

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE UPGRADING OF
THE SEWER CLEANING EQUIPMENT IN COLOMBO CITY
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

SEPTEMBER 2004

JAPAN INTERNATIONAL COOPERATION AGENCY
NJS CONSULTANTS 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 the Project for the Upgrading of the Sewer Cleaning Equipment in Colombo City and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team from 15th May to 13th June 2004.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted 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 basic design, 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 team.

September 2004

Kazuhisa Matsuoka

Vice-President

Japan International Cooperation Agency

September 2004

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Upgrading of the Sewer Cleaning Equipment in Colombo City in the Democratic Socialist Republic of Sri Lanka.

This study was conducted by NJS Consultants Co., Ltd., under a contract to JICA, during the period from May to September 2004. 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.

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

Very truly yours,

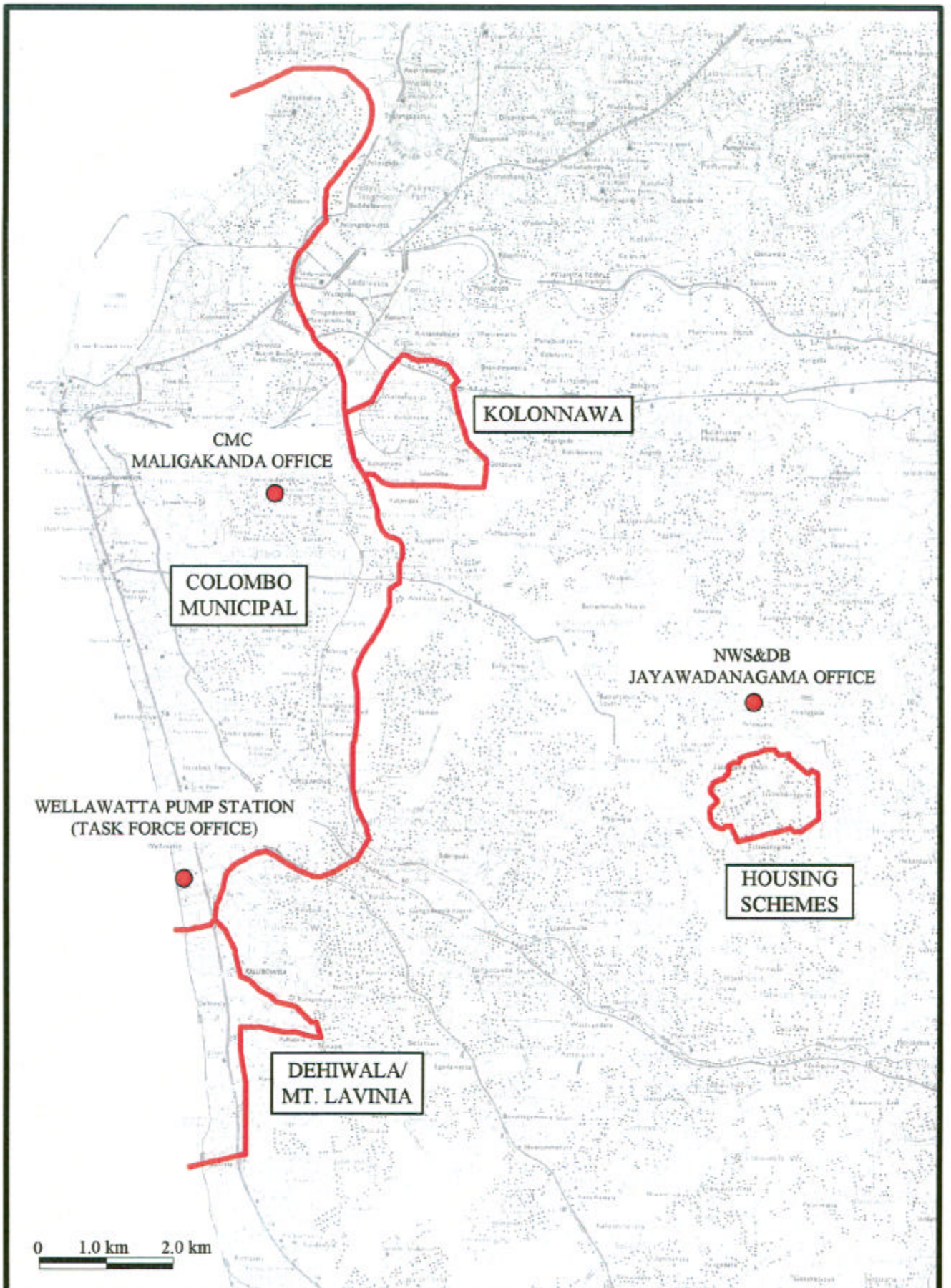
Shinichi Osaka

Project Manager,
Basic design study team on
the Upgrading of the Sewer Cleaning Equipment
to Improve Colombo Environment

NJS Consultants Co., Ltd.



LOCATION MAP
THE PROJECT FOR THE UPGRADING OF THE SEWER CLEANING
EQUIPMENT TO IMPROVE COLOMBO ENVIRONMENT



COLOMBO MUNICIPALITY AND THE SUBURB SEWER CLEANING AREA

Summary

Summary

The sewerage system of Colombo and its suburbs was initially developed from 1906 to 1920 during the British colony period, to serve the planned population of 373,200 in the target year of 1951. This was gradually extended following the urbanization of the area. The sewerage service areas are divided into two, the northern and southern areas, where the collected sewage is discharged into the ocean. Since only preliminary treatment is carried out, the raw sewage of approximately 200,000 m³/day is discharged from the Madampitiya and Wellawatta Pump Stations to the ocean through 1.5 km long outfall pipes. The discharged sewage sometimes causes water pollution in the ocean due to the absence of diffusion or dilution by current and wind. The present sewerage system in Colombo Municipality comprises approximately 260 km of sewers, 18 pump stations and two ocean outfalls, which was constructed in 1983. The population served by the system now comprises approximately 500,000 persons. Sewerage systems in the suburb consist of 60 km of sewers and 19 pump stations in the Kolonnawa Urban Council area located in the eastern side of Colombo, the Dehiwala/Mt. Lavinia Municipal Council located in southern side of Colombo, and some Housing Schemes.

Currently, the sewerage system of Colombo and its suburbs faces many problems caused by many blockages occur in the sewers due to the inflow of sand, sludge, domestic garbage, oils and fats.

- a. The people in Colombo and its suburbs are inconvenienced by unsanitary living conditions since the sewerage system has not been well maintained.
- b. Wastewater overflows into the storm water pipe and are released to public water bodies.

The sewerage system of Colombo and its suburbs has been operated and maintained by the National Water Supply and Drainage Board (hereinafter referred to as NWS&DB) and the Colombo Municipal Council (hereinafter referred to as CMC). The sewerage system in Colombo has been operated and maintained by the CMC, and the suburb, such as Dehiwala/Mt. Lavinia, Koconawa and some housing schemes by the NWS&DB, the system however has not been properly maintained. This is because that lack of the sewer cleaning equipment and technology/experience for NWS&DB and CMC. With these conditions, the Sri Lankan Government requested the Japanese Government to provide sewer-cleaning equipment as grant-in-aid in order to improve the living environment of the study area.

In response, the Japanese Government decided to implement a Basic Design Study on “the Project for the Upgrading of the Sewer Cleaning Equipment in Colombo City” to be undertaken by the Japan International Cooperation Agency (hereinafter referred to as JICA) was conducted the study in May 2004.

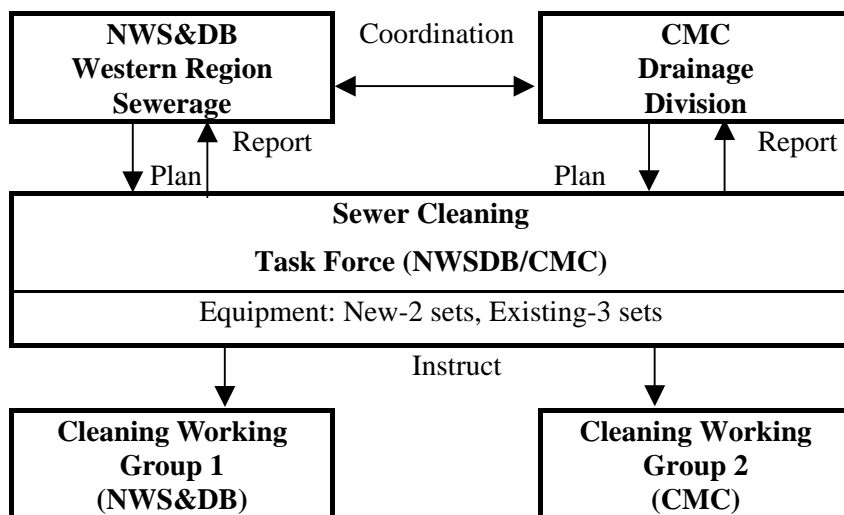
In discussing the Basic Design Study, NWS&DB and CMC explained to the JICA Study Team that it was necessary to first implement a program to clean all sewers with total length of 330 km in Colombo and its suburbs by 2010. The program also prescribes regular sewer cleaning based on the “Preventive Maintenance” concept in simultaneity with the current sewer cleaning being carried out as “Breakdown Maintenance” in cases of blockades. The ADB/JBIC plans to finance a project that will improve the Greater Colombo Sewerage System by 2010. The implementation of this sewerage project aims to cover all sewerage facilities that need to be renovated and improved in Colombo and its suburbs. By the end of August, 2004, the NWS&DB and CMC presented to the JICA Sri Lanka Office an Action Plan showing the following activities for actual implementation.

1) Establishment of individual Task Force

The Task Force will be jointly established by the NWS&DB and CMC according to target. The Task Force will issue plans and instructions to the Cleaning Working Group 1 that will be manned by personnel from the NWS&DB; they will be tasked to clean sewers mainly in the suburb; the Cleaning Working Group 2 will be manned by personnel from the CMC; they will be tasked to clean sewers mainly in the CMC area.

2) Personnel and cost for the Task Force

The NWS&DB and CMC will provide the necessary funds for Cleaning Working Group 1 and Cleaning Working Group 2 respectively.



The NWS&DB and CMC will continue to discuss the annual program, operation, personnel, cost etc. of the task force prior to actual implementation.

The requested sewer cleaning equipment have been procured and examined; these, and those that still need to be procured for the project as planned are shown in the following table. These items were targeted under the Basic Design Work.

Major Contents of the Request and its Changes

Requested Item	Application Form	M/D	Equipment Plan		
			NWS&DB	CMC	Total
High Pressure Jetting Machine	2 units	2 units	2 units	2 units	4 units
High Power Sludge Suction Machine	2 units	2 units	2 units	0	2 units
Water Tanker	2 units	1 unit	2 units	0	2 units
Pipe Plug	2 sets	2 sets	1 set	1 set	2 sets
Other Equipment	1 Ls	1 Ls	1 Ls	1 Ls	1 Ls
CCTV & Database	1 Ls	—	—	—	—

Sewer cleaning equipments for the NWS&DB which are used for “Preventive Maintenance” by the Task Force is planned as follows.

Sewer Circular: Diameter: 100mm~1000mm Length: 301 km
 Horseshoe shaped: Width: 900mm~1800mm Length: 26 km
 Accumulated Sludge in Sewer: 7,831 m³ (sludge accumulates 20 % of sewer height)
 Cleaning Equipment: 1 set of a high pressure jetting machine, a high power sludge suction machine and a water tanker
 Sludge Removal per Day: 2.0 m³/(day.set)
 Operational Days for 5 Years: 16 days x 12 month x 5 years = 960 days
 Numbers of Required Equipment: 4.1 sets → 5 sets

Accordingly, five sets of sewer cleaning equipment, each consisting of a high pressure jetting machine, a high power sludge suction machine and a water tanker, is required for the “Preventive Maintenance” sewer cleaning program. However NWS&DB has three sets of equipment and the additional two set will be provided.

Equipment will likewise be provided to the CMC for “Breakdown Maintenance” sewer cleaning works urgently needed by the residents.

Also, soft component will be implemented to train engineers of the Task Force in NWS&DB to increase their knowledge on sewer cleaning services and enable them to learn newer technologies and know-how. This will enable them to implement and manage the sewer cleaning program for Colombo and its suburb for a period of five years based on the “Preventive Maintenance” concept.

The project timetable will take approximately 15 months inclusive of the manufacturing period,

ocean shipping and inland transportation as well as delivery inspection and technical assistance to the NWS&DB and CMC.

The Executing Agency of the Project in Sri Lanka is the NWS&DB. The Task force established by the NWS&DB and CMC will directly implement the Project. It was decided that the implementation of the Project and maintenance of equipment will be properly carried out by both organizations that have adequately organized their respective task force and have allocated the appropriate budgets.

Expected project effects are as follows.

- (1) Task Force can clean all sewers with a total length of 330 km in Colombo and its suburbs by 2010 under the “Preventive Maintenance” program using the provided cleaning equipment, and the sewers will be improved the flow capacity;
- (2) Grit and sludge of 7,800m³ accumulated in sewers will be removed and disposed by 2010 under the “Preventive Maintenance”;
- (3) The sewage overflow to the public water bodies will be minimized by the removal of the sewer blockages, and unsanitary living conditions of the population will be improved, as well as it will restrain water-borne diseases in the sewerage service area.

The following items are recommended for the effective and efficient implementation of the Project.

- (1) Upon the procurement and availability of the proposed cleaning equipment, the Sri Lankan counterpart shall form the Task Force under the joint control of Greater Colombo Sewerage Section of the NWS&DB and the Drainage Section of CMC. The NWS&DB and CMC shall secure to this Task Force with the necessary staff and budget for the cleaning work and the proposed equipment, to acquire knowledge on the operation of the sewerage system, to prepare the cleaning plan, and to transfer the technology on sewer cleaning.
- (2) The establishment of the “Preventive Maintenance” sewer cleaning program differs from the present operation under the “Breakdown Maintenance” concept. Therefore, it is recommended that a experienced expert in sewer-cleaning be hired by the soft component to work with the members of the Task Force, and assist the local staff in program improvement for Colombo and its suburbs.
- (3) A storage yard with shed for the procured equipment such as high pressure jetting machines, high power sludge suction machines and water tankers will be provided by the NWS&DB and CMC respectively. The existing warehouse shall be provided to properly store supplied accessories and spare parts.

- (4) The JICA Expert for Sewerage shall regularly monitor and advise the Task Force in all program activities. The Expert shall be requested to revise the program as needed and to fully support the sewer cleaning services.
- (5) Educational programs and campaigns in schools and the media services on the subject of sewerage systems are expected to comprise some of the activities.

**Basic Design Study Report on the Project for the Upgrading of
the Sewer Cleaning Equipment in Colombo City
in The Democratic Socialist Republic of Sri Lanka**

Final Report

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Abbreviations

ADB	:Asian Development Bank
AGM	:Assistant General Manager
BHN	:Basic Human Needs
CCTV	:Closed Circuit Television
CMC	:Colombo Municipality Council
DANIDA	:Royal Danish Consulate-General
DFID	:Department for International Development, England
E/N	:Exchange of Note
GDP	:Gross Domestic Product
GNP	:Gross National Product
JBIC	:Japan Bank for International Cooperation
JICA	:Japan International Cooperation Agency
LTTE	:The Liberation Tigers of Tamil Eelam
OECD	:Overseas Economic Cooperation Fund
PS	:Pump Station
M/D	:Minute of Discussion
NWS&DB	:National Water Supply & Drainage Board
PTO	:Power Take Off
PVC	:Polyvinyl Chloride
WB	:World Bank
WHO	:World Health Organization
4×2	:4 wheels×2 drives

Units

bar	:bar
deg	:degree
Kpa	:Kilo Pascal
KVA	:Kilo Voltage Ampere
KN	:Kilo Newton
Mpa	:Mega Pascal
rad	:Radian
Rs	:Sri Lanka Rupee

Chapter 1
Background of the Project

Chapter 1 Background of the Project

The people in Colombo and the suburbs experience inconvenience and unsanitary living conditions since their sewerage system has not been well maintained. Many blockages occur in the sewers caused by the inflow of sand, sludge, domestic garbage, oils and fats. Wastewater then overflows into the storm water pipe and are released to public water bodies. With these conditions, the Sri Lankan Government requested the Japanese Government to provide sewer-cleaning equipment as grant-in-aid in order to improve the living environment of the study area. A Basic Design Study was conducted for this purpose.

In the discussion of the Basic Design Study, the NWS&DB and CMC explained to the JICA Study Team about a program as preventive maintenance¹ to complete the cleaning all sewers with a total length of 330 km in Colombo and its suburbs by 2010, while they are currently cleaning sewers as breakdown maintenance² upon the residents' reports of the blockages. The ADB/JBIC plans to finance a project that will improve the Greater Colombo Sewerage System by 2010. The implementation of this sewerage project is targeted to cover all sewerage facilities to be renovated and improved in Colombo and its suburb. The NWS&DB and CMC presented to the JICA Study Team a proposal to set up an independent Task Force that will implement the sewer-cleaning program, as well as an action plan showing the following concept by the end of August 2004.

a. Institutional Arrangement

The Task Force will be established in the NWS&DB to fulfill the target. The personnel required for the Task Forces are to be provided by the NWS&DB and CMC jointly. While, the **Cleaning Working Group 1** will be manned by the NWS&DB, the CMC will use their own manpower for **Cleaning Working Group 2**.

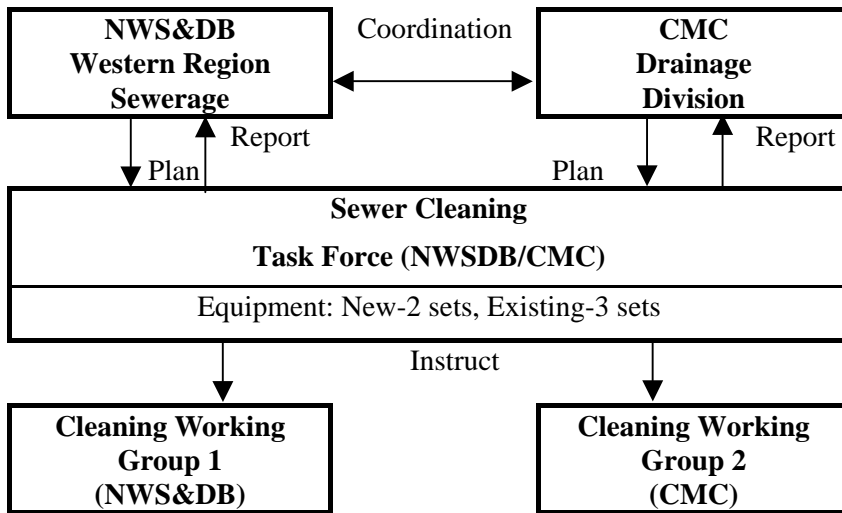
b. Financial Arrangement

The Sewer Cleaning Equipment to be provided under this Grant-in-Aid will be distributed as shown in Item 4 of this document. Therefore, the ownership of the equipment will also be transferred accordingly.

The NWS&DB and CMC will continue to discuss the annual program, operation, personnel, cost etc. of their respective task forces prior to the actual implement.

¹ Performing proactive maintenance in order to prevent breakdowns.

² Performing diagnostic or corrective maintenance in order to correct already existing breakdowns.



Requested equipments are shown in Table 1-1.

Table 1-1 Major Contents of the Request and its Changes

Requested Item	Application Form	M/D	Action Plan Equipment Plan			
			NWS&DB	CMC	Total	Priority
High Pressure Jetting Machine	2 units	2 units	2 units	2 units	4 units	A
High Power Sludge Suction Machine	2 units	2 units	2 units	0	2 units	A
Water Tanker	2 units	1 unit	2 units	0	2 units	A
Pipe Plug	2 sets	2 sets	1 set	1 set	2 sets	A
Other Equipment	1 Ls	1 Ls	1 Ls	1 Ls	1 Ls	B
CCTV & Database	1 Ls	—	—	—	—	—

Chapter 2
Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

The present sewerage system in Colombo Municipality comprises approximately 260 km of sewers, 18 pump stations and two ocean outfalls that were constructed in 1983. The population served by the system now is approximately 500,000 persons. Sewerage systems in the suburb consist of 60 km of sewers and 19 pump stations in the Kolonnawa Urban Council area located in eastern side of Colombo, the Dehiwala/Mt. Lavinia Municipal Council located in southern side of Colombo, and some Housing Schemes.

Currently, the sewerage system of Colombo and its suburbs faces many problems caused by many blockages occur in the sewers due to the inflow of sand, sludge, domestic garbage, oils and fats.

- a. The people in Colombo and its suburbs are inconvenienced by unsanitary living conditions since the sewerage system has not been well maintained.
- b. Wastewater overflows into the storm water pipe and are released to public water bodies.

With these conditions, the Sri Lankan Government requested the Japanese Government to provide sewer-cleaning equipment as grant-in-aid in order to improve the living environment of the study area.

In discussing the Basic Design Study before the JICA Study Team, NWS&DB and CMC cited the need for a program to complete the cleaning all sewers with total length of 330 km in Colombo and its suburbs by 2010. The ADB/JBIC plans to finance a project that will improve Greater Colombo sewerage System by 2010. The implementation of this sewerage project aims to cover all sewerage facilities to be renovated and improved in Colombo and its suburbs. NWS&DB and CMC presented to the JICA Study Team a proposal to set up independent Task Forces that will implement the sewer-cleaning program.

2-2 Basic Design of the Required Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Concept for the Provision of Equipment

The basic design policy for this grant aid project is set as follows:

(1) Equipment for Sewer Cleaning

In order to achieve the objectives of the project, an independent Task Force will be set up to implement sewer cleaning as “preventive maintenance” rather than “breakdown maintenance”, the latter of which NWS&DB and CMC have been doing after receiving a complaint/report from residents on sewer blockages. Cleaning equipment will be provided to meet the requirements of the sewer cleaning program in Colombo and its suburbs.

(2) Technical Assistance for Sewer Cleaning

1) Technical Assistance to Task Force (Training for sewer cleaning plan)

The assistance of an experienced engineer is a requirement in the implementation of the sewer-cleaning program (Detailed plan based on the Action Plan) based on the “preventive maintenance” concept . The technical assistance by such an engineer will be provided to a Task Force to be set up for the purpose.

2) Technical Assistance to Operator (Training for equipment operation)

Most of the existing sewer cleaning equipments owned by NWS&DB and CMC have had breakdowns and have incurred damages after only five years of operation. With the procurement of new equipment, adequate training will be necessary for NWS&DB and CMC operators and maintenance crew in the proper operation and maintenance for these equipment.

2-2-1-2 Basic Concept of the Equipment Plan

In maximizing and planning for the sewer cleaning equipment for the project, an equipment plan will be drawn up. The plan for the sewer-cleaning program will take into consideration effective utilization of existing equipment taking into account site conditions, number of state of existing equipment and maintenance ability of the personnel.

1) Equipment plan in response to the site conditions

Sewer cleaning work has been and is being done in Colombo Municipal using existing sewer cleaning equipment. The equipment plan will be drawn up taking into account actual site conditions in Colombo such as, but not limited to, operator working conditions, traffic conditions for roadwork and sand/sludge disposal methods.

2) Use of Existing Equipment

The sewer-cleaning program must utilize the existing sewer cleaning equipment owned by NWS&DB and CMC, together with the new equipment. It is imperative, therefore for NWS&DB and CMC to repair without delay the existing sewer cleaning equipment that are not operational due to breakdown and other damage for the project to proceed as scheduled.

2-2-2 Basic Plan (Equipment Plan)

2-2-2-1 Equipment Examination

(1) Diameter, Material and Length of Existing Sewer

The diameter, material and length of existing sewer in Colombo and its suburbs are shown in Table 2-1, 2.

Table 2-1 Sewers in Colombo Municipal

Diameter (mm)	Sewer Length (m)				Sub-total
	VC	DI	Concrete	PVC	
Ø100	-	-	-	-	-
Ø110	-	-	-	-	-
Ø150	18,000	-	-	-	18,000
Ø160	-	-	-	-	-
Ø200	-	-	-	-	-
Ø225	190,000	-	-	-	190,000
Ø250	-	-	-	-	-
Ø300	15,300	-	-	-	15,300
Ø375	2,600	-	-	-	2,600
Ø400	-	-	-	-	-
Ø450	4,700	-	-	-	4,700
Ø500	-	-	-	-	-
Ø525	2,900	-	-	-	2,900
Ø600	2,000	-	-	-	2,000
Ø1000	-	-	-	-	-
* HSS 900x600	-	-	6,300	-	6,300
HSS 1050x700	-	-	4,200	-	4,200
HSS 1350x900	-	-	1,275	-	1,275
HSS 1425x950	-	-	11,320	-	11,320
HSS 1800x1200	-	-	2,550	-	2,550
Total	235,500	-	25,645	-	261,145

* HSS: Horseshoe Shaped Sewer

Table 2-2 Sewers in Colombo suburb

Diameter (mm)	Sewer Length (m)				Sub-total
	VC	DI	Concrete	PVC	
Ø100	-	-	-	-	-
Ø110	-	-	-	13,020	13,020
Ø150	320	3,570	-	-	3,890
Ø160	-	-	-	1,208	1,208

Ø200	29,801	1,902	-	3,080	34,783
Ø225	-	-	-	-	-
Ø250	3,715	2,500	-	-	6,215
Ø300	1,592	115	-	225	1,931
Ø375	-	-	-	-	-
Ø400	1,129	15	-	-	1,144
Ø450	631	-	-	-	631
Ø500	455	38	-	-	493
Ø525	335	-	-	-	335
Ø600	805	11	-	-	815
Ø1000	-	-	1,108	-	1,108
Total	38,783	8,151	1,108	17,533	65,574

Sewer length and component ratio for each diameter and material are shown in Table 2-3.

Table 2-3 Sewers by Each Diameter and Material

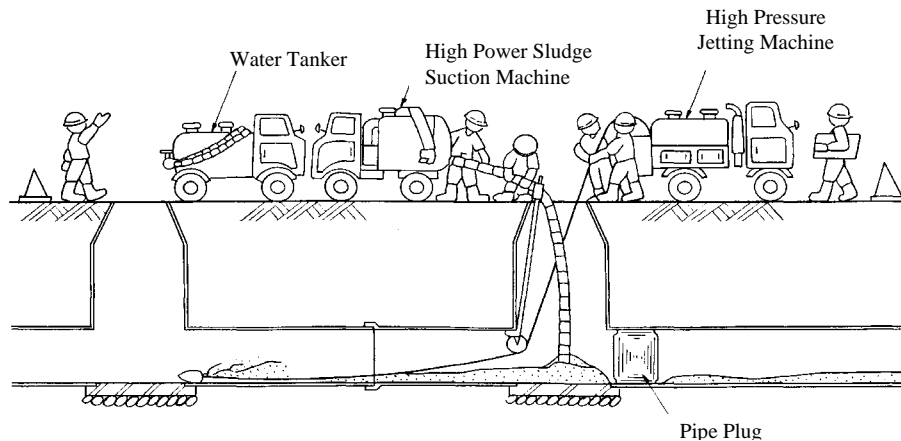
Diameter (mm)	Sewer Length (m)				Total	Ratio (%)
	VC	DI	Concrete	PVC		
Ø100	-	-	-	-	-	0.00%
Ø110	-	-	-	13,020	13,020	3.99%
Ø150	18,320	3,570	-	-	21,890	6.70%
Ø160	-	-	-	1,208	1,208	0.37%
Ø200	29,801	1,902	-	3,080	34,783	10.65%
Ø225	190,000	-	-	-	190,000	58.15%
Ø250	3,715	2,500	-	-	6,215	1.90%
Ø300	16,892	115	-	225	17,231	5.27%
Ø375	2,600	-	-	-	2,600	0.80%
Ø400	1,129	15	-	-	1,144	0.35%
Ø450	5,331	-	-	-	5,331	1.63%
Ø500	455	38	-	-	493	0.15%
Ø525	3,235	-	-	-	3,235	0.99%
Ø600	2,805	11	-	-	2,815	0.86%
Ø1000	-	-	1,108	-	1,108	0.34%
HSS 900x600	-	-	6,300	-	6,300	1.93%
HSS 1050x700	-	-	4,200	-	4,200	1.29%
HSS 1350x900	-	-	1,275	-	1,275	0.39%
HSS 1425x950	-	-	11,320	-	11,320	3.46%
HSS 1800x1200	-	-	2,550	-	2,550	0.78%
Total	274,283	8,151	26,753	17,533	326,719	100%
Component Ratio (%)	83.95%	2.49%	8.19%	5.37%	100%	

* HSS: Horseshoe Shaped Sewer

The total sewer length in Colombo and its suburbs is approximately 327 kms with 84 % of the sewer being of clay pipe in terms of pipe material; while 58 % of all sewers are circle pipe with a diameter of 225mm.

(2) Examination for Appropriate Equipment on the Site

Sewer cleaning work shall basically be done using a high pressure jetting machine, a high power sludge suction machine and a water tanker. The equipment to be selected to efficiently clean the sewer must take into consideration the conditions of the existing sewer network, the sewer blockage situation and the traffic condition in Colombo.



(Source: "Sewerage Facility Maintenance Manual" Japan Sewage Works Association)

Figure 2-1 Sewer Cleaning Equipment

1) High Pressure Jetting Machine

Sewer cleaning work will be done on both large and narrow roads. The sewer cleaning equipment required must possess a small turning radius and mobility for use in narrow roads. For these reasons, a four-ton vehicle is the most suitable. The high pressure jetting machine would have a high pressure jetting device, a water tank, hose reels and other attachments needed for cleaning work. The power source for the high-pressure pump shall be the PTO (Power-Take-Out), which transfers driving power from the curing engine in the vehicle.

The high pressure jetting machines owned by NWS&DB and CMC are large-size type vehicles, belonging to the six to eight-ton class. Such large-size cleaning equipment are likely to cause a traffic jam, since the traffic is very heavy on the main trunk roads in Colombo. On the other hand, since the width of branch roads in residential areas are only six to eight meters wide, sewer cleaning works using large-size equipment will surely cause inconvenience to the residents due to diversion of traffic. It is for this reason that the four-ton class high pressure jetting machine is recommended.

The large-size high pressure jetting machines owned by NWS&DB and CMC are the so-called combined type, that is equipped with both the jetting clean function and sucking function. When one of the functions breaks down, sewer cleaning work is suspended to make way for repair. Therefore, high pressure jetting machine to be used must have only the jetting clean function, which is a major type for the four-ton class. Since a four-ton class high pressure jetting machine has the adequate abil-

ity of 210 PS, a common pump pressure of 180kg/m², and a discharge flow 230 L/min, it is deemed sufficient for sewer cleaning.

2) High Power Sludge Suction Machine

Sludge sucking machines suck sludge/wastewater, and moves it from the sewer to a manhole using a high pressure jetting machine. This machine can separate solid and liquid by gravity in the tank and carries separated sand/sludge to the disposal site. The separated liquid or wastewater is drained downstream of the sewer from the manhole. Since the existing gully suckers with vacuum pumps can suck only five to seven meters in depth, the blower type shall be adopted for high pump head since most of the manholes in Colombo are from seven to 10 m in depth.

The person in charge of sewer cleaning in NWS&DB requested that the suction machine be used for sucking grit out of the pump stations. Since most pump stations in Colombo Municipality and its suburb do not have a grit chamber system, grits coming from sewer accumulate in the pump pit. NWS&DB removes the grit periodically, that is, once every three months, to keep operation normal in some pump stations. At present, NWS&DB uses a submersible pump to remove the grit in the pump pit, which is from 10 to 13 m in depth. At such a depth, the grit is so hardened that workers have to enter the pump pit to loosen up the hardened grit. This grit removal work entails two to three hours of work a day, and takes around three days to complete.

The sand/sludge sucking machine to be supplied by this project should reduce the hardened grit removal time and minimize the frequency of workers entering the pump pits. With this situation, the pump head of the high power sludge suction machine should be at least be 15 meters.

The power source should be PTO which diverts driving power from the cursing engine of the vehicle. For the sand/sludge sucking machine, the “High Power Sludge Suction Machine” shall be adopted because this type can blow much air due to the capacity of the high pump head, which will come in handy when cleaning deep sewers, siphon pipes and shafts. Compared with ordinary vacuum type, the receiver tank volume of the high power sludge suction machine is smaller because the sucking device is much bigger than the vacuum type. In addition, the vehicle size should be four-ton class, the same as the high pressure jetting machine.

3) Water Tanker

Sewer cleaning using jetting machines needs a large amount of washing water. Although the jetting machine has a 3-m³ water tank, cleaning work consumes 9.0 m³ volume of water per day taking into account an average discharge volume 150 L/min and actual watering for one hour/day (Source: Cost

Estimate Guideline for Sewerage Facility Maintenance – Sewer System edited (Japan Sewerage Works Association)). Therefore, a water tanker needs to be stationed at the sewer-cleaning site in order to supply washing water, with a vehicle size or class of four tons, the same class as the high pressure jetting machine. The water tankers to be supplied by this project are similar to the existing water tankers.

An existing and two new water tankers will be fully utilized to supply water for three existing and two new jetting machines in the Task Force.

It should be concluded from the above Items 1), 2), and 3), that constant and effective sewer cleaning for the program will need the following combination of machines – a 4-ton class High Pressure Jetting Machine, plus a 4-ton class High Power Sludge Suction Machine, and lastly a 4-ton class Water Tanker.

(3) Examination of Necessary Equipment Specification/Quantity for the Sewer Cleaning Program
Colombo Municipality and its suburb have approximately 330 kms of sewers. The result of investigation shows that the accumulated sand/sludge in the sewer is estimated to be around 20 % of sewer height. The total volume of accumulated sand/sludge is estimated at 7,831m³. An examination is needed to estimate the number of cleaning equipment sets required to complete cleaning all the sewers within five years.

1) Estimation of Accumulated Sand/Sludge Volume

Assuming 20 % of sewer height sand/sludge, present sand/sludge volume is estimated as shown in Table 2-4.

Table 2-4 Examination of Sand/Sludge Volume

Shape	Diameter		Closed Section Height (m)	Center Angle		Blockage Section Area (m ²)	Sewer Length (m)	Sand/Sludge Volume (m ³)
	(mm)	(m)		(deg)	(rad)			
Circle Sewer	φ100	0.10	0.020	106.2602	1.85459	0.0011182380	0	0
	φ110	0.11	0.022	106.2602	1.85459	0.0013530680	13,020	18
	φ150	0.15	0.030	106.2602	1.85459	0.0025160356	21,890	55
	φ160	0.16	0.032	106.2602	1.85459	0.0028626894	1,208	3
	φ200	0.20	0.040	106.2602	1.85459	0.0044729522	34,783	156
	φ225	0.23	0.045	106.2602	1.85459	0.0056610801	190,000	1,076
	φ250	0.25	0.050	106.2602	1.85459	0.0069889878	6,215	43
	φ300	0.30	0.060	106.2602	1.85459	0.0100641424	17,231	173
	φ375	0.38	0.075	106.2602	1.85459	0.0157252225	2,600	41
	φ400	0.40	0.080	106.2602	1.85459	0.0178918087	1,144	20
	φ450	0.45	0.090	106.2602	1.85459	0.0226443204	5,331	121
	φ500	0.50	0.100	106.2602	1.85459	0.0279559511	493	14
φ525	0.53	0.105	106.2602	1.85459	0.0308214361	3,235	100	

	φ600	0.60	0.120	106.2602	1.85459	0.0402565696	2,815	113
	φ1000	1.00	0.200	106.2602	1.85459	0.1118238045	1,108	124
horseshoe shaped sewer	W900mm×H600mm		0.120			0.1080000000	6,300	680
	W1050mm×H700mm		0.140			0.1470000000	4,200	617
	W1350mm×H900mm		0.180			0.2430000000	1,275	310
	W1425mm×H950mm		0.190			0.2707500000	11,320	3,065
	W1800mm×H1200mm		0.240			0.4320000000	2,550	1,102
Total							326,719	7,831

* Accumulated sand/sludge height is 20 % of sewer height. Since structure and dimension of horseshoe shaped sewer are unknown, accumulated sand/sludge is assumed to be 20 % of sewer height. Sewer bottom R is not calculated.

Total Sewer Length (m)	326,719
Total Sand/Sludge Volume (m ³)	7,831
Sand/Sludge Volume per 1 m (m ³)	0.0240
Sand/Sludge Volume per 100 m (m ³)	2.3969
Sand/Sludge Volume per 1 km (m ³)	23.9689

2) Estimation of the Number of Necessary Sewer Cleaning Equipment Set

The number of cleaning equipment sets – a high pressure jetting machine, a high power sludge suction machine, and a water tanker – shall be estimated with the goal of completely removing sand/sludge in five years.

Table 2-5 Sewer Cleaning Work Time Schedule at Site

Time	Content of Work
9:00	Coming to office ~ Preparation (0.5h)
9:30	
10:00	Arrived the site ~ Preparation for work (1.0h)
10:30	
11:00	Sewer cleaning work in the morning (2.0h)
11:30	
12:00	
12:30	
13:00	Lunch/Rest (1.0h)
13:30	
14:00	Sewer cleaning work in the afternoon (2.0h)
14:30	
15:00	
15:30	
16:00	Tidy up and sand/sludge disposal (1.0h)
16:30	
17:00	Completion of work (16:45)

An estimate of the number of necessary cleaning equipment sets is shown in Table 2-6. The volume of sand/sludge to be sucked shall be around 2.0 m³ per day for one set. But because the suction tank will be filled with a volume of 2.0 m³ of sand/sludge the sucking efficiency of the cleaning equipment will be reduced. This means suspending the work and disposing the sand/sludge, which takes from two to three hours. Therefore, the estimate is calculated at 2.0 m³ sand/sludge removal volume per day for one set, working four hours per day per site.

The number of cleaning equipment sets needed is calculated in consideration of the following requirements

- i. Sewer cleaning work will be completed in five years
- ii. Number of working days is 20 days per month
- iii. One day per week x 4 weeks = 4 days for preparation
- iv. Working days (20 days) – Preparation (4 days) = Actual working days (16 days)

Table 2-6 Estimation of the Number of Necessary Cleaning Equipment Set

Items	Unit	Qt	Basis	Reference
Working days per month	day	20	a	1 month 30 days, Holiday 10 days
Preparation per month	day	4	b	Preparation: 1 day per week, 4 days for 4 weeks
Actual working days per month	day	16	c=a-b	
Working days in a year	day	192	d=c×12 months	
Working days in 5 years	day	960	e=d×5 years	
Total sand/sludge volume	m ³	7,831	f	
Removal Volume per day for 1 set	m ³ /day·set	2.0	g	For 1 set of cleaning equipment of High pressure jetting machine, High power sludge suction machine, Water tanker
Total working days for 1 set	day	3,916	h=f÷g	3916 days÷192 days = 20.4 years (Completed by using 1 set)
Total removal volume per day in order to complete in 5 years	m ³ /day	8.2	I=f÷e	
Necessary Cleaning Equipment Sets	set	4.1	j=I÷g	4.1 sets ÷= 5 sets 5 sets are necessary to complete sewer cleaning work in 5 years

As the result of this examination, five sets of sewer cleaning equipment would be needed in order to complete the cleaning of all sewers in Colombo Municipality and its suburb within five years. Considering the availability of three existing equipment, two additional sets of cleaning equipment shall be supplied.

(4) Examination of Specification/Quantity of Necessary Equipment to Satisfy “Breakdown Maintenance”

CMC sewer cleaning work is being attended to upon receipt of complaints or reports from residents about sewer blockage.

As shown in Table 2-7, the complaints or reports in the whole CMC area reached a maximum number of 92 cases and an average of 53.2 cases per day. Of these cases, 41.3 cases were cleaned on the same day that the reports were received while 12.6 cases remained to be done in the following days.

It is clear that the sewer-cleaning capability of CMC could not keep up with the demand. The major reason for the insufficient service is the lack of cleaning equipment.

Table 2-7 Complaints/Reports in Each District and Cleaning Services

District	1	2A	2B	3	4	5	Total
Requests - Average	13.4	4.4	11.7	13.1	4.8	4.8	52.3
- Maximum	21	8	24	39	12	11	92
- Minimum	6	2	1	1	1	1	20
Cleaned - Average	10.2	4.4	10.0	7.1	4.8	4.8	41.3
- Maximum	18	6	22	15	8	11	58
- Minimum	5	2	1	1	1	1	1
Remained - Average	3.2	1.9	1.6	6.0	1.8	0.0	12.6
- Maximum	12	6	6	24	7	0	32

High-pressure cleaning/suction machines and suction machines are mainly used for this cleaning work. At present, CMC owns a total of 17 cleaning vehicles. Some of these are old and broken, so that only 12 cleaning vehicles are in operation.

In examining the past three months of operation, it was observed that all cleaning vehicles were sent out every day. However, high-pressure cleaning/suction machines were repaired every 52 days-unit at the repair shop within the period of 273 (3 units x 91 days) operating days, giving a breakdown ratio of 19%. On the other hand, suction machines were repaired every 95 days-units within the period of 819 (9 units x 91 days) operating days, giving a breakdown ratio of 12%.

Table 2-8 Estimation of the Number of Necessary Cleaning Equipment Set

Equipment	Owning Unit	Year of Manufacturing	Operation Unit	Breakdown Ratio
High-pressure cleaning/suction machine	4	1989—1998	3	19%
Suction machine	13	1980—1992	9	12%

As described above, the existing sewer cleaning equipment owned by CMC break down quite often and have to be repaired without delay in order to address the many complaints/reports received every day.

It is expected that the utilization of these cleaning equipment will help meet the needs as well as alleviate the discomfort of the complaining residents.

For this reason, CMC requires one unit of high pressure jetting machine and one unit of high power sludge suction machine. During discussions of M/D, CMC strongly requested the Study Team to include the supply of a high-pressure jetting machine and a suction machine, indicating that it could provide the budget for the two suction machines. However, CMC modified the request and instead

recommended the supply of two high-pressure jetting machines for minimizing the remaining 12.6 cases per day.

CMC also requested the supply of the following equipment that it considers indispensable to the proper operation and maintenance of the CMC sewerage facility.

- 1) Pipe Plugs
Pipe plugs prevent sewage flowing into manholes and provide safe and sufficient conditions for cleaning services.
- 2) Rod Turning Machine
Variable tools can be attached to the ends of the rods and the machine turns the rods for cutting roots and removing grit, gavages, grease etc in sewers.
- 3) Portable Submersible Pumps and Mobile Generators
Submersible pumps are used to drain sewage from manholes. Mobile generators supply electricity for the pumps at sewer cleaning sites.
- 4) Crane Mounted Truck
The truck can be transport all equipment and tools for sewer cleaning services.
- 5) Hydraulic Puller
This tool is used for maintenance of pumps.

(5) Accessories/Spare Parts

Sewer cleaning work is difficult knowing present sewer and manhole conditions. Equipment accessories such as nozzles and high-pressure hoses are easily worn, damaged or lost during sewer cleaning work. It is seen that the lack of some accessories will disrupt daily sewer cleaning work. The needed quantity of accessories should be supplied with the sewer cleaning equipment itself.

Shortage of spare parts will surely cause problems to the program to complete cleaning all sewers with total length of 330 km in Colombo and its suburb by 2010. It is preferable to supply an adequate number of spare parts to ensure completion of sewer-cleaning work without undue delay.

Procurement of spare parts for vehicles is relatively easy, since Japanese trucks are very popular and many local agents are available in Sri Lanka. While spare parts for special equipment of the upper section such as high pressure pumps, blowers etc. are not available, they can be ordered and imported on demand. Therefore, vehicle spare parts shall be locally procured in Sri Lanka using local funds. Spare parts provided under this Project will only be for the upper section of the equipment, but spare parts for these sections are difficult to find in the local Sri Lankan market. Only these special spare

parts will be supplied by the Japanese grant-in-aide to facilitate the implementation of the sewer-cleaning program.

The content and quantity of the accessories are shown in Table 2-10 to 2-13.

The content and quantity of the spare parts are shown in Table 2-14.

2-2-2-2 Specifications of Required Equipment

Standardized common specifications of the required equipment are set as the minimum program requirements based on the comparative evaluation of more than three different manufacturers. Available equipment will be examined to select those that will facilitate ease of operation and maintenance by NWS&DB and CMC operators.

Among others, basic common specifications to be applied are as follows:

(1) Truck Specification

Principal traffic rules in Sri Lanka allow for the use of vehicles with left and right hand drives are the same as those in Japan. A 4 x 2 (4 wheels vehicle with 2 wheels drive) transmission shall be specified considering the road condition in Colombo and its suburb. Power transfer to cleaning equipment shall be of PTO in view of mobility and cost effectiveness.

(2) Pump Head of High Power Sludge Suction Machine

Referring in 2-2-1 (2), pump head is required to be 15 m since the high power sludge suction machine has to remove sand and sludge from deep manholes and pump pits. Root type blower is also required.

(3) Other Sewer Cleaning Equipments

The performance of the submersible pump is determined by taking into account the maximum depth of and sludge volume in the deep manholes. The generator for the submersible pump shall have a rated output of 12/15 KVA based on the start-up load and the power consumption for operating two pumps needed by one generator. The number of pipe plugs determined equally by the existing sewer diameter/length and the assumed frequency of use for each diameter. A crane mounted truck (4 ton) should be considered for inclusion as transport for the manhole cleaning equipment.

The required specifications of the above-mentioned equipment are summarized in Table 2-9.

Table 2-9 Required Quantity and Specifications of Sewer Cleaning Equipment

Name of Equipment	Specifications	Quantity		
		NWS & DB	CMC	Total
A-1 High Pressure Jetting Machine	Type: Medium size (4 ton class), right-handle, 4x2 Engine: Water-cooled, 4-cycle, diesel engine Power transfer: PTO Max. Discharge Pressure: 20 Mpa (Common use 18 Mpa) Max. Discharge Volume: more than 230 liter/min Water Tank Volume: more than 2.4 m ³ High Pressure Hose: Hydraulic winding system, dia. of more than 7/8B and length of more than 120 m	2 units	2 units	4 units
A-2 High Power Sludge Suction Machine	Type: Medium size (4 ton class), equipped with dehydration system, out-rigger and dump mechanism for sludge tank, right-handle, 4x2, Engine: Water-cooled, 4-cycle, diesel engine Power transfer: PTO Blower Type: Roots blower Theoretical Air Flow: more than 20 m ³ /min Vacuum Pressure: less than -69 kPa (-520 mmHg) Pressure: more than 49 kPa (0.5 kg/cm ²) Pump Head for Sludge: more than 15 m Vacuum Capacity (For Dry Sand): more than 4 t/hr Vacuum Capacity (For Sludge): more than 10 t/hr Sludge Tank Volume: more than 3.2 m ³ Size of Suction/Drain Hose: more than 100 mm	2 units	0	2 units
A-3 Water Tanker	Type: Medium size (4 ton class), right-handle, 4x2 Engine: Water-cooled, 4-cycle, diesel engine Water Tank Volume: more than 4.0 m ³ Delivery Pump Capacity: more than 400 liter/min	2 units	0	2 units
A-4 Pipe Plug For Ø150mm	Type: Sleeve type pipe plug Applied diameter: Ø133 – 211 mm Product weight: less than 1.0 kg	3 units	2 units	5 units
A-5 Pipe Plug For Ø200 - 250mm	Type: Sleeve type pipe plug Applied diameter: Ø178 – 260 mm Product weight: less than 3.0 kg	6 units	2 units	8 units
A-6 Pipe Plug For Ø300 - 450mm	Type: Sleeve type pipe plug Applied diameter: Ø273 – 477 mm Product weight: less than 14.5 kg	3 units	2 units	5 units
A-7 Pipe Plug For Ø375 - 600mm	Type: Sleeve type pipe plug Applied diameter: Ø375 – 635 mm Product weight: less than 42.0 kg	3 units	2 units	5 units
B-1 Rod Turning Machine	Type: Type: Mobile type rod turning machine (with wheel) Power: Gasoline engine, 5 HP or more Applied rod: Ø8 mm Cleaned pipe diameter: Ø75 – 350 mm	0	1 unit	1 unit
B-2 Portable Submersible Pump	Type: Mobile type submersible pump Diameter: Ø80 mm Pump head: 20 m Power: 3.7 kW	6 units	2 units	8 units
B-3 Crane Mounted Truck	Type: Medium class (4 tons) for transportation Vehicle Specification: Boom length: retracted length, more than 3 m, extended length, more than 5 m Lifting capacity: max. 2.9 ton or more (working radius, 2.7 m) Outrigger device: hydraulic system	0	1 unit	1 unit

B-4 Mobile Generator	Type: Mobile type generator, Trailer mounted type, Soundproof type Power: 12.5/15 kVA Product weight: less than 580 kg	3 unit	1 unit	4 unit
B-5 Hydraulic Puller	For pulling pump impeller Type: Hydraulic type Pulling power: more than 50 ton	0	1 unit	1 unit

Note: Any figures (as dimension of chassis) shown in the above table are to have the permissible range \pm 10 %.

Table 2-10 Quantity and Specifications of High Pressure Jetting Machine Accessory

Name of Equipment	Specifications	Quantity		
		NWS &DB	CMC	Total
AC-1 Standard Nozzle	Type: 1 inch backward jetting nozzle Outer diameter: 54 mm Jetting angle: 20°	1 unit	1 unit	2 units
AC-2 Standard Nozzle	Type: 1 inch backward jetting nozzle (Front opening type) Outer diameter: 54 mm Jetting angle: 20°	1 unit	1 unit	2 units
AC-3 Standard Nozzle	Type: 10 holes carrier nozzle Outer diameter: 105 mm Jetting angle: 15°	1 unit	1 unit	2 units
AC-4 Standard Nozzle	Type: 10 holes carrier nozzle (Front opening type) Outer diameter: 105 mm Jetting angle: 15°	1 unit	1 unit	2 units
AC-5 Hose roller		2 units	2 units	4 units
AC-6 Hose guide pipe		2 units	2 units	4 units
AC-7 Hose roller stay		2 units	2 units	4 units
AC-8 Hose guide holder		2 units	2 units	4 units
AC-9 Jet gun		2 units	2 units	4 units
AC-10 High pressure main hose	Length 20m	1 unit	1 unit	2 units
AC-11 High pressure main hose	Length 40m	2 unit	2 unit	4 units
AC-12 High pressure sub hose	Length 20m	1 unit	1 unit	2 units
AC-13 High pressure hose for manhole washing	Length 4m	1 unit	1 unit	2 units

Table 2-11 Quantity and Specifications of High Power Sludge Suction Machine Accessory

Name of Equipment	Specifications	Quantity		
		NWS & DB	CMC	Total
AC-14 Suction Hose	Ø100 mm×20 m	2 units	0	2 units
AC-15 Center joint	Ø100 mm	2 units	0	2 units
AC-16 One touch coupler	Ø100 mm	2 units	0	2 units
AC-17 Attachment	Ø100 mm	2 units	0	2 units

Table 2-12 Quantity and Specifications of Water Tanker Accessory

Name of Equipment	Specifications	Quantity		
		NWS & DB	CMC	Total
AC-18 Hose	Ø50 mm×20 m	1 unit	0	1 unit
AC-19 Hose	Ø50 mm×40 m	1 unit	0	1 unit
AC-20 Attachment	Ø50 mm	1 unit	0	1 unit

Table 2-13 Quantity and Specifications of pipe plug Accessory

Name of Equipment	Specifications	Quantity		
		NWS & DB	CMC	Total
AC-21 Air hose	Length 10 m including gauge	5 units	3 units	8 units
AC-22 Air hose	Length 20 m including gauge	2 units	2 units	4 units
AC-23 Handy type pump	Including gauge type	2 units	1 unit	3 units
AC-24 Compressor	Power: AC 240V, 600 W Discharge Volume: 65 liter/min Product weight: less than 15 kg	2 units	2 units	4 units

Table 2-14 Spare Parts List

No.	Name of Spare Parts	Q'ty
Spare Parts for High Pressure Jetting Machine		
1	For Plunger Pump	1 Ls
2	For Hydraulic Parts	1 Ls
3	For Electric Parts	1 Ls
4	For Electric Parts	1 Ls
5	For Driving Unit	1 Ls
6	For Pipe Parts	1 Ls
7	For Unloader Valve	1 Ls
8	Other Spare Parts	1 Ls
Spare Parts for High Power Sludge Suction Machine		
1	For Vacuum Pump	1 Ls
2	For Hydraulic Parts	1 Ls
3	For Electric Parts	1 Ls
4	For Driving Unit	1 Ls
5	For Overflow Check System	1 Ls
6	For Sludge Tank	1 Ls
7	Other Spare Parts	1 Ls
Spare Parts for Water Tanker		
1	For Electric Parts	1 Ls
2	For Driving Unit	1 Ls
3	For Water Tank	1 Ls
4	Other Spare Parts	1 Ls

2-2-3 Basic Design Drawing

There are no basic design drawings, since this project doesn't have the equipment to be installed.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Executing Agency of the Project in Sri Lanka is NWS&DB which is under the jurisdiction of MUD&WS, as shown in Figure 2-2.

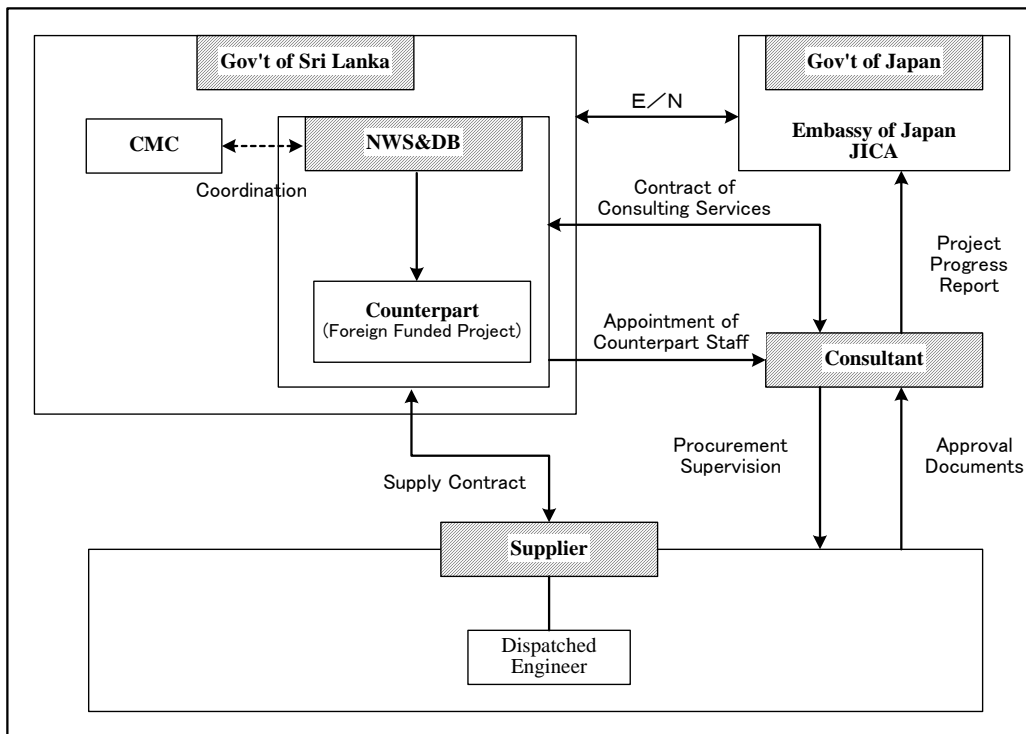


Figure 2-2 Implementation Set-up

To implement the Project, close coordination and cooperation among NWS&DB and the CMC are required. In this respect, NWS&DB shall appoint a fulltime counterpart staff exclusively for the Project and to form a team which will maintain close cooperation with the consultants during Project implementation. Prior to delivery of equipment, NWS&DB and CMC shall form a task force consisting of a manager, executive engineers, equipment operators, assistant operators, and workers to undertake the following assignments:

The role of the counterpart staff for this project is as follows;

- (1) To be the coordination and implementing arm of NWS&DB for the Project
- (2) To liaise and coordinate with NWS&DB and with relevant agencies
- (3) To enforce cooperation in design, bidding and project supervision,
- (4) To plan, coordinate and implement the sewer cleaning program with sewer cleaning groups upon participating in the OJT to be rendered by the Japanese Expert etc.

The Japanese consultant shall undertake the preparation of tender documents, provide assistance in bidding, supervision of procurement and delivery for the smooth implementation and completion within the designated period of the Project.

The Japanese supplier shall enter into a supply contract through bidding and negotiation with the Government of Sri Lanka, and commence manufacturing and assembling of sewer cleaning equipment upon verification of the contract by the Government of Japan. At the delivery and turn-over of equipment, the Japanese supplier shall provide NWS&DB with trial operation and technical guidance on maintenance and repair work, as described hereafter.

2-2-4-2 Implementation Conditions

(1) Equipment Placement Plan

Currently, sewer cleaning work is undertaken by CMC for Colombo the system, while the work for Dehiwala/Mt. Lavina and some housing scheme systems is undertaken by NWS&DB. In this connection, there are plans to allocate the procured equipment under the Project to NWS&DB for preventive maintenance and CMC for breakdown maintenance.

The Equipment Placement Plan was prepared, taking into account the number of equipment to be procured and the location conditions of NWS&DB and CMC, as shown in Table 2-15.

Table 2-15 Equipment Placement Plan

Organization	Sewer Cleaning Area	Remarks
Task Force (NWS&DB)	Colombo and suburb sewerage system	<p>- Sewer cleaning vehicles[*]: 2 sets 5 sets of the vehicles will be required to clean all sewers (330 km) in the area within 5 years. However in view of existing 3 sets in NWS&DB, only 2 new sets will be procured.</p> <p>- Pipe plugs: 1 set Specifications and numbers of plugs are determined considering diameters, length etc. of the existing sewerage systems.</p> <p>- Submersible pump, mobile generator These equipment will be supplied upon the request of NWS&DB to maintain sewers and manholes.</p>
CMC	Colombo sewerage system (“Breakdown Maintenance”)	<p>- High pressure jetting machine: 2 set The equipment will be utilized upon request from citizens as breakdown maintenance. 1 set of new vehicles except a water tanker will be provided, because some existing equipment are heavily deteriorated.</p> <p>- Pipe plugs: 1 set Specifications and numbers of plugs are determined con-</p>

		sidering diameters, length etc. of the existing sewerage systems. - Rod turning machine, submersible pump, crane mounted truck, mobile generator, hydraulic puller These equipment will be supplied upon the request of CMC to maintain sewers and manholes.
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Note *): A set of sewer cleaning vehicles consists of a high pressure jetting machine, a high power sludge suction machine and a water tanker.

(2) Equipment Operation and Maintenance Plan

There are many operators and workers of NWS&DB and CMC in charge of sewer cleaning services are who not well trained for equipment operation and maintenance. After equipment is supplied,, initial skills training shall be conducted for proper operation and sustainable maintenance. Hands-on training will be provided to the maintenance crew.

Given the situation cited above, in addition to the provision of cleaning equipment, skills training for equipment operation, safety control and cleaning procedures will form part of the Project activities.

Skills training for operation, maintenance and repair work will be undertaken as planned at NWS&DB’s Jayawadanagama Office and CMC’s Maligakanda Office by an engineer from the Japanese supplier for the period of one month, as shown in Table 2-16.

Table 2-16 Skills Training Plan

Expert	Training Activity	Timing and Duration
Equipment Operation Maintenance Specialist	Skills training to personnel of task force of NWS&DB and CMC for operation, maintenance and repair works.	One month period upon delivery of equipment to NWS&DB and CMC.

2-2-4-3 Scope of Work

In accordance with the Minutes of Discussions and the outcome of this Basic Design Study, implementation conditions required for both the Government of Sri Lanka and the Government of Japan are described in Table 2-17.

Sewer cleaning vehicles shall be parked under the shelter and the spare parts shall be kept at NWS&DB’s and CMC’s workshops. In this connection, NWS&DB and CMC shall, at their own expense, prepare proper shelters and workshops for this purpose at the locations as shown in Table 2-15. All spare parts shall be properly stored using its inventory for proper stock keeping and supplemental procurement of used spare parts.

Table 2-17 Implementation Conditions to be Undertaken by Each Government

Required Undertaking	Responsible Government	
	Sri Lanka	Japan
1. To bear the following commissions to a bank of Japan for banking services based upon the B/A 1) Advising commission of A/P 2) Payment commission of A/P	○ ○	
2. To ensure prompt unloading and customs clearance at the port of disembarkation in Sri Lanka 1) Marine (Air) transportation of the products from Japan to Sri Lanka 2) Tax exemption and custom clearance of the products at the port of disembarkation 3) Internal transportation from the port of disembarkation to the project site	○ ○	○
3. To accord for entry and stay	○	
4. To exempt duties, taxes, etc.	○	
5. To maintain and use properly the equipment supplied by the Grant Aid	○	
6. To bear all the expenses, other than those to be borne by the Grant Aid	○	
7. To conduct technical assistance on operation, maintenance and repair of the equipment		○
8. To establishment of a task force for sewer cleaning program	○	
9. To implement appropriate stock keeping and supplemental procurement of spare parts	○	

2-2-4-4 Consultant Supervision

The provision of services for consultant supervision will be contracted with NWS&DB upon the execution of the Exchange of Notes and will be effective when the contract is verified by the Government of Japan. Supervisory services will include the following activities and duration:

- | | |
|--|---------|
| (1) Final confirmation of content of the Project with NWS&DB | 7 days |
| (2) Preparation of Tender Documents | 50 days |
| (3) Approval of Tender Documents by NWS&DB | 14 days |
| (4) Project Briefing and Tender Document Release | 10 days |
| (5) Bid Evaluation | 15 days |

The bar chart showing the time frame for consultant's supervision is shown in Table 2-18.

2-2-4-5 Procurement Plan

NWS&DB and CMC own European-made (British and Italian) sewer cleaning equipment that consist of truck-mounted high pressure jetting machines and vacuum cleaner. However, for this project, Japanese-made sewer cleaning equipment will be procured.

- (1) Sewer cleaning equipment of various types are mounted on vehicles. In Sri Lanka, Japanese vehicles are popular and there are Japanese manufacturers with local agents in the country. Therefore, spare parts are also available from local agents in Sri Lanka and can be easily procured for needed repairs.
- (2) Private garages and maintenance shops are familiar with Japanese vehicles, making maintenance easier and unproblematic.
- (3) When European-made sewer cleaning equipment or vehicles break down, procurement time for spare parts takes longer which can delay the sewer cleaning program. Local garages and maintenance shops that are unfamiliar and inexperienced with the vehicle and equipment will likewise face difficulties when doing repair work.

2-2-4-6 Quality Control Plan

Prior to ordering the equipment, a meeting will be held to confirm the order. Prior to the manufacturing approval, the documents/drawings will be examined by the Consultant. Before shipment, the equipment will be inspected by the independent inspector, to ensure that the specified quality for the equipment is strictly followed.

2-2-4-7 Implementation Schedule

The prepared implementation schedule takes into consideration the manufacturing period, ocean shipping and inland transportation as well as delivery inspection and technical assistance to NWS&DB and CMC personnel, as shown in Table 2-18

The procurement process will include the following activities:

- | | |
|--|----------------|
| (1) Negotiation and arrangement with contractor for manufacturing: | 10 days |
| (2) Manufacturing period: | about 6 months |
| (3) Inspection before shipment from the factory: | 10 days |
| (4) Delivery inspection before ocean transportation | 3 days |
| (5) Ocean transportation (Japan to Colombo): | about 1 month |
| (6) Unloading, custom clearance and inland transportation: | about 1 month |

- (7) Delivery inspection and turnover: about 0.5 month
- (8) Initial training for operation, maintenance and repair: about 1 month

Table 2-18 Project Implementation Schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E/N	▼															
Detailed Design Stage																
Consultant Contract/Confirmation	▨															
Preparation of Tender Documents		▨	▨													
Tendering/Evaluation			▨	▨	▨											
Supply Contract/Verification						▨										
Procurement																
Designing/Manufacturing						▨	▨	▨	▨	▨	▨					
Ocean Transport/Custom Clearance												▨	▨			
Delivery inspection/Turnover														▨		
Initial Training															▨	

2-3 Obligations of Recipient Country

The following necessary measures should be undertaken by the Sri Lankan government if the grant-in-aid by the Government of Japan is extended to the Project:

- (1) To assume the cost of commissions to the Japanese bank for banking services based on the Banking Arrangement, namely advising commission of the "Authorization to Pay" and payment commission.
- (2) To ensure prompt payment of taxes, customs clearance at the port of disembarkation and facilitate prompt unloading and internal transportation therein of the materials and equipment for the Project purchased under the Grant-in-Aid.
- (3) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts, such facilities as may be necessary for their entry into Sri Lanka and their stay therein for the perform-

ance of their work in accordance with the relevant laws and regulations of Sri Lanka.

- (4) To exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts. To the extent that any taxes or duties are to be paid, the implementing organization shall bear such liabilities.
- (5) To maintain and use properly and effectively the facilities constructed and the equipment provided under the Grant-in-Aid.
- (6) To bear all the expenses, other than those to be borne by Japan's Grant-in-Aid within the scope of the Project.
- (7) To establish a task force and provide necessary personnel for the sewer cleaning program.
- (8) To implement appropriate stock keeping and supplemental procurement of spare parts.

As one of several requirements to meet the above items, the following necessary measures should be undertaken by the Sri Lanka government.

(1) Provision of Parking Spaces

NWS&DB and CMC shall provide the following parking space with shed for the equipment provided by the Project, respectively.

NWS&DB

Space: 6 vehicles (300 m²)

Cost: 300 thousand Rs.

CMC

Space: 3 vehicles (150 m²)

Cost: 150 thousand Rs.

(2) Storage Areas

NWS&DB and CMC shall use the storage space in offices and workshops for spare parts provided by the Project.

Cost: Not required.

2-4 Project Operation and Maintenance Plan

2-4-1 Project Operation Plan

NWS&DB and CMC have been maintaining sewers in their respective areas but have encountered problems and difficulties such as the following:

- 1) Malfunctions of existing sewer cleaning equipment (NWS&DB and CMC)
- 2) Absence of regular cleaning programs as preventive maintenance, except for periodic cleaning works as breakdown maintenance upon the request of residents (CMC)
- 3) Lack of knowledge and experience in proper maintenance services (NWS&DB and CMC)

After new equipment is supplied, the first problem can be solved; however, proper cleaning programs and methods shall be introduced in accordance with targets. For this purpose, an individual task force will be established by NWS&DB. A Task Force representative will plan and coordinate with NWS&DB and CMC for implementation of the program using both new and existing equipment. The following items shall be considered.

(1) Selection of the members of the Task Force and the budget allocation

Members of the task force should be knowledgeable in the use of the supplied equipment in sewer cleaning. Personnel will be assigned as heads of the task force, heads of the working groups, operators and other staff. All costs pertaining to program operation, personnel, and equipment maintenance shall be provided..

(2) Training for the engineers/operators of relevant organizations

Knowledge/know-how on sewers and sewer cleaning services shall be imparted to the members of the task force as well as to the sewer cleaning teams of CMC, who have been previously conversant only with “breakdown maintenance”. Specifically, the knowledge skills transfer shall cover subjects such as the existing sewer network in CMC and suburb, location of the sewer lines, functions and operation of the equipment supplied by the Project, sewer cleaning methods, sludge disposal, sanitary/safe instructions for the services etc. NWS&DB has to prepare a manual for sewer cleaning services and cause the delivery of the same to the officers/engineers/operators concerned.

(3) Maintenance/storage of spare parts and manuals

NWS&DB and CMC have not previously kept operating manuals on existing equipment on file for the use of operators and workers, hence contributing to their scant knowledge about the equipment. To remedy this situation, all manuals and technical data shall be

strictly maintained at the task force office, other relevant offices and the libraries in NWS&DB and CMC. All accessories and spare parts shall also be stored properly.

2-4-2 Operation and Maintenance

2-4-2-1 Formation of Sewer Cleaning Program

A set of sewer cleaning equipment consists of a high pressure jetting machine, a high power sludge suction machine and a water tanker. The required team composition for operating a set of sewer cleaning equipment are as follows.

1) Inspector	1 person
2) Operators of vehicles	2 persons
3) Drivers of vehicles	2 persons
4) Workers	5 persons
Total	10 persons

The sewer cleaning program requires five sets of equipment and five teams; however, since only two new sets of equipment are supplied by this Project, two teams will be required. This will be in addition to the three existing sets in NWS&DB, which are presently being operated by three teams.

In the CMC areas, some equipment have become deteriorated; but the new equipment supplied by the Project can be operated by available personnel. Hence, additional personnel will not be required.

In totality, only 20 additional personnel are required for the program,, as follows:

$$10 \text{ persons/team} \times 2 \text{ teams} = 20 \text{ persons}$$

Additional personnel such as the head of the task force, assistants or staff can be allocated from the existing NWS&DB's & CMC's roster.

2-4-2-2 Additional Personnel Expenses for Sewer Cleaning Program

As shown in Table 2-19, additional personnel expenses Rs 5,880,000 (Japanese Yen 6,468,000) will be required on an annual basis.

Table 2-19 Wages/Salaries of Sewer Cleaning Team

Unit: Rs

Position	Average Salary (Rs/month)	No. of Staff	Total Salary/Year	Remarks
Inspector	33,000	2	792,000	1 /team x 2 team
Operator	23,000	4	1,104,000	1 /team x 2 team
Driver	23,000	4	1,104,000	1 /team x 2 team
Field Worker	24,000	10	2,880,000	1 /team x 2 team
Total		20	5,880,000	

Note: Average salary is referred to NWS&DB data as of July, 2004.
The average salary includes overtime.

2-4-2-3 Annual Operation Cost of Equipment

Annual cost of operating and maintaining the sewer cleaning equipment is estimated as follows:

- 1) Sewer cleaning program to be implemented by the Task Force shall be carried out by using sets of equipment (a high pressure jetting machine, a high power sludge suction machine and a water tanker). Annual operating days is assumed to be 192 days.
- 2) Sewer cleaning services by CMC will be done to address the complaints and other requirements of the residents. These services are quite frequent, and annual operating days are assumed to be five days a week or 240 days per year. Other equipment such as rod turning machine, crane mounted truck and generators, are not that frequently operated, thus the annual operating days of the equipment is assumed to be 120 days per year.
- 3) Operating cost consisting of fuel (diesel) and lubricant is estimated, using the standard consumption rate stipulated in the "Guideline for Cost Estimate of Operation and Maintenance of Sewerage Facilities-Sewer Network" (issued by Japan Sewage Works Association). An actual unit consumption rate is considered at 120% of the said standard consumption rate considering heavy traffic conditions in Colombo. It shall be noted that fresh water for sewer cleaning and sludge treatment are not considered in these estimates

Based on the above estimates, annual operation cost is calculated as follows..

NWS&DB

1) Jetting Machine:	930 Rs/day x 192 days/year x 2 sets = 357,120 Rs/year
2) Suction Machine:	1,290 Rs/day x 192 days/year x 2 sets = 495,360 Rs/year
3) Water Tanker	910 Rs/day x 192 days/year x 2 sets = 349,440 Rs/year
4) Mobile Generator	229 Rs/day x 120 days/year x 3 sets = 82,440 Rs/year
Sub-Total	1,284,360 Rs/year

CMC

1) Jetting Machine:	930 Rs/day x 240 days/year x 2 set = 446,400 Rs/year
2) Rod Turning Machine:	224 Rs/day x 120 days/year x 1 set = 26,880 Rs/year
3) Mobile Generator	229 Rs/day x 120 days/year x 1 set = 27,480 Rs/year
4) Truck with Crane	625 Rs/day x 120 days/year x 1 set = 75,000 Rs/year
Sub-Total	575,760 Rs/year

Total 1,284,360 + 575,760 = 1,860,120 Rs/year

Table 2-20 Daily Operation Cost of Sewer Cleaning Equipment

Name of Equipment	Consumables	Unit	Q'ty	Unit Cost (Rs)	Operating Cost (Rs)	Remarks
1. Jetting Machine	Fuel	liter	23.5	33	775	4.9L/hr × 1.2 × 4hr
	Lubricant	set	1		155	20% of fuel
	Sub-Total				930	
2. Suction Machine	Fuel	liter	32.6	33	1,075	6.8L/hr × 1.2 × 4hr
	Lubricant	set	1		215	20% of fuel
	Sub-Total				1,290	
3. Water Tanker	Fuel	liter	23.0	33	759	4.8L/hr × 1.2 × 4hr
	Lubricant	set	1		151	20% of fuel
	Sub-Total				910	
4. Rod Machine	Fuel	liter	3.4	55	187	1.7L/hr × 2hr
	Lubricant	set	1		37	20% of fuel
	Sub-Total				224	
5. Generator	Fuel	liter	5.8	33	191	2.9L/hr × 2hr
	Lubricant	set	1		38	20% of fuel
	Sub-Total				229	
6. Crane Truck	Fuel	liter	15.8	33	521	6.6L/hr × 1.2 × 2hr
	Lubricant	set	1		104	20% of fuel
	Sub-Total				625	

Based on NWS&DB 2004 Rates

2-4-2-4 Annual Operation and Maintenance Cost

The annual operation and maintenance cost consists of salaries/wages of NWS&DB personnel and operating cost of equipment. This is estimated at Rs 7,740,120, with following breakdown:

Operating cost of the equipment	1,860,120 Rs/year
<u>Personnel expenses</u>	<u>5,880,000Rs/year</u>
Total	7,740,120 Rs/year

This annual O&M cost (7,740,120 Rs/year) falls within sustainable level which is 13.1 % of NWS&DB's average annual operation and maintenance expenses at Rs 58.9 million from 2001 to 2003.

On the other hand, the additional annual O&M cost of 7,740,120 Rs/year falls within affordable level which is only 5.3 % of average annual operation and maintenance expenses for CMC's sewerage system of Rs 144.5 million from 2000 to 2002.

2-4-2-5 Considerations on Operation and Maintenance

NWS&DB and CMC are responsible for the conduct of the following activities for the proper implementation of the sewer-cleaning program.

- 1) NWS&DB and CMC will provide all necessary personnel exclusively for the Task Force and all necessary expenses for operation and maintenance of the Task Force.
- 2) NWS&DB and CMC will provide proper storage for the supplied equipment, spare parts, as well as operation manuals for the program.
- 3) The Task Force will transfer the technology, knowledge, know-how and experiences to other relevant engineers and technical staff in NWS&DB and CMC.

2-5 Other Relevant Issues

2-5-1 Technical Assistance by Means of Soft Component Work

(1) The Need for Assistance for Problems to be Solved

The target of this soft component is to train engineers of the Task Force in NWS&DB to increase their knowledge on sewer cleaning services and enable them to learn newer technologies and know-how. This will enable them to implement and manage the sewer cleaning program for Colombo and its suburb for a period of five years based on the “Preventive Maintenance” concept. Engineers, operators and workers to be assigned to the new Task Force may have had some experiences on sewer cleaning services, but they need to adapt to updated technology and enrich and enhance their experiences and know-how, to further strengthen the recently established “Preventive Maintenance” sewer cleaning program.. Therefore, it is recommended a well-experienced Japanese consultant for establishing sewer-cleaning program to work together with the members of the Task Force, and assist the member to elaborate the program for Colombo and its suburb.

(2) Expected Result

A reliable and effective sewer cleaning program for the sewerage system in Colombo and its suburb will be established. The implementation of the program will greatly improve the living conditions of the population because such unsanitary environment, not to mention the inconvenience caused by sewer-blockage and sewage-overflow will be reduced, if not eliminated. The project will ultimately contribute to better health and a better environment for the 700,000 people of Colombo.

(3) Activity and Period

Activity

- Training of members of the Task Force
- Establishing the sewer cleaning program
- Providing a manual of sewer cleaning services

Period

- A specialist will be assigned to this component for 0.25 month in Japan and 1.5 month in Colombo

Implementation of this component will be expected in February 2006.

After implementation, Final Report will be submitted to NWS&DB and JICA by the end of March 2006.

Table 2-21 Training Activities and Duration of Soft Component

Item	2005						2006						
	7	8	9	10	11	12	1	2	3	4	5	6	7
Equipment Supply													
Manufacturing	[Solid Green Bar]												
Inspection					[Solid Green Bar]								
Ocean Transportation						[Solid Green Bar]							
Custom Clearance							[Solid Green Bar]						
Delivery								[Solid Green Bar]					
Task Force	(Training, Sewer Cleaning)							[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]
JICA Expert	(Monitoring, Advising)							[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]	[Dashed Green Bar]
Consultant	(Training/Support of Planning)							[Solid Green Bar]	[Solid Green Bar]				
Supplier	(Training for O&M of Equipment)							[Solid Green Bar]	[Solid Green Bar]				

(4) Obligations of Recipient Country's Counterpart

The following items shall be prepared for implementation of the Soft Component Work.

- Provision of engineers and technical staff (approx. 10 persons)
- Provision of all costs for the above personnel (ex. personnel cost, transportation etc.)
- Provision of rooms for this training
- Provision of all necessary technical data and information etc. on the existing sewer system in Colombo and suburb
- Provision of sewer cleaning equipment and all costs for operation of the equipment

Chapter 3
Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effect

The present sewerage system in Colombo Municipality comprises approximately 260 km of sewers, 18 pump stations and two ocean outfalls that were constructed in 1983. The population served by the system now is approximately 500,000 persons. Sewerage systems in the suburb consist of 60 km of sewers and 19 pump stations in the Kolonnawa Urban Council area located in eastern side of Colombo, the Dehiwala/Mt. Lavinia Municipal Council located in southern side of Colombo and some Housing Schemes.

The people in Colombo and suburb experience inconvenience and unsanitary living conditions since their sewerage system has not been well maintained. Many blockages occur in the sewers caused by the inflow of sand, sludge, domestic garbage, oils and fats. Wastewater then overflows into the storm water pipe and released to public water bodies. NWS&DB and CMC have proposed a preventive maintenance program to complete the cleaning of all sewers with a total length of 330 km in Colombo and suburb by 2010, while the ADB/JBIC plans to finance a project that will improve Greater Colombo Sewerage System by 2010.

Expected project effects are shown in Table 3-1.

Table 3-1 Expected Project Effects

Current Status	Countermeasures to be Taken by this Project	Project Effects
<p>1. Sewer cleaning as “preventive maintenance” is not conducted appropriately to prevent the blockages</p>	<ul style="list-style-type: none"> - 2 sets of the following equipment with accessories and spare parts will be supplied: <ul style="list-style-type: none"> a) High Pressure Jetting Machine b) High Power Sludge Suction Machine c) Water Tanker - Task Force will prepare sewer cleaning program and provide personnel to implement. - Soft Component will also be implemented for the technical transfer of sewer cleaning skills. 	<ul style="list-style-type: none"> - All sewers with a total length of 330 km in Colombo and its suburb can be cleaned by 2010 - Knowledge acquisition programs on sewerage and cleaning services will be developed for offices concerned. - Effective and efficient sewer cleaning methods will be developed for operators. - Regular sewer cleaning services will be implemented for the purpose of preventive maintenance.
<p>2. Proper cleaning services are not provided as breakdown maintenance due to lack of equipment.</p>	<ul style="list-style-type: none"> - 2 sets of High Pressure Jetting Machines with accessories and spare parts will be supplied: - Other auxiliary equipment such as rodding machine, truck with crane and submersible pump will be supplied. 	<ul style="list-style-type: none"> - Proper sewer cleaning services will be provided.
<p>3. Systematic and proper cleaning methods are not observed by supervisor and workers.</p>	<ul style="list-style-type: none"> - Organize Cleaning Task Force with procured equipment and secure the needed number of workers and engineers. - Soft Component will also be implemented for the technical transfer of pipe cleaning skills. 	<ul style="list-style-type: none"> - Participants’ knowledge on sewer cleaning and sewerage system will be enhanced. - Techniques in efficient pipe cleaning methods will be acquired.
<p>4. Populations in sewerage service areas are experiencing inconvenience and unsanitary living environment due to blockage in the sewers.</p>	<ul style="list-style-type: none"> - Procurement of sewer cleaning equipment and implementation of cleaning works in priority cleaning sections. 	<ul style="list-style-type: none"> - Living environment of local population of about 500 thousand residing in sewerage service areas will be improved.
<p>5. Overflowing raw sewage is discharged to public water bodies through drainage canals.</p>	<ul style="list-style-type: none"> - Sewer blockages will be minimized by systematic cleaning of 330 km sewers in Colombo and suburb using supplied sewer cleaning equipment. 	<ul style="list-style-type: none"> - Raw sewage discharge will be decreased.

3-2 Recommendations

In order to activate and sustain the project outcomes, recommendations are made that will enable Sri Lankan authorities to address issues and extend the needed technical cooperation:

(1) Formation of Task Force

Upon the procurement and availability of the proposed cleaning equipment, the Sri Lankan side shall form the Task Force under the joint control of the NWS&DB and CMC. This Task Force shall coordinate with the NWS&DB and CMC to secure the necessary staff and budget for the cleaning work and acquisition of the proposed equipment, to enable local operators to acquire the knowledge on sewerage system, to prepare the cleaning plan, and to transfer technology on sewer cleaning.

(2) Implementation of Soft Component

Engineers, operators and workers assigned to the new Task Force may have had the benefit of experience in sewer cleaning; however, their knowledge will have to be updated and their experiences enriched to be able to undertake “Preventive Maintenance” under the sewer cleaning program that is presently limited to “Breakdown Maintenance”.

Therefore, it is recommended that a well-experienced Japanese consultant be hired to implement the sewer-cleaning program in coordination with members of the Task Force. He will be able to assist the Task Force in working for the sustainability of the program for Colombo and its suburb.

(3) Reservation of Storage Yard for Procured Equipment and O&M Budget

Storage yard with shed for procured equipment such as high pressure jetting machines, high power sludge suction machines and water tankers will be provided by the NWS&DB and CMC, respectively. The existing warehouse shall provide ample storage for supplied accessories and spare parts.

Sewer cleaning equipment shall be utilized appropriately by workers and technicians after initial training for operation and maintenance. Regular oiling and greasing of the equipment is necessary in order to maximize their life span and good working condition. NWS&DB and CMC shall prepare the spare parts procurement plan based on inventory control for stable and long-term O&M works. Periodical inspection shall be conducted to ensure the optimal performance of the equipment.

(4) Monitoring of the Implementation of Sewer Cleaning Program

The Task Force shall monitor the progress of cleaning working groups every month and plan the activities of the groups in the next month.

Meanwhile, The JICA Expert for Sewerage shall regularly monitor and render advise on activities of the Task Force. The Expert shall be requested to assist in revising the program, if necessary, and to fully support the sewer cleaning services.

(5) Education for residents on Sewerage System

The functionality of the sewerage system depends on the proper use of drainage facilities and waste disposal practices of the residents. Sewer blockage can be decreased by the residents' basic knowledge and adequate usage of the sewerage system.

It will be necessary for the NWS&DB and CMC to educate residents on the sewerage system, as a vital activity that will minimize sewer blockages. School-based educational programs and media campaigns will serve as added activities.

(6) Project Cost Estimate

The project cost borne by the Japanese Government was estimated as follows:

Total Project Cost Approximately 1,346 thousand US\$

Items		Project Cost (1,000 US\$)
Equipment	Sewer cleaning equipment	989
	Spare parts and others	92
Site Supervision and Site Expenses		18
Detailed Design, Procurement Supervision and Technology Transfer		247

Note) This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Appendices

Appendix –1 Member List of the Study Team

Appendix –2 Study Schedule

Appendix –3 List of Parties Concerned

in the Recipient Country

Appendix –4 Minutes of Discussions

Appendix –5 Cost Estimate Borne

by the Recipient Country

Appendix-1 Member List of the Study Team

(1) Field Survey

Name of Team Member	Assignment	Organization
Toshio SUGIHARA	Team Leader	Resident Representative, JICA Sri Lanka Office
Shunsuke TAKATOI	Project Co-ordination	Project Management Group II, Grant Aid Management Department, JICA
Shin-ichi OSAKA	Chief Engineer/Sewerage Plan	NJS Consultants Co.,Ltd.
Jun-ichi HACHIYA	Sewer Cleaning Equipment Plan	
Toru YAGI	Procurement Plan/Cost Estimation	

(2) Explanation and Discussion on Draft Basic Design Report

Name of Team Member	Assignment	Organization
Toshio SUGIHARA	Team Leader	Resident Representative, JICA Sri Lanka Office
Shin-ichi OSAKA	Chief Engineer/Sewerage Plan	NJS Consultants Co.,Ltd.
Toru YAGI	Procurement Plan/Cost Estimation	

Appendix-2 Study Schedule

(1) Field Survey

Days	Month, Day	DW	Activities	Study Team Member				
				Sugihara	Takato	Osaka	Hachiya	Yagi
1	May 15	Sat	Transition (Narita – Columbo)		○	○		
2	May 16	Sun	Field Survey		○	○		
3	May 17	Mon	Courtesy call to JICA • Embassy of Japan	○	○	○		
4	May 18	Tue	Discussion with NWS&DB	○	○	○		
5	May 19	Wed	Ditto	○	○	○		
6	May 20	Thu	Discussion on M/M	○	○	○		
7	May 21	Fri	M/M signing/Report to JICA • EOJ	○	○	○		
8	May 22	Sat	Field survey		○	○		
9	May 23	Sun	Day off			○		
10	May 24	Mon	Internal meeting • Discussion with NWS&DB			○	○	○
11	May 25	Tue	Data collection • Field survey			○	○	○
12	May 26	Wed	Ditto			○	○	○
13	May 27	Thu	Ditto			○	○	○
14	May 28	Fri	Ditto			○	○	○
15	May 29	Sat	Participation to ADB seminar			○	○	○
16	May 30	Sun	Day off			○	○	○
17	May 31	Mon	Data collection • Field survey			○	○	○
18	June 1	Tue	Ditto			○	○	○
19	June 2	Wed	Ditto			○	○	○
20	June 3	Thu	Ditto			○	○	○
21	June 4	Fri	Ditto			○	○	○
22	June 5	Sat	Internal meeting			○	○	○
23	June 6	Sun	Day off			○	○	○
24	June 7	Mon	Data collection • Field survey			○	○	○
25	June 8	Tue	Technology Transfer Seminar • Discussion with NWS&DB			○	○	○
26	June 9	Wed	Data collection • Field survey			○	○	○
27	June 10	Thu	Ditto			○	○	○
28	June 11	Fri	Report to JICA • Embassy of Japan			○	○	○
29	June 12	Sat	Transition (Columbo – Narita)			○	○	○
30	June 13	Sun	Transition (Columbo – Narita)			○		

Note) DW=Day of the Week

(2) Explanation and Discussion on Draft Basic Design Report

Days	Month, Day	DW	Activities	Study Team Member		
				Sugihara	Osaka	Yagi
1	September 5	Sun	Transition (Narita – Columbo)		○	○
2	September 6	Mon	Courtesy call and report explanation to JICA, Courtesy call to NWS&DB	○	○	○
			Courtesy call and report explanation to Embassy of Japan and Department of External Resources		○	○
3	September 7	Tue	Report explanation and discussion with NWS&DB and Columbo Municipal Council		○	○
			Courtesy call and report explanation to Ministry of Urban Development & Water Supply	○	○	○
4	September 8	Wed	Discussion on M/D		○	○
5	September 9	Thu	Preparation of M/D		○	○
6	September 10	Fri	M/D signing, Report to JICA • EOJ	○	○	○
7	September 11	Sat	Internal meeting		○	○
8	September 12	Sun	Transition (Columbo – Narita)		○	○

Note) DW=Day of the Week

Appendix-3 List of Parties Concerned in the Recipient Country

Organization	Position	Name
National Water Supply & Drainage Board (NWS&DB)	Chairman	S. L. Seneviratne
	General Manager	M. Wickramage
	Additional General Manager Planning & Monitoring	K. M. N. S. Fernando
	Additional General Manager Foreign Funded Project	A. H. C. Silva
	Deputy General Manager Foreign Funded Project	K. R. Dewasurendra
	Assistant General Manager Japanese Project Unit	J. K. S. Pathirana
	Assistant General Manager Greater Colombo Sewerage Section	S. G. J. Rajkumar
	Chief Mechanical Engineer Wellawatta Pumping Station	M. K. A. Nishantha
	Colombo Sewerage Rehabilitation Project Project Manager	N. M. S. Kalinga
Colombo Municipal Council (CMC)	Municipal Commissioner	Dr. Jayantha Liyanage
	Superintending Engineer Sewerage Pumping Station	S. Thiagarasah
	Director (Engineering) Solid Waste Management	Lalith Wickramaratne
Ministry of Urban Development & Water Supply	Secretary	Thosapala Hewage
Department of External Resources (DER) Ministry of Policy Development and Implementation	Additional Director General	J. H. J. Jayamaha
Asian Development Bank (ADB)	Project Implementation Specialist Sri Lanka Resident Mission	M. Thiruchelvam
	Senior Urban Development Specialist South Asia Department	M. Teresa Kho
Royal Danish Consulate-General (DANIDA)	Consul-General	D. H. S. Jayawardena
Japan International Cooperate Agency (JICA)	JICA Expert Sewerage	Ken-ichiro Yasuda
	JICA Expert Water Supply	Akira Ikeda

Appendix –4 Minutes of Discussions

MINUTES OF DISCUSSION
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR THE UPGRADING OF THE SEWER CLEANING EQUIPMENT
TO IMPROVE COLOMBO ENVIRONMENT
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

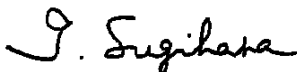
In response to the request from the Government of the Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "Sri Lanka"), the Government of Japan decided to conduct a Basic Design Study on the Project for the Upgrading of the Sewer Cleaning Equipment to Improve Colombo Environment (hereinafter referred to as "the Project"), and entrust the study to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Sri Lanka the Basic Design Study Team (hereinafter referred to as "the Team"), which was headed by Mr. Toshio Sugihara, Resident Representative, JICA Sri Lanka Office and was scheduled to stay in the country from May 15th to June 13th, 2004.

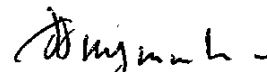
The Team held a series of discussions with the concerned officials of the Government of Sri Lanka and conducted a field survey in the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

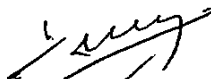
Colombo, May 21st, 2004



Toshio Sugihara
Leader
Basic Design Study Team
Japan International Cooperation Agency
Japan



J. H. J. Jayamaha
Additional Director General
Department of External Resources
Ministry of Policy Development and
Implementation
Sri Lanka



Dr. Jayantha Liyanage
Municipal Commissioner
Colombo Municipal Council
Sri Lanka



M. Wickramage
General Manager
National Water Supply and Drainage Board
Sri Lanka



M. M. C. Ferdinando
Additional Secretary
Ministry of Urban Development and Water
Supply
Sri Lanka

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance the sewer cleaning operations in order to prevent sewerage overflow to drain, canal system and water bodies and to mitigate environmental pollution.

(National Water Supply and Drainage Board (hereinafter referred to as NWS&DB) is proposing ADB/JBIC to invest for "Colombo Sewerage Project" starting in 2006. All sewerage facility will be rehabilitated and improved by the ADB/JBIC project. NWS&DB is planning to clean the existing sewers in Colombo city and suburbs by 2010, the completion of the ADB/JBIC project.)

2. Responsible Agency and Implementation Agency (Annex-1)

2-1 Responsible Agency

Ministry of Urban Development and Water Supply

2-2 Implementation Agency

NWS&DB

Colombo Municipal Council (hereinafter referred to as CMC)

2-3 Action Plan Task Force (Annex-2)

3. Project Site

The site of the Project is Colombo city and suburbs, where Colombo Sewerage System covers, in Western Province of Sri Lanka as shown in Annex-3

4. Items Requested by the Government of Sri Lanka

After discussions with Team, the items (with priority) shown in Annex-4 were requested by Sri Lanka side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1 Sri Lanka side has understood the Japan's Grant Aid Scheme explained by the Team, as shown in Annex-5.

5-2 Sri Lanka side will take necessary measure as described in Annex-6 for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6. Further Schedule of the Study

6-1 The consultant members of the Team will proceed with further studies in Sri Lanka until June 13th, 2004.

6-2 JICA will prepare the Draft of Basic Design Study Report in English and dispatch a mission in order to explain its contents in (or around) August 2004.

6-3 In case the contents of the Draft of Basic Design Study Report are accepted in principle by the Government of Sri Lanka, JICA will complete the final report and sent it to Sri Lanka side by the end of October 2004.

Handwritten signatures and initials in black ink, including a stylized signature, the letter 'W', a signature that looks like 'A', a circled 'Q', and a signature that looks like '7'.

7. Other Relevant Issues

7-1 Action Plan for Retrieval Work and Implementation System

- (1) NWS&DB and CMC explained that they were preparing the Action Plan for Utilization of Cleaning Equipment and Implementation of Cleaning Work (including transportation and disposal of sludge).
[CONCEPT : Cleaning all sewers in Colombo city and suburbs (as shown in Annex-3) by 2010]
- (2) NWS&DB and CMC will finalize it and send it to JICA Sri Lanka Office by the end of July.

7-2 Technical Support

- (1) Sri Lanka side explained their request for technical support and both sides discussed the components of it as below.
 - (a) Prioritizing the sewer areas for urgent cleaning
 - (b) Annual cleaning plan for five years
 - (c) Standard procedure for sewer cleaning work
 - (d) Monitoring/recording procedure of sewer cleaning work
 - (e) Method of maintenance and repair of equipments
- (2) The Team will examine the validity and suitability of components of technical support in Japan.

7-3 Warehouse

NWS&DB explained they were constructing a warehouse within the maintenance office site in Jayawadanagama to keep the equipment requested properly.

7-4 Tax Exemption

The taxes including customs duties and the Value Added Tax (VAT) related to the Project shall be met by responsible (implementation) agency.

7-5 Safety for Japanese Nationals

The Government of Sri Lanka will take all possible measures to secure the safety for the concerned people during the study and implementation of the Project on condition that the Grant Aid by the Government of Japan is extended to the Project.

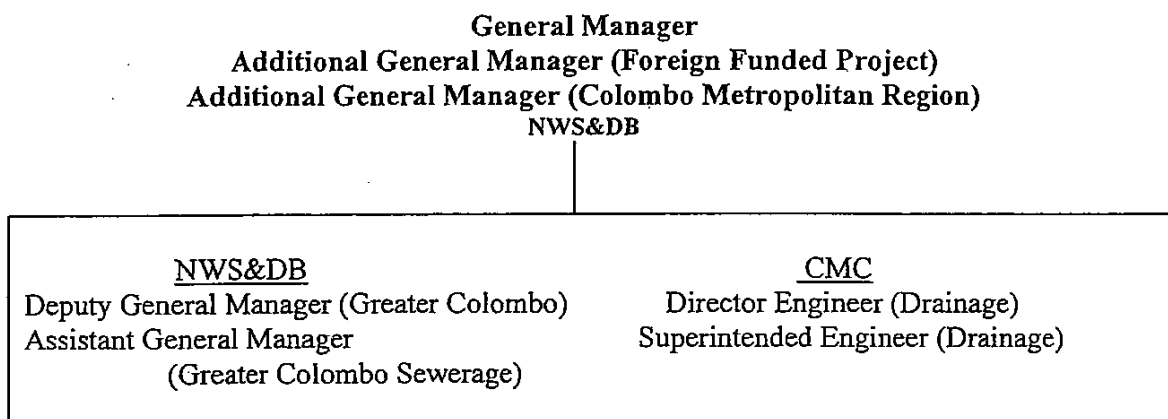


The Project-related Agencies

Agency	Responsibility
Ministry of Urban Development and Water Supply	
Water Sector Division	<ul style="list-style-type: none"> • to coordinate overall with the agencies related with the Project
National Water Supply and Drainage Board	
1. Foreign Funded Project Section / Japanese Project Unit	<ul style="list-style-type: none"> • to provide budget required • to nominate competent manager and personnel for implementing and monitoring Action Plan Task Force (APTF)
2. Operation and Maintenance Department (Greater Colombo Sewerage)	<ul style="list-style-type: none"> • Operation & Maintenance
3. Foreign Funded Project Section / Finance Section	<ul style="list-style-type: none"> • Tax exemption procedures • Procedures of major undertakings to be taken by Government of Sri Lanka
Colombo Municipal Council	
1. Water Supply and Drainage Department	<ul style="list-style-type: none"> • Planning • Operation and Maintenance • to nominate competent manager and personnel for implementing and monitoring Action Plan Task Force (APTF)
2. Treasurers Department	<ul style="list-style-type: none"> • to provide budget

ACTION PLAN TASK FORCE (APTF)
FOR
THE PROJECT FOR THE UPGRADING OF THE SEWER CLEANING EQUIPMENT
TO IMPROVE COLOMBO ENVIRONMNET

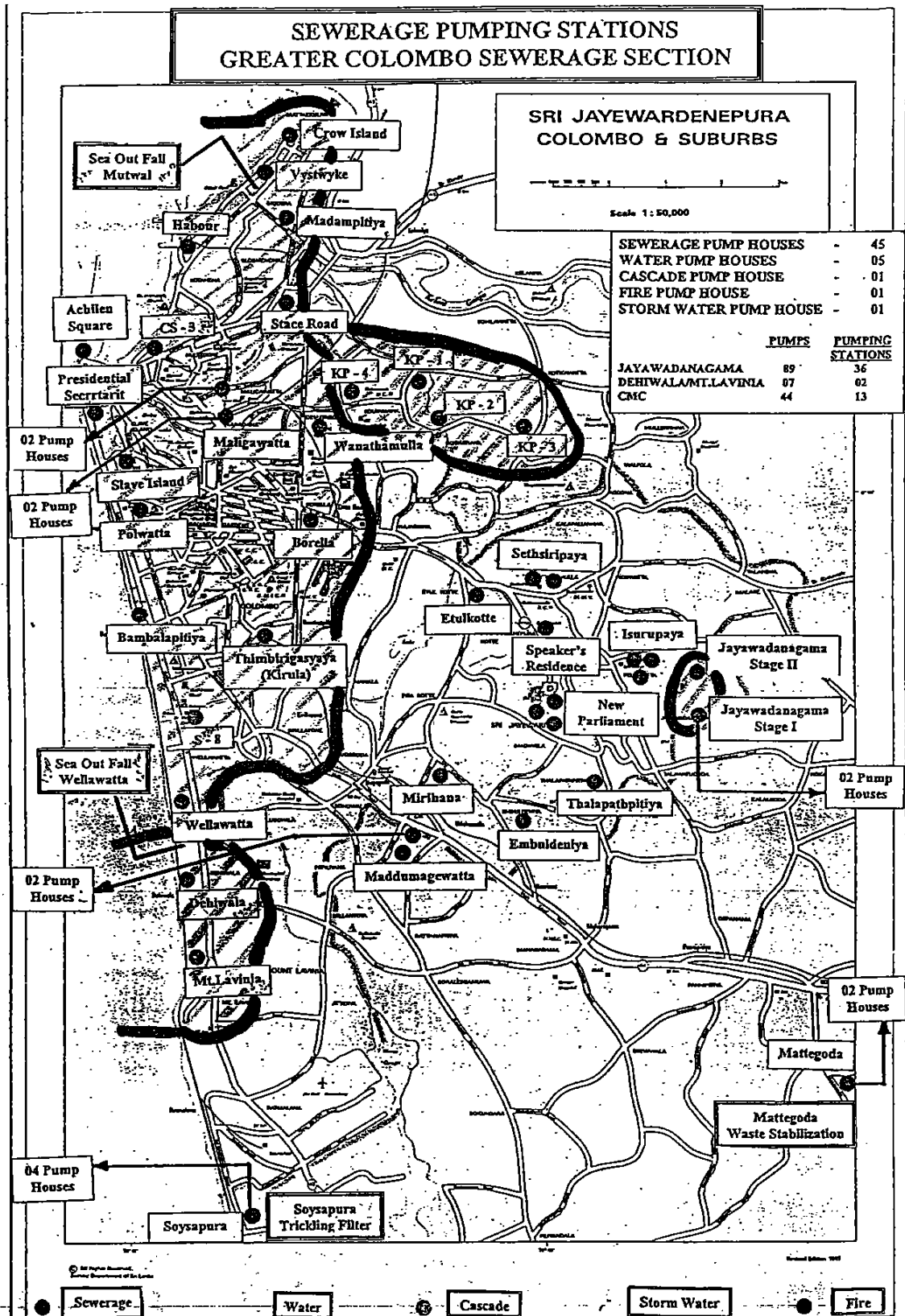
1. Organization Chart



2. Responsibilities of APTF

- Coordination with respective Govt. Agencies and JICA Teams for maturation of the Project.
- Planning for implementation.
- Organizing the activities for implementation.
- Implementation of the Project
- Monitoring of the project
- Reporting of the progress and feedback.

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Appen 4-6

Items Requested by the Government of Sri Lanka

No.	Equipment	Q'ty	Priority
1	Water jetting sewer cleaner (4 ton)	2 units	A
2	High power sludge suction machine (4 ton)	2 units	A
3	Water car (bowser) (4 ton)	1 unit	A
4	Pipe stopper (160 mm to 1000 mm)	2 sets	A
5	Other tools, equipment <ul style="list-style-type: none"> - Rodding machine, heavy duty - Diesel driven mobile sewerage pump - Mobile generator - Crane mounted truck (4 ton) - Hydraulic puller (75 ton) - Others (if any) 	<ul style="list-style-type: none"> 1 unit 1 unit 1 unit 1 unit 1 set 	B

Appendix 4-7



JAPAN'S GRANT AID

【Japan's Grant Aid Scheme】

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application (Request made by a recipient country)

Study (Basic Design Study conducted by JICA)

Appraisal & Approval (Appraisal by the Government of Japan and Approval by Cabinet)

Determination of Implementation (The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request. If necessary, JICA send a Preparatory Study Team to the recipient country to confirm the contents of the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

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2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- a) confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
- b) evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
- c) confirmation of items agreed on by both parties concerning the basic concept of the Project;
- d) preparation of a basic design of the Project; and
- e) estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a consulting firm selected through its own procedure (competitive proposal). The selected firm participates the Study and prepares a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Project, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to

maintain the technical consistency between the Basic Design and Detailed Design as well as to avoid any undue delay caused by the selection of a new consulting firm.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

- a) to secure a lot of land necessary for the construction of the Project and to clear the site;
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;
- c) to ensure prompt unloading and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid;
- d) to exempt Japanese nationals from customs duties, internal taxes and fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts;
- e) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;
- f) to ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Project; and
- g) to bear all the expenses, other than those covered by the Grant Aid, necessary for the Project.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from the recipient country.


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9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.

9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.


Appen 4-12

Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site		•
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

MINUTES OF DISCUSSION
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR THE UPGRADING OF THE SEWER CLEANING EQUIPMENT
TO IMPROVE COLOMBO ENVIRONMENT
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
(EXPLANATION ON DRAFT FINAL REPORT)

In 2004 May, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project for the Upgrading of the Sewer Cleaning Equipment to Improve Colombo Environment (hereinafter referred to as "the Project") to the Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "Sri Lanka"), and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft final report of the study.

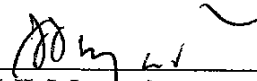
In order to explain and to consult Sri Lanka on the components of the draft final report, JICA sent to Sri Lanka the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Toshio Sugihara, Resident Representative, JICA Sri Lanka Office and was scheduled to stay in the country from September 4th to September 11th, 2004.

As result of discussion, both parties confirmed the main items described on the attached sheets.


Colombo, September 10th, 2004



Toshio Sugihara
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan



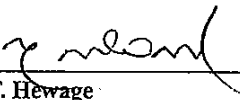
J. H. J. Jayamaha
Additional Director General
Department of External Resources
Ministry of Policy Development and
Implementation
Sri Lanka



Dr. Jayantha Liyanage
Municipal Commissioner
Colombo Municipal Council
Sri Lanka



M. Wickramage
General Manager
National Water Supply and Drainage Board
Sri Lanka



T. Hewage
Secretary
Ministry of Urban Development and Water
Supply
Sri Lanka

ATTACHMENT

1. Components of the Draft Final Report

The Government of Sri Lanka agreed and accepted in principle the components of the draft final report explained by the Team.

2. Responsible Agency and Implementation Agency (Annex-1)

2-1 Responsible Agency

Ministry of Urban Development and Water Supply

2-2 Implementation Agency

National Water Supply & Drainage Board (hereinafter referred to as NWS&DB)

Colombo Municipal Council (hereinafter referred to as CMC)

3. Japan's Grant Aid Scheme

Sri Lanka side has understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Sri Lanka as explained by the Team and described in Annex-2 and Annex-3 of the Minutes of Discussion signed by both parties on May 21st, 2004.

4. Further Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Sri Lanka by the end of October 2004.

5. Other Relevant Issues

5-1 Sewer Cleaning Task Force

NWS&DB and CMC will establish Sewer Cleaning Task Force based on the Action Plan and the Establishment and Operation Policy as shown in Annex-4 by the beginning of January 2006.

5-2 Quantity / Specifications of Sewer Cleaning Equipment

- (1) The Sewer Cleaning Equipment to be provided under this Grant Aid will be owned and maintained by the organizations as shown in Annex-5.
- (2) The Team handed this draft quantity / specifications of the equipment (Annex-5) and Draft Final Report to Mr. M. Wickramage of NWS&DB and Dr. T. Liyanage of CMC. Both sides agreed that the draft quantity / specifications and Draft Final Report are confidential and should not be duplicated or released to any outside parties.
- (3) Quantity / Specifications are subject to minor change based on the result of further study in Japan.

5-3 Soft-Components Work

Sri Lanka side understood the Implementation Plan for Soft-Components Work as shown in Annex-6 and the necessary measures to be taken by the Government of Sri Lanka as explained by the Team and described in Annex-6.

5-4 Warehouse & Garage

- (1) NWS&DB will construct a warehouse within the maintenance office site in Jayawadanagama and have garages in Jayawadanagama equipped with roofs by the end of 2005 to keep the equipment requested properly.
- (2) CMC will construct (improve) a warehouse within the maintenance office site in Maligakanda and have garages in Maligakanda equipped with roofs by the end of 2005.

5-5 Repair of Existing Equipment

NWS&DB will repair existing one jetting machine by the end of 2004 so that Task Force can operate preplanned number of sewer cleaning equipment for preventive maintenance.

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The Project-related Agencies

Agency	Responsibility
Ministry of Urban Development and Water Supply	
Water Sector Division	<ul style="list-style-type: none"> • to coordinate overall with the agencies related with the Project
National Water Supply and Drainage Board	
1. Foreign Funded Project Section / Japanese Project Unit	<ul style="list-style-type: none"> • to provide budget required • to nominate competent manager and personnel for implementing and monitoring Action Plan Task Force (APTF) • to coordinate overall with the agencies related with the Project
2. Operation and Maintenance Department (Greater Colombo Sewerage)	<ul style="list-style-type: none"> • Planning • Operation & Maintenance
3. Foreign Funded Project Section / Finance Section	<ul style="list-style-type: none"> • Tax exemption procedures • Procedures of major undertakings to be taken by Government of Sri Lanka
Colombo Municipal Council	
1. Water Supply and Drainage Department	<ul style="list-style-type: none"> • Planning • Operation and Maintenance • to nominate competent manager and personnel for implementing and monitoring Action Plan Task Force (APTF)
2. Treasurers Department	<ul style="list-style-type: none"> • to provide budget

JAPAN'S GRANT AID

【Japan's Grant Aid Scheme】

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedure

1) Japan's Grant Aid Program is executed through the following procedures.

Application (Request made by a recipient country)

Study (Basic Design Study conducted by JICA)

Appraisal & Approval (Appraisal by the Government of Japan and Approval by Cabinet)

Determination of Implementation (The Notes exchanged between the Governments of Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request. If necessary, JICA send a Preparatory Study Team to the recipient country to confirm the contents of the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- a) confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
- b) evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from the technical, social and economic points of view;
- c) confirmation of items agreed on by both parties concerning the basic concept of the Project;
- d) preparation of a basic design of the Project; and
- e) estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even through they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Study, JICA uses a consulting firm selected through its own procedure (competitive proposal). The selected firm participates the Study and prepares a report based upon the terms of reference set by JICA.

At the beginning of implementation after the Exchange of Notes, for the services of the Detailed Design and Construction Supervision of the Project, JICA recommends the same consulting firm which participated in the Study to the recipient country, in order to

maintain the technical consistency between the Basic Design and Detailed Design as well as to avoid any undue delay caused by the selection of a new consulting firm.

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2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

- a) to secure a lot of land necessary for the construction of the Project and to clear the site;
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the site;
- c) to ensure prompt unloading and customs clearance at ports of disembarkation in the recipient country and internal transportation therein of the products purchased under the Grant Aid;
- d) to exempt Japanese nationals from customs duties, internal taxes and fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts;
- e) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;
- f) to ensure that the facilities constructed and products purchased under the Grant Aid be maintained and used properly and effectively for the Project; and
- g) to bear all the expenses, other than those covered by the Grant Aid, necessary for the Project.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

8) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

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- 9) Banking Arrangement (B/A)
- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of recipient country or its designated authority.
- 10) Authorization to Pay (A/P)
- The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site		•
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

**Colombo Sewer Cleaning Program
Task Force
- Establishment and Operation Policy -**

1. Date of Establishment

By the beginning of January 2006

(before delivery of equipment supplied by Japanese grant aid)

2. Location of Main Office

Wellawatta Office

Greater Colombo Sewerage Section

National Water Supply and Drainage Board

3. Staff

(Task Force)

Head: NWS&DB Assistant General Manager (Greater Colombo Sewerage)

CMC A. G. Irshadh (Superintending Engineer-Dr)

CMC S. Thiagarajah (Superintending Engineer-P/S)

Other Staff: NWS&DB -01

CMC Engineer (Drainage) -01

(Group 1) for 2 groups

Head: NWS&DB Manager (Dehiwala/Mt. Lavinia)

Other Staff: NWS&DB Engineering Assitant -02

Drivers -08

Labourers -10

(Group 2) for 2 groups

Head: CMC Technical Officer -02

Other Staff: CMC Drivers -04

Labourers -10

4. Cost of Operation and Maintenance

4-1. NWS&DB

a. Operation of Task Force and Group 1 (2 new groups)

No.	Designation	Unit Cost (Rs/month · ps)	Personel	Cost (Rs/month · 1 group)
1	Engineering Assistant	32,382	1	32,382
2	Drivers	23,134	4	92,536
3	Sanitary Labourer	23,542	5	117,710
	Total			242,628

b. Operation and Maintenance of Equipment Supplied by Japanese Grant Aid

No.	Mechanical Type	Fuel Cost (Rs/month)	Running Maintenance Cost (Rs/month)	No. Vehicle	Cost (Rs/month · 1 group)
1	Jetting Machine	38,400	7,000	1	45,400
2	Suction Machine	38,400	7,000	1	45,400
3	Water Tanker	43,400	5,000	1	48,400
4	Pick-up or Crew Cab	5,600	4,000	1	9,600
	Total				148,800

c. Others

Manhole Cover Replacement: 3 units/month × 13,000 Rs/unit = 39,000 Rs/month

d. Total

Operation of Task Force:	242,628 Rs/month · group
Maintenance of Equipment:	148,800 Rs/month · group
Others (Manhole Cover Replacement):	39,000 Rs/month · group
<u>Unexpected Expenditures (4% of above):</u>	<u>17,217 Rs/month · group</u>
Total	447,645 Rs/month · group
Considering inflation and other factors say	500,000 Rs/month · group

NWS&DB will work 2 groups:

500,000 Rs/month · group × 2 groups × 12 months = 12,000,000 Rs/year · 2 groups

However one existing group to be assign for the preventive maintenance for Kolannawa, Dehiwala-Mt. Lavinia and Housing Scheme with sewerage facility. The cost of the existing groupe for cleaning will be borne from NWS&DB budget.

4-2. CMC

a. Operation of Task Force and Group 2

1) Task Force

No.	Designation	Unit Cost (Rs/month · ps)	Personel	Cost (Rs/month)
1	Head (Superintending Engineer-Dr)	33,000	1	33,000
2	Head (Superintending Engineer-P/S)	22,000	1	22,000
3	Other Stuff (Engineer-Drainage)	17,000	1	17,000
	Total			72,000

72,000 Rs/month × 12 months = 864,000 Rs/year

2) Group2

No.	Designation	Unit Cost (Rs/month · ps)	Personel	Cost (Rs/month · 1 group)
1	Technical Officer	15,860	1	15,860
2	Drivers	13,450	2	26,900
3	Labourers	11,030	5	55,150
	Total			97,910

97,910 Rs/month × 2 groups × 12 months = 2,349,840 Rs/year

b. Operation and Maintenance of Equipment Supplied by Japanese Grant Aid

No.	Mechanical Type	Fuel Cost (Rs/year)	Running Maintenance Cost (Rs/year)	No. Vehicle	Cost (Rs/month · 1 group)
1	Jetting Machine	840,000	1,700,000	2	5,080,000
2	Suction Machine	840,000	1,500,000	2	4,680,000
3	Water Tanker	630,000	1,250,000	2	3,760,000
4	Truck with Crane	630,000	570,000	1	1,200,000
5	Rodding Machine	40,000	265,000	1	305,000
6	Mobile Generator	40,000	190,000	1	230,000
	Total				15,255,000

c. Total

CMC will work 2 groups.

Operation of Task Force: 864,000 Rs/year · 2groups

Operation of Group2: 2,349,840 Rs/year · 2groups

Maintenance of Equipment: 15,255,000 Rs/year · 2groups

Unexpected Expenditures (4% of above): 738,800 Rs/year · 2groups

Total 19,207,640 Rs/year · 2groups

Considering inflation and other factors say 19,500,000 Rs/year · 2groups

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Required Quantity and Specifications of Sewer Cleaning Equipment

Name of Equipment	Specifications	Quantity		
		NWS & DB	CMC	Total
A-1 High Pressure Jetting Machine	Type: Medium size (4 ton class), right-handle, 4x2 Engine: Water-cooled, 4-cycle, diesel engine Power transfer: PTO Max. Discharge Pressure: 20 Mpa (Common use 18 Mpa) Max. Discharge Volume: more than 230 liter/min Water Tank Volume: more than 2.4 m ³ High Pressure Hose: Hydraulic winding system, dia. of more than 7/8B and length of more than 120 m	2 units	2 units	4 units
A-2 High Power Sludge Suction Machine	Type: Medium size (4 ton class), equipped with dehydration system, out-rigger and dump mechanism for sludge tank, right-handle, 4x2 Engine: Water-cooled, 4-cycle, diesel engine Power transfer: PTO Blower Type: Roots blower Theoretical Air Flow: more than 20 m ³ /min Vacuum Pressure: less than -69 kPa (-520 mmHg) Pressure: more than 49 kPa (0.5 kg/cm ²) Pump Head for Sludge: more than 15 m Vacume Capacity (For Dry Sand): more than 4 t/hr Vacume Capacity (For Sludge): more than 10 t/hr Sludge Tank Volume: more than 3.2 m ³ Size of Suction/Drain Hose: more than 100 mm	2 units	0	2 units
A-3 Water Tanker	Type: Medium size (4 ton class), right-handle, 4x2 Engine: Water-cooled, 4-cycle, diesel engine Water Tank Volume: more than 4.0 m ³ Delivery Pump Capacity: more than 400 liter/min	2 units	0	2 units
A-4 Pipe Plug For Ø150mm	Type: Sleeve type pipe plug Applied diameter: Ø133 – 211 mm Product weight: less than 1.0 kg	3 units	2 units	5 units
A-5 Pipe Plug For Ø200 - 250mm	Type: Sleeve type pipe plug Applied diameter: Ø178 – 260 mm Product weight: less than 3.0 kg	6 units	2 units	8 units
A-6 Pipe Plug For Ø300 - 450mm	Type: Sleeve type pipe plug Applied diameter: Ø273 – 477 mm Product weight: less than 14.5 kg	3 units	2 units	5 units
A-7 Pipe Plug For Ø375 - 600mm	Type: Sleeve type pipe plug Applied diameter: Ø375 – 635 mm Product weight: less than 42.0 kg	3 units	2 units	5 units
B-1 Rod Turning Machine	Type: Type: Mobile type rod turning machine (with wheel) Power: Gasoline engine, 5 HP or more Applied rod: Ø8 mm Cleaned pipe diameter: Ø75 – 350 mm	0	1 unit	1 unit
B-2 Portable Submersible Pump	Type: Mobile type submersible pump Diameter: Ø80 mm Pump head: 20 m Power: 3.7 kW	6 units	2 units	8 units
B-3 Crane Mounted Truck	Type: Medium class (4 tons) for transportation Veicle Specification: Boom length: retracted length, more than 3 m, extended length, more than 5 m Lifting capacity: max. 2.9 ton or more (working radius, 2.7 m) Outtrigger device: hydraulic system	0	1 unit	1 unit
B-4 Mobile Generator	Type: Mobile type generator, Trailer mounted type, Soundproof type Power: 12.5/15 kVA Product weight: less than 580 kg	3 unit	1 unit	4 unit
B-5 Hydraulic Puller	For pulling pump impeller Type: Hydraulic type Pulling power: more than 50 ton	0	1 unit	1 unit

Soft-Components Work

(1) The Need for Assistance for Problems to be Solved

The target of this soft component is to train engineers in the Task Force in the NWS&DB to increase their knowledge of sewer cleaning services and of newer technologies and know-how. This will enable them to establish and manage the sewer cleaning program for Colombo and its suburb in five years based on the "Preventive Maintenance" concept. Engineers, operators and workers to be assigned to the new Task Force may have had some experiences on sewer cleaning services, but they need to adapt to updated technology and enrich and enhance their experiences and know-how, to further strengthen the recently established "Preventive Maintenance" sewer cleaning program..

Therefore, it is recommended a well-experienced Japanese consultant for establishing sewer-cleaning program to work together with the members of the Task Force, and assist the member to elaborate the program for Colombo and its suburb.

(2) Expected Result

A reliable and effective sewer cleaning program for the sewerage system in Colombo and its suburb will be established. The implementation of the program will greatly improve the living conditions of the population because such unsanitary environment, not to mention the inconvenience caused by sewer-blockage and sewage-overflow will be reduced, if not eliminated. The project will ultimately contribute to better health and a better environment for the 700,000 people of Colombo.

(3) Activity and Period

Activity

- Training of members of the Task Force
- Establishing the sewer cleaning program
- Providing a manual of sewer cleaning services

Period

- A specialist will be assigned to this component for 0.25 month in Japan and 1.5 month in Colombo

Implementation of this component will be expected in February 2006.

After implementation, Final Report will be submitted to NWS&DB and JICA by the end of March 2006.

Table 5-1 Training Activities and Duration of Soft Component

Item	2005						2006							
	7	8	9	10	11	12	1	2	3	4	5	6	7	
Equipment Supply														
Manufacturing	████████████████████													
Inspection					████									
Ocean Transportation						████████								
Custom Clearance							████							
Delivery								████						
Task Force	(Training, Sewer Cleaning)							██	██	████████████████████				
JICA Expert	(Monitoring, Advising)							██	██	██	██	██	██	██
Consultant	(Training/Support of Planning)							████						
Supplier	(Training for O&M of Equipment)							████						

(4) Obligations of Recipient Country's Counterpart

The following items shall be prepared for implementation of the Soft Component Work.

- Provision of engineers and technical staff (approx. 10 persons)
- Provision of all costs for the above personnel (ex. personnel cost, transportation etc.)
- Provision of rooms for this training
- Provision of all necessary technical data and information etc. on the existing sewer system in Colombo and suburb
- Provision of sewer cleaning equipment and all costs for operation of the equipment

Appendix -5 Cost Estimate Borne by the Recipient Country

Items		Cost (Rs)	Reference
1	Construction of Equipment Storage	450,000	
2	Port Charge, Custom clearance Charge, Storage etc. for Vehicle Equipment	1,063,000	
3	Transportation etc. for Vehicle Equipment	195,000	
4	Port Charge, Custom clearance Charge, Storage etc. for other Equipment	161,000	
5	Transportation etc. for other Equipment	75,000	
	VAT	291,600	15%
	Total	2,235,600	