted periodically to obtain the necessary product quality specified in the design.
- Much attention should be paid to the adverse influence of stone crushing on the environment (noise, dust etc.).

Walawe bridge

- The river bed shall be excavated carefully so that muddy water does not flow into the river.
- Dewatering after reaching the rock foundations shall be conducted carefully so that the foundations will not be disturbed because the foundations are weathered rock and can be easily broken up into sand.
- Concrete pitching for the substructure shall be 3 m each time.
- After completion of the substructure, the shoe position shall be surveyed and this will be reflected in the preparation of the superstructure.
- Expansion of the PC cable for the main girders shall be carried out after testing the strength of the concrete.
- For construction of the piers, equipment and apparatus shall be checked and much attention shall be paid to safety.

Water supply facilities

- After opening the bank of the Gal tank, it shall be reconstructed.
- The foundations of the operation and administration house shall be checked as they are earth foundations.
- For the pressure pipeline, flanges shall be installed firmly.
- Special attention shall be paid to the water distribution tower construction because the work place will be at a height.
- The concrete quality for the PC tank shall be examined carefully because it must be high strength.
- Before discharge to the existing pipeline, GOSL shall make sufficient preparations and call attention to the situation to avoid accident.

4-6-3 Construction and Supervisory Plan

(1) Detailed design and tender works

Prior to the implementation of the Project, a topographic survey, investigation, detailed design and tender works have to be carried out. Immediately after the conclusion of the Exchange of Note (E/N), the consulting services agreement will be concluded with MASL, and the consultants will start the detailed design after discussions with MASL. In the field investigation at the detailed design stage, discussions will be held with MASL on the implementation schedule. MASL is requested to acquire the land required for the construction of the Project facilities, arrange the temporary construction office, and collect other necessities prior to the commencement of the Project works. The works involved in the detailed design are as follows:

Additional Field Survey/Investigation (to be conducted by local consultants)

Item	Work Description	Reasons for Survey/Investigation
Topographic survey (1)	Center Line Survey of N/S Road	N/S road was not included in the original S/W of B/D and MASL conducted the survey in a short time. Therefore, the survey was rough due to the limited time (cross section survey with a 200 m interval only), and longitudinal and cross sections should be surveyed.
Topographic survey (2)	Map for Confirmation of the Road Alignment	Where E/W road runs in populated areas, the location of existing houses and road alignment should be checked.
Concrete test	Aggregates for Concrete and the Concrete Strength Test	The availability of aggregates in the neighboring areas for high quality concrete to be used for the Walawe bridge superstructure and water distribution tower shall be checked. A mix proportion test will also be necessary.
Soil investigation	Additional CBR Tests on the Roads (about 60 points, every 500 m) and at 2 Soil Borrow Pits (about 20 points)	On N/S road, only 2 samples are available at present and they are not enough for D/D. For the soil borrow pit, its area and depth should be determined.
Water Quality analysis	4 Samples at the Gal Tank	For future operation of the water purification plant, as many samples as possible are necessary.

Detailed design

(i) Review of the basic design according to the result of survey/investigation

The basic design of N/S road is based on a rough survey and limited sample number of CBR tests. The design needs to be reviewed on the basis of additional survey and investigation. As for the right bank area, E/W road alignment should be reviewed because it runs through paddy fields.

(ii) Review of the Project cost through the detailed design

Preparation of tender documents and tender/contracting works

(i) Preparation of tender drawings

(ii) Preparation of tender documents for the civil works and procurement of equipment

(iii) The tender for selection of the civil works contractor will take place after the approval by MASL of the tendering process. The first step is the prequalification tender notice which will be published on behalf of MASL in the major daily newspapers on the construction business and economy in Japan. The prequalification documents will be distributed by the consultants to the tenderers who show interest in the tender. The tender documents will be distributed by the consultants to the prequalified tenderers. The completed tenders will be received by the consultants and opened in the presence of the MASL representatives. Immediately after the opening, the tender evaluation will be carried out by the

consultants in collaboration with the MASL representatives, and in line with the evaluation result the draft contract will be prepared by the consultants.

(2) Construction supervision

After conclusion of the civil works contract, the consultants will clarify the construction methods and the construction time schedule of the civil works in discussions with the Contractor. Upon the commencement of construction, the consultant's resident engineer will supervise construction, and regularly report the progress of the construction works, the problems encountered, and countermeasures if any to both JICA Sri Lanka Office and MASL. He will also coordinate the agencies concerned with the Project, including the Contractor, to smoothly implement the Project. Since the Project comprises many kinds of work components, the consultant's construction engineer, in addition to the resident engineer, will be assigned to render the construction supervision for the improvement of the main rural roads and water supply plant. In addition, a construction material engineer, a bridge engineer and a water treatment plant engineer will be dispatched for short terms to supervise construction according to the progress of the respective construction. With this arrangement, the construction supervision will ensure completion of the Project works at the scheduled rates and required quality work. The scope of the construction supervision is outlined below:

Assistance and advice in the civil works contract

Pre-qualification evaluation of the tenderers, tender evaluation, support for the contract award and witnessing of the contract signing

Evaluation and approval of the construction drawings

Evaluation and approval of the construction drawings, application for commencement of the works, sample of materials, specifications of equipment etc. submitted by the contractor

Progress and quality control of construction

Guidance on and checking of the construction plan and time schedule, progress and quality control of construction, and necessary inspections of the construction methods

Approval of payments to the contractor

Checking and evaluation of the performance of the works necessary for issuance of payment certificates and completion certificates to the Contractor

Report on the progress of construction

Regular reporting to and discussion with MASL and agencies concerned with the Government of Japan on the progress of construction for the purposes of smooth construction

Handing-over of the completed facilities

Attendance at the handing-over of the completed facilities to the Government after confirming the completion of the works and the fulfillment of the contract

4-6-4 Procurement Plan

Of the equipment and materials necessary for the civil works construction, those available in Sri Lanka will, in principle, be procured from the local markets. However, the equipment and materials, for which procurement is not so easy because of different specifications, limited quantity in the market, difficulty of timely procurement, etc. will be imported from Japan. The major equipment and materials to be imported from Japan are the water purification plant and its related equipment, ductile cast iron pipes, reinforcement bars and shaped steel, PC cables and water tankers. The common materials for the building construction and civil works such as cement and bitumen can be purchased in the local market. In principle, special construction machinery is not necessary. Concerning the necessary machinery, that available in the local area will be rented and other machines, of which the quality, condition and/or specifications do not satisfy the requirements, will be imported from Japan. The main construction machinery to be imported from Japan is the concrete batching plant, asphalt plant, dump trucks, crushing plant, portal cranes, and expansion jacks.

The equipment and materials imported from Japan will be unloaded at Colombo sea port, and transported by trucks to the Walawe area. The transportation by trucks will be easy since the road from Colombo to the site is paved with asphalt. The period necessary for the transportation of the equipment and materials from Japan to the Site is estimated at one (1) month, including the marine transport, customs clearance at Colombo sea port and inland transport in Sri Lanka.

4-6-5 Implementation Plan

The implementation of the Project is divided into two (2) stages. In Stage I, immediately after conclusion of E/N, the consulting services agreement will be concluded with the Government and the detailed design will be performed by the consultants in three (3) months, which will be followed by the prequalification, tender, tender evaluation, signing of the civil works contract, etc. In the contract, the construction period will be set at nine (9) months. In Stage II, after conclusion of E/N, the detailed design will be performed for three (3) months and the tendering for selection of the civil works contractor will be carried out, and the construction period will be set at twelve (12) months. The implementation schedule of the Project is shown in Figure 4.

The water supply plant construction is an urgent matter and it will be completed in Stage I. As the Walawe bridge should be constructed during the dry season when the river discharge is lower, it will be constructed in Stage II which covers the dry season. E/W road will be constructed in line with the completion of the Walawe bridge. For the implementation of the Project, the works to be undertaken by the Government of Japan are as follows:

Stage I	Stage II
Improvement of N/S road (19 km, up to the subbase course)	Improvement of E/W road (12 km, up to the asphalt pavement)
Construction of the water supply plant in Suriyawewa	Improvement of N/S road (19 km of asphalt pavement)
Procurement of chemicals for water purification	Construction of the Walawe bridge
	Procurement of four (4) water tankers

The works to be carried out by GOSL are as follows:

Stage I	Stage II
Supply of data, drawings, reports, documents, arrangement of counterpart personnel and office space for the consultants necessary for the detailed design	same as the left
Land acquisition for the construction of N/S road and water supply facilities	Land acquisition for the construction of E/W road and Walawe bridge
Land compensation for construction of the site office, temporary stores, material stock yards, crushing plant, asphalt plant, borrow areas, disposal areas, etc.	same as the left
Installation of power distribution lines connecting with the water purification plant and water distribution tower	
Construction of fences and gates around the yard of the water supply plant and procurement of furniture and office equipment for the operation and administration house	
Banking arrangements for payments, issue of Authorization to Pay and sharing of all the expenses on such arrangements	same as the left
Assurance of prompt unloading and customs clearance at ports of disembarkation in Sri Lanka and internal transportation therein of the equipment, materials, vehicles, tools and spare parts necessary for the construction of the Project works	same as the left
Permission for Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts, to enter Sri Lanka and stay therein for the performance of their work	same as the left
Exemption of Japanese nationals from custom duties, internal taxes and fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts	same as the left
Assurances on the operation and maintenance of the facilities, plant and equipment constructed or installed under the Grant and on proper and effective use of them for the Project	same as the left
Share of all the expenses, other than those covered by the Grant, necessary for the Project.	same as the left

The costs to be borne by GOSL for the implementation of Project are estimated as follows:

Work Item	Stage I	Stage II	Total
Preparation of land for the water treatment plant	Rs. 4,900	Rs. 0	Rs. 4,900
Installation of fences and gates for the water treatment plant	Rs. 1,320,000	Rs. 0	Rs. 1,320,000
Installation of power distribution lines connecting with the water treatment plant	Rs. 15,000	Rs. 0	Rs. 15,000
Total	Rs. 1,339,900	Rs. 0	Rs. 1,339,900

CHAPTER 5
PROJECT EVALUATION AND CONCLUSION

5 PROJECT EVALUATION AND CONCLUSION

5-1 Project Benefits

The direct Project benefit is improvement of infrastructure in rural areas and the indirect benefit is activation of rural social and economic activities. The present conditions and problems in the Project area, countermeasures, and beneficiaries/benefits and their magnitude are listed below:

	Present Conditions and Problems	Countermeasures	Beneficiaries/ Benefits
1	The road between Suriyawewa, the central town of the left bank area of the Walawe river, and the improved agricultural area, where infrastructure was already been improved, is a narrow and unpaved road. The road is not connected at the Walawe river due to the lack of a bridge on the river and it cannot function as a trunk road. In addition, N-S road, which runs from Suriyawewa southward in the left bank area to the Route A-2 national road becomes unpassable in the rainy season. Therefore, the inhabitants suffer from very inconvenient medical services, education, transportation of farming equipment and products, food supply and daily life activities.	Improvement of the existing roads (2 roads, 31 km with an asphalt pavement) and construction of the Walawe bridge	By construction of all-weather type roads, the isolated road network during the rainy season in the left bank area will be remarkably improved. Moreover, both sides of the Walawe river will be connected, the traffic system in the Walawe area will be more convenient, the agricultural sector will be encouraged, and the access will be improved by the infrastructure in the right bank area and the district capital in respect to medical and educational services etc. The beneficiary population is estimated at 30,000 along the roads and 100,000 in the whole Walawe left bank area.
2	Although the supply of safe and hygienic water to all the population is the basic policy of the Government of Sri Lanka, the water supplied in Suriyawewa is raw water having high turbidity and colon bacilli levels without any treatment. As the capacity of the water supply facility is small and the distribution system is not developed, the beneficiary population is as low as 1,400. Other people receive water from domestic shallow wells, of which the quality is also low and the available water volume becomes insufficient in the dry season and inhabitants suffer in their usual life activity.	i) Construction of a water treatment plant (intake, water purification plant, water distribution tower and distribution pipeline of 1.2 km) ii) Installation of 11 public pipe stands in the town iii) Provision of 4 water tankers for the inhabitants who cannot receive the service of the public pipe stands	After the construction of a water treatment plant, safe and hygienic water can be supplied to 2,240 inhabitants of Suriyawewa through a pipeline system and to the people in the suburbs of the town (40,000 people) by water tankers.

5.2 Justification of the Project Implementation

Implementation of the Project is judged feasible by the Grant Aid for the following reasons:

1) The major beneficiaries are the general people including the poor class in Janasabia on the left bank of the Walawe river, which is in the national counter plan against poverty. The population which will benefit directly from the road improvement and water supply plant construction will be at least 30,000 and it is expected to be more.

2) Especially the people living along N-S road have seen little development in the last 30 years due mainly to the delay in irrigated agriculture and infrastructure improvement. For stabilization and improvement of the people's livelihoods, the Project implementation is urgently required.

3) MASL, RDA, and NWSDB are the Sri Lankan executing agencies with experience of many projects. These agencies are capable of O&M of the Project facilities using their own finance, personnel, and technology. MASL already has experience of foreign-financed projects such as grant aid and OECF loan projects and there will be no problems with the Project implementation in line with the system of the Japanese Grant Aid.

4) It is expected that this Project will contribute to the accomplishment of the Sri Lankan long-term development plan through the improvement of infrastructure in "Southern Area Development Plan", which GOSL is promoting. In addition, the Project objectives are improvement of public facilities such as roads and water supply, not ones for commercial profit and they are appropriate for the Grant Aid concept.

5-3 Conclusions and Recommendations

After the field survey in Sri Lanka and analyses in Japan, it was concluded that this Project can contribute not only to the rural infrastructure improvement in the left bank of the Walawe river, but also to the nationwide infrastructure improvement as well as to the above-mentioned direct and indirect benefits. Therefore, this Project is suitable for

Japanese Grant Aid. Moreover, the administrative system of Sri Lanka cannot afford the implementation in respect of its personnel, technological know-how, and financial situation.

For the smooth implementation and O&M of the Project, the following are recommended:

1) acquisition of land for construction, temporary structures, quarry sites, borrow pits, and soil disposal areas in advance of the commencement of construction;

2) the construction works to be undertaken by GOSL; and

3) budgetary and administrative arrangements for the Project implementation and O&M.