Chapter I

Study on the Improvement Project of the Gohagoda Landfill Site in Kandy

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I.1 Introduction

I.1.1 Objectives and justification of the proposed project

The objective of project is to rehabilitate the existing Gohagoda landfill in order to mitigate environmental & sanitary hazards that caused by present open dumping practices. Although the expected lifetime after construction is comparatively short it is necessary resolve existing problems. The rehabilitate landfill site will be a model of Rehabilitated dumping site for Sri Lanka as well as it will be a model for Lift-Up type landfill. In terms of environment protection, the improvements will reduce adverse effect on environment that has identified as a critical issue in Gohagoda Landfill Site.

I.1.2 Background to the proposed project

The Study on the Solid Waste Management for Secondary Cities in Sri Lanka, which targets the improvement of the solid waste problems in all local towns, has been implemented by JICA (Japan International Cooperation Agency) since May 2002. The study targets especially seven model towns selected and one of seven towns is Kandy Municipal Council. The Study deals with not only the formulation of the improvement plan but also the actual improvement of the condition as a pilot project within the scope of the Study.

I.1.3 Extent and scope of the project

The extent and scope of the scope of the project consists of three items as follows.

- Improvement of Gohagoda Existing Landfill site at Gohagoda, Kandy Municipal Council
- Training of proper operation and maintenance for the sanitary landfill
- Establishment of monitoring committee for the sanitary landfill operation

I.1.4 Main beneficiaries of the project and expected socio-economic effects

Main beneficiaries of the project and expected socio-economic effects are described at "1.1 Objectives and justification of the proposed project"

I.1.5 Policy

Policy, Legal and Administrative frame work with reference to Solid Waste Management.

The responsibility of collection, transport and disposal of solid waste falls within the purview of Local Authorities in Sri Lanka.

According to the Municipal Council Ordinance and By laws, Section 129, 130 and 131 etc., the function of Solid Waste Management in the Municipal City falls within the legal Provisions of the Municipal Council.

Other than the above enactment, the following ordinances and the Act also provides legal Provision for the Solid Waste Management in Sri Lanka.

- ✓ Nuisances Ordinance
- ✓ Housing and Town Improvement Ordinance
- ✓ Urban Development Authority law
- ✓ Central Environment Authority law

I.2 Description of the project and reasonable alternatives

I.2.1 Location of the Gohagoda Landfill Site – Kandy Municipal Council

The Gohagoda dumping site is located approximately 7 km away from the city centre, out of the Kandy Municipal Council limits. Further, the site is located within the limits of Harispaththuwa Pradeshiya Sabha (Local Authority) 200 m away from the Peradeniya – Katugasthota Main Road near the Village Gohagoda. The total land area own by the Kandy Municipal council is around 12 Hectares while nearly 2.5 hectares is active filling area. Rest of the land mainly consist of Old dumping sites and Residence area that distributed among the workers of Kandy Municipal Council. The Gohagoda site has been used since 1970's and remaining capacity is limited to active filling area.

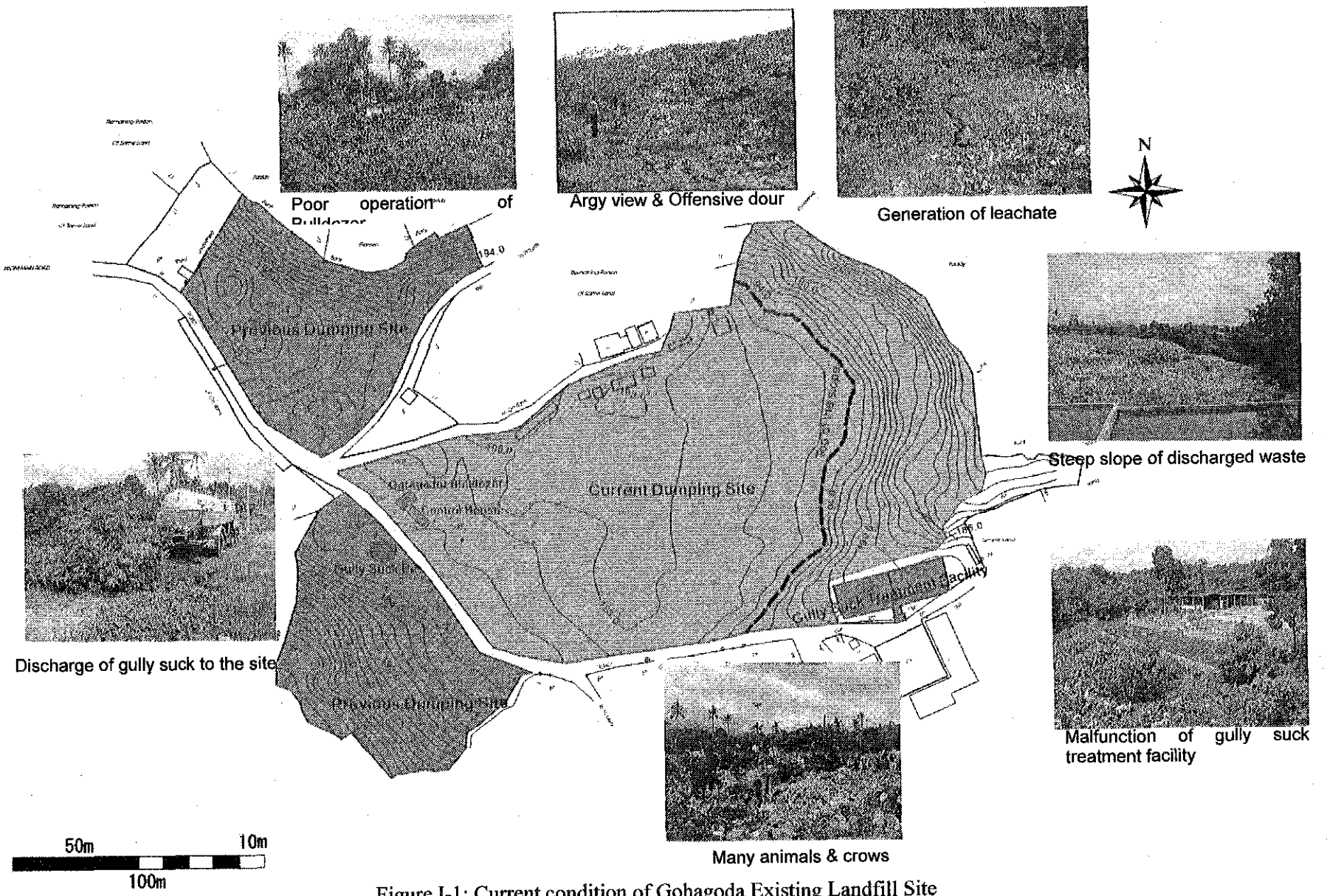


Figure I-1: Current condition of Gohagoda Existing Landfill Site

I.2.2 Nature of the project

I.2.2.1 Landfill facility

a. Conceptual design of the landfill facility, extent capacity and life span

The existing landfill facility will rehabilitate to mitigate the problems arise from open dumping and to prevent hazardous risk. The active dumping site area, which causes negative impact on Environment and sanitation, has been selected for improvement. The extended capacity of Gohagoda improved site will be 2-3 years.

Table I-1: Conceptual Design of Improved Gohagoda Landfill Site

Item		unit	Qty
Total area of improved landfill site		ha	Approx. 2.0
Extent Capacity		m^3	191,000
Life span		years	2-3
Type of landfill method		-	Semi-Aerobic
Administration	Control office	no.	1
	Garage for bulldozer	no.	1
Security and safety facility	Fence (Movable type)	L.S.	1
Sanitary waste disposal facility	Access road (gravel) for short term use	L.S.	1
Leachate collection Pond		L.S.	1
Modification of Gully suck and leachate treatment facility – System consist of mechanical aerators that fixed to the existing gully suck tanks		no.	1
Storm water drainage	Rip rap type on final slope (type "B")	L.S.	1
	Rip rap type drain along the road (type "A")	L.S.	1
Gas ventilation facility –Perforated oil barrel filled with rubble stone		nos.	5
Disposal pit for medical waste		no.	1

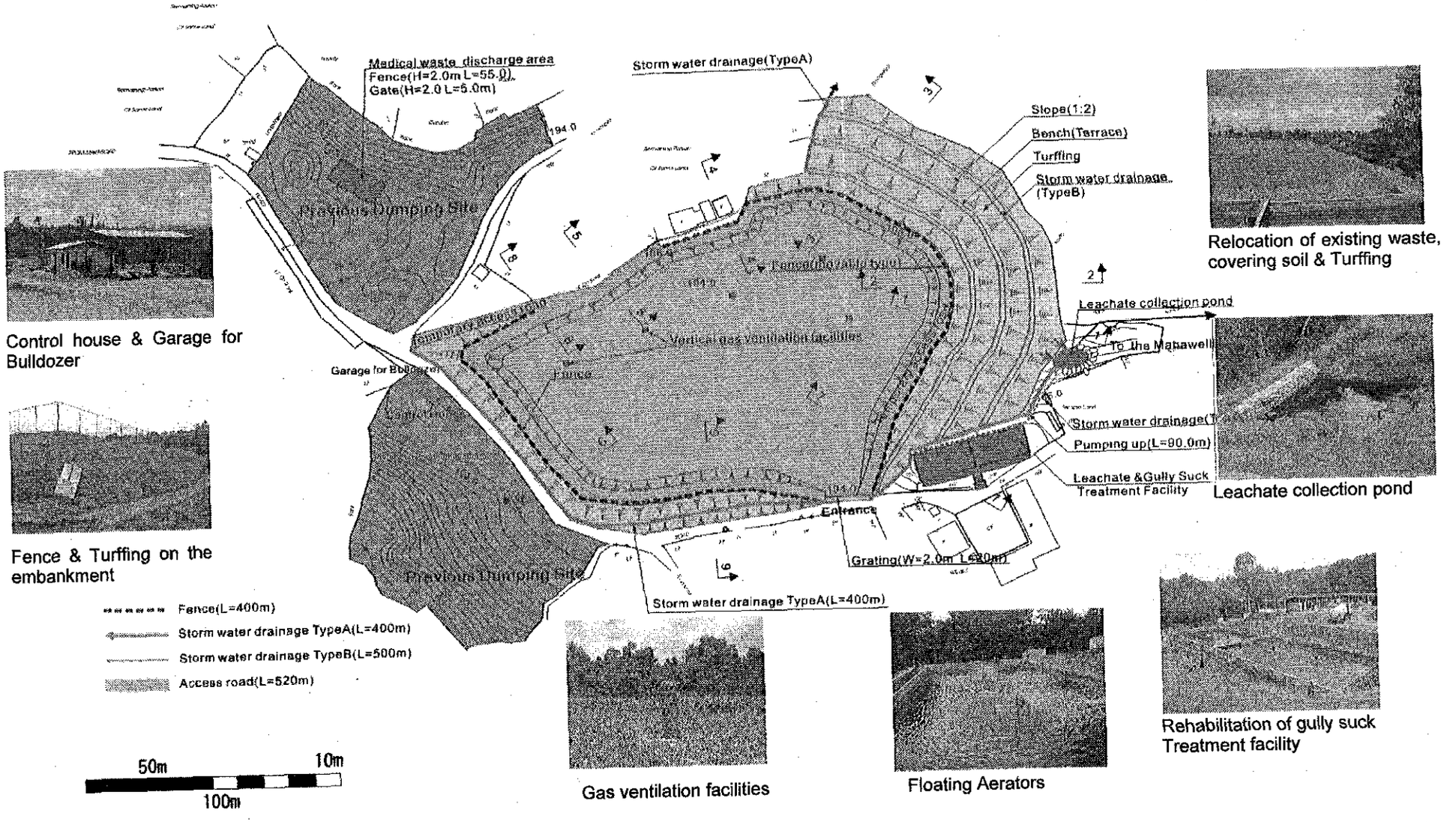
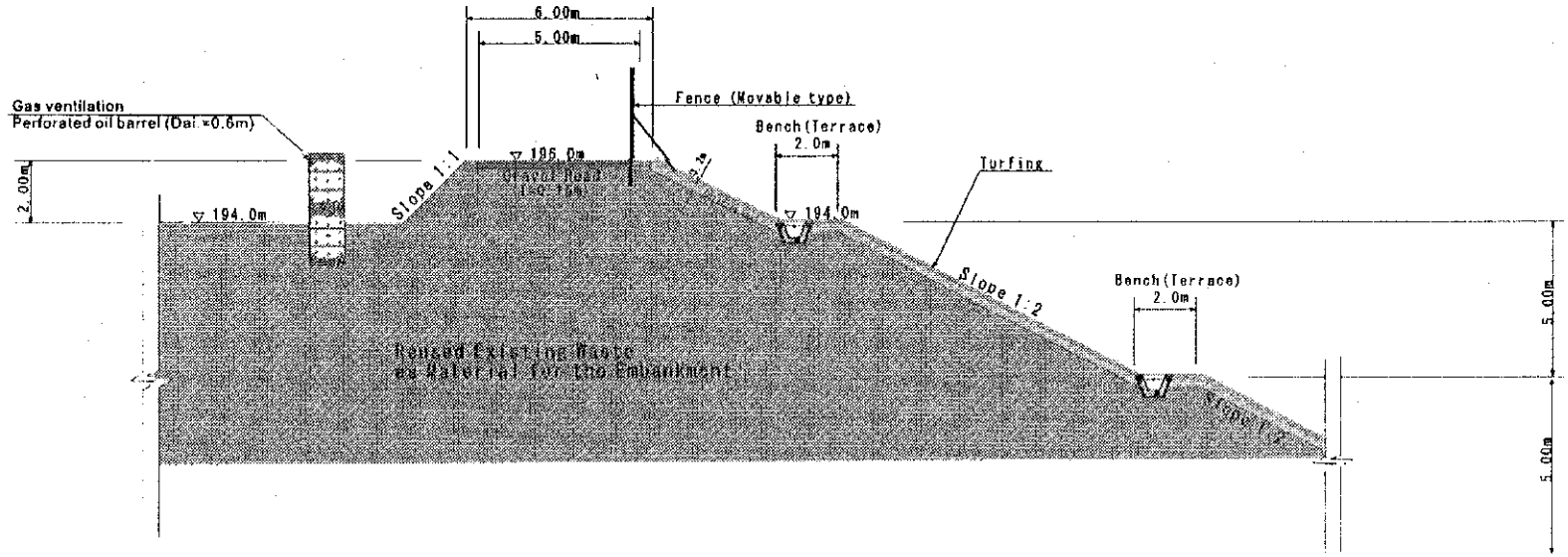


Figure I-2:Layout Plan of Improved Landfill Site

Typical Section A



Typical Section B

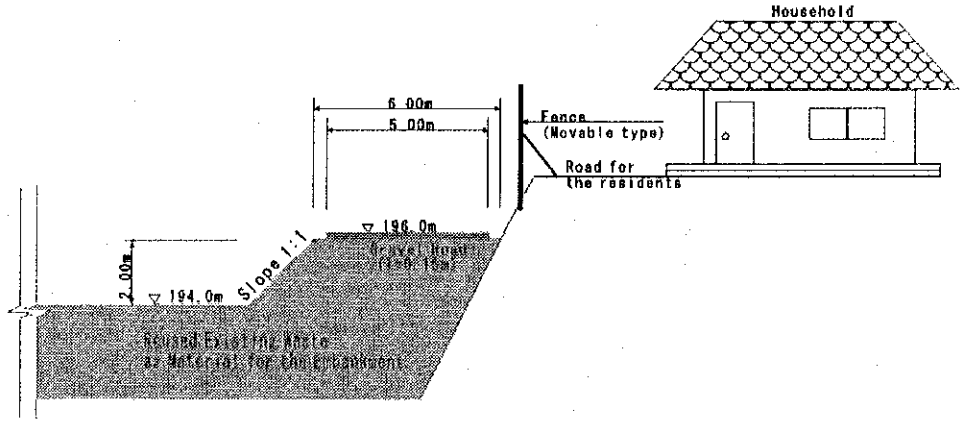


Figure I-3:Typical section after improvement

b. Leachate Collection Pond

A leachate collection pond will be constructing at the lowest point of the fill in order to collect leachate seep from the bottom of the landfill. The facility will be a excavated pit supported with sand bags. Electrical pump and pipeline installed to divert collected leachate to the modified gully suck-Leachate treatment facility. (Figure: Leachate collection Pond)

c. Modification of Gully suck and leachate treatment facility

The existing gully suck disposal tanks will be modified in order to treat leachate and gully suck. The tank receives approximately 23m^3 of gully suck, which collected from the septic tanks. The quality of gully suck waste shows that it has already decomposed most of BOD but further treatment is needed to reduce the BOD before release to the inland water bodies. In addition to gully suck, the facility will receive leachate that pumped out from the leachate collection pond after modifications. Four aerators will be installed in primary tank to enhance the degradation process and secondary tank will be design as settlement tank & temporary storage prior to discharge. The treated effluent will be discharge to small stream flowing below the landfill facility.

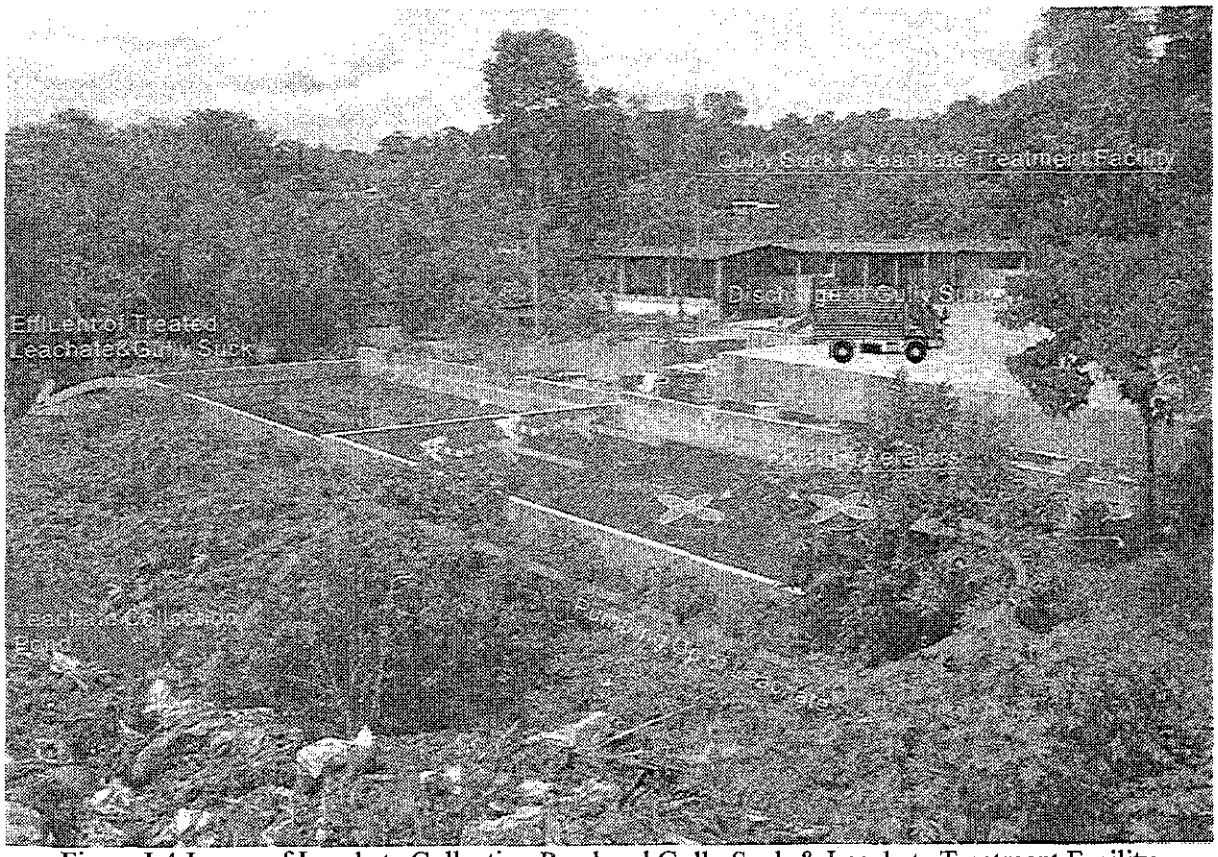


Figure I-4:Image of Leachate Collection Pond and Gully Suck & Leachate Treatment Facility

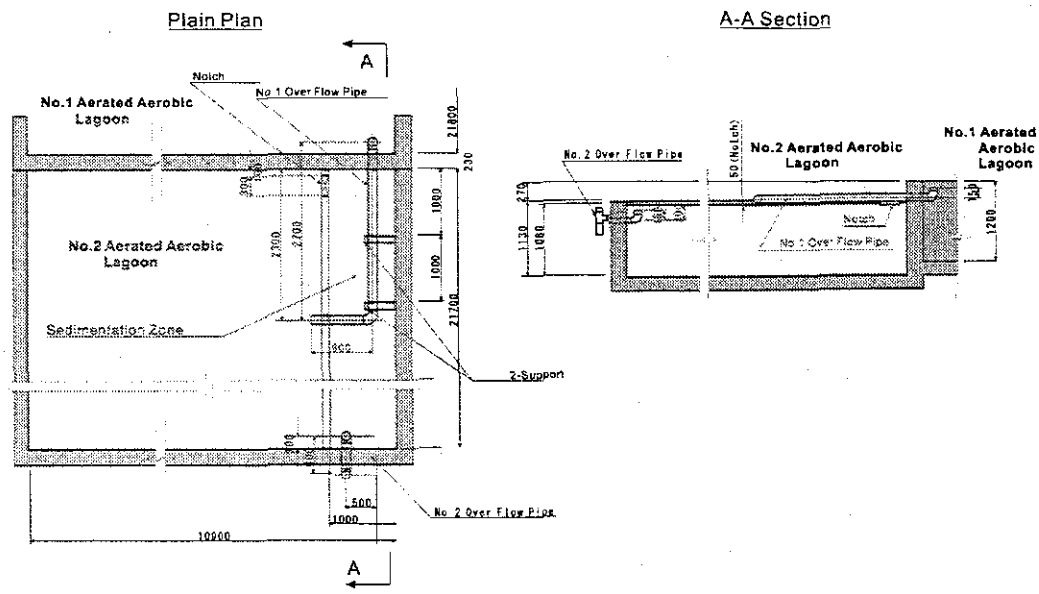


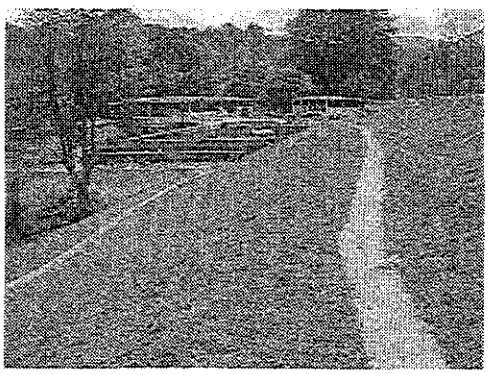
Figure I-5:Modified Leachate and Gully Suck treatment facility

d. Details of any other structure

d.1 Bench (terrace)

The purpose of bench is as follows.

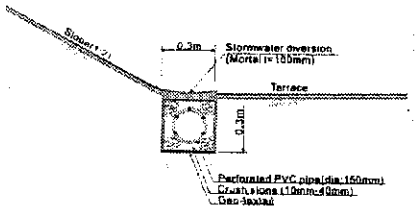
1) To protect the slope by intercepting runoff water flowing on the slope.
2) To provide the enough space for the interceptor drain on benches.
3) To provide the enough working space for the slope maintenance.
4) To keep the waste filling slope stable.



The bench plan is as follows.

- Every 5 meters in height.
- 2 meters in bench width.

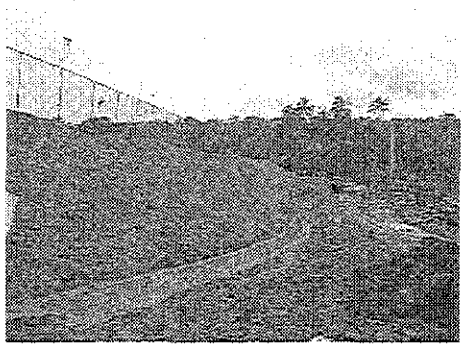
The purpose of leachate collection facility on the bench was to collect seeping leachate from the relocated landfill site.

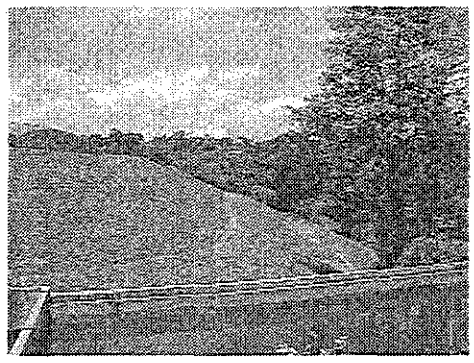


d.2 Turffing

The outside of slope of the waste filling will be turffed for the following purposes.

1) Protection of the slope from erosion by runoff water.
2) Maintenance of the good view.



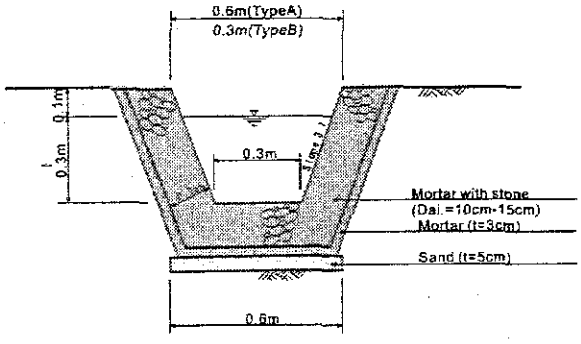


d.3 Storm water Drain

The storm water drain on the bench terrace and along the foot of the landfill will be installed for the following purposes.

1) Minimization of leachate generation amount by intercepting runoff water into the site.
2) Maintenance of access road

Type "A" drain will be constructed along the road to collect storm water coming from surrounding area and slope of the fill. The collected water will be diverted to the small stream at the bottom of landfill. Type "B" drains will be constructed on the bench terraces. All the drains will be lined to protect from destruction



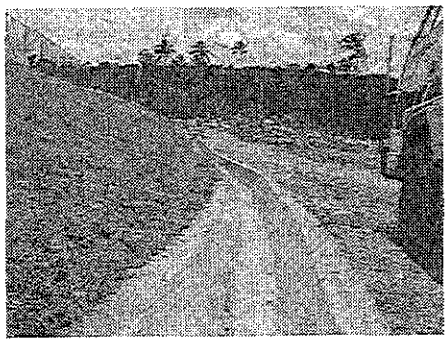


Figure I-6:Storm Water Drain

d.4 Gas Ventilating Facility

The gas ventilating facility will be provided for the following purposes.

1) Exhaust landfill gas generated in the landfilled waste to minimize the risk of gas explosion
2) Acceleration of waste decomposition process with supplying air into the landfilled waste through gas ventilating facility (semi-aerobic type)

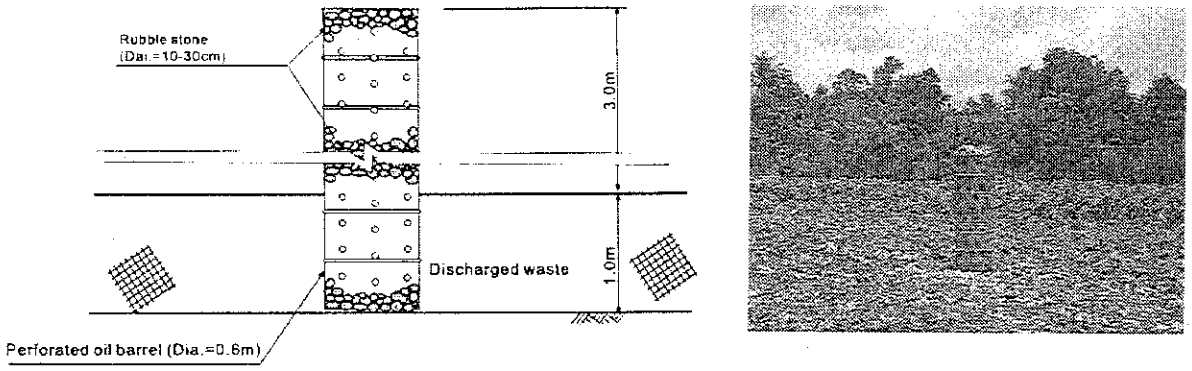


Figure I-7:Gas Ventilating Facility

d.5 Disposal Pit for Healthcare Waste

The disposal pit for healthcare waste will be constructed separately on the old dumping area. It receives the following wastes which require special care for handling.

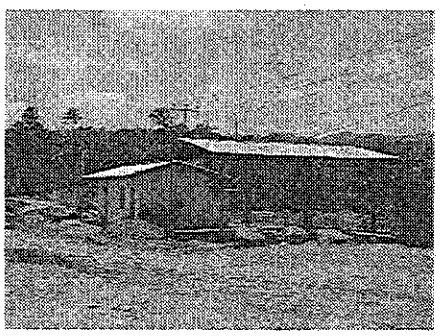
- Syringes
- Medical tools and goods which contacted blood

The disposal pit will be completely surrounded by a gate and a fence to ensure nobody except the landfill staff can enter.

I.2.2.2 Other support facilities

a. Relocation of Control House and Garage for Bulldozer

The existing site office and garage for the bulldozer will be demolished during the construction of landfill. Those facilities will be relocate outside the landfill. The relocated facilities will consist of following items;



1) A site office will be built to provide a proper space for administrative work, rest space, and sanitary facility for employees in the landfill site.
2) A store house will be built to keep tools, materials, safety goods, etc.
3) A garage for a bulldozer will be built to secure and to protect a bulldozer.

b. Security and Safety Facilities

b.1 Security facilities

A fixed type fence will be installing along the temporary access road on the embankment to prevent waste scattering from active filling area.

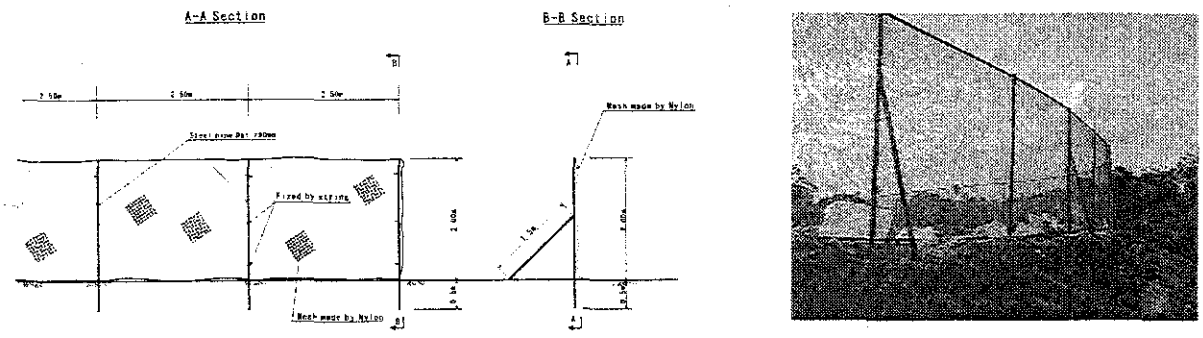


Figure I-8: Movable type fence

I.2.2.3 Construction of new Access roads

Provision of a good access road is very important for land filling operation because many waste collection vehicles have to access to a disposal area even on wet days . In addition, good access road will help to prolong the life year of waste collection vehicles and to reduce the repairing cost.

New access road will be constructed around the landfill facility. The collection vehicle to dump its waste to the filling area will use the constructed access road. The access road will be located 2 m above the active filling area. The road will be established by filling old waste on the Embankment and finished with compacted soil and gavel to easy access of collection vehicle.

I.2.2.4 Details of phased development activities and time schedule

This project is planned to be implemented with the cooperation of JICA Study Team subject to the JICA approval. JICA is planned to cover the following tasks.

Table I-2: Detail of Phase development Gohagoda Landfill Site Kandy Municipal Council

Stage	Kandy Municipal Council	JICA Study Team
Planning works	1) Provision of required data	1) Field surveys 2) Preparation of the improvement plan.
Preparation works	1) Obtaining all required approvals from • relevant authorities, • neighbourhoods • municipal council 2) Allocation of the enough budget for	1) Technical assistance

	the works to be done by KMC 3) Allocation of the enough human resources to execute the proper landfill operation.	
Construction works	1) Two electric lines across the active landfill area, which have to be relocated prior to start of construction. 2) Relocation of scoter houses and toilets that exist within the proposed site	1) Construction of following facilities: • Riprap Drainage system • Leachate collection pond • Leachate- Gully suck treatment system • Gas ventilation system • Access road • Waste scattering prevention net fence • Construction of secured disposal area for health care waste • Relocation of control house and garage for bulldozer
Operation & maintenance works	1) Execution of the landfill operation in accordance with the landfill operation manual prepared by the JICA Study Team	1) Preparation of the operation manual for the sanitary landfill 2) Provision of on the job training
Monitoring work	1) Establishment of the monitoring committee 2) Implementation of the periodical monitoring by the monitoring committee in accordance with the procedure prepared by the JICA study Team	1) Preparation of the monitoring checklist. 2) Technical advice for the monitoring process

I.2.2.5 Details of site restoration and potential after use

The landfill site has been used for approximately 30 years but predicted future use is limited to 2-3years. Therefore, the detailed site restoration and potential shall be designed as soon as possible. The samples of site restoration are such as "play ground" and "Eco Park" etc

I.2.3 Methodology of Construction

I.2.3.1 Details of land preparation activity (to be done by KMC)

There are two Electric lines across the active landfill area, which have to be relocated prior to start of construction. The scoter houses, Piggeries and toilets should be relocated prior to construction and new location should be identified by KMC.

I.2.3.2 Construction details of major components of the landfill facility

a. Clearing the field

This work is to clear the site before beginning of improvement work at Gohagoda landfill site.

b. Making gentle slope

This work is to make gentle slope at the exiting landfill site in accordance with the drawings in order to keep the waste landfilling stable and maintain the nice view by minimizing the waste exposed area.

This work includes all required work such as excavation, transportation, dumping, spreading , compaction of all existing waste and 20cm thickness of covering soil.

c. Installation of Bench (terrace)

This work is to construct the bench (terrace) on the gentle slope in accordance with drawings. The purpose of bench is as follows.

1) To protect the slope by intercepting runoff water flowing on the slope.
2) To provide the enough space for the interceptor drain on bench.
3) To provide the enough working space for the slope maintenance.
4) To keep the waste filling slope stable.

This work includes all required work such as excavation, compaction and installation of rip rap.

d. Turffing

The turf shall be placed on the entire slope designated on the drawing and shall be fully taken care until turf is surely rooted. The purpose of turffing is as follows.

1) Protection of the slope from erosion by runoff water.
2) Maintenance of the good view.

e. *Construction of the temporary access road*

This work is to construct a gravel faced temporary access road in the Gohagoda landfill site in accordance with drawings.

This work includes all required work such as survey, filling soil on waste dumped to form a road base, spreading and compacting 0-40 mm crushed stones with 5 m width and 15 cm thickness. The sufficient density shall be obtained by compaction.

f. Construction of the storm water drainage (rip rap)

This work is to construct the storm water drainage (rip rap) along the foot of the slope and bench (terrace) in accordance with drawings. "Type A" and pipe culvert shall be constructed along the foot of slope, while "Type B" shall be constructed on the bench.

This work includes all required work such as survey, excavation, purchasing cobble stones, mortar bedding, stone pitching and filling mortal in gaps. The thickness of riprap lining shall be more than 15 cm.

g. Construction of Leachate collection pond

This work is to excavate the pond in order to collect the leachate in accordance with drawings. This work includes all required works such as excavation, laying sand bag, installation of pump, laying pipes on sand bed, plugging joints of pipes, backfilling, compacting soil, disposal of extra soil, materials, etc.

h. Modification of leachate and gully suck treatment facility

This work is to rehabilitate the treatment tanks constructed by Kandy Municipal Council. The purpose of the tanks is to treatment leachate pumped from the collection pond and gully suck.

This work includes all required work such as installation of pump, aerator, electric pole and water supply pipe etc in accordance with drawings.

i. Installation of Gas ventilation facility

This work is to construct vertical gas removal facilities at the designed location in accordance with drawings. This work includes all required works such as excavation, installing perforated oil barrel, covering perforated oil barrel with cobble stones, backfilling, compacting soil, disposal of extra soil, all materials, etc.

j. Fence for the mitigation of scattering waste

This work is to install the fence in accordance with drawings in order to prevent waste from scattering to outside of the site. The fence will be placed along the access road on the top of landfill site.

k. Relocation of control house

This work is to relocate the existing control house and garage of Bulldozer. The new site will be indicated by the Client.

I.2.4 Operational Activities

Operation will be done by Kandy Municipal Council.

I.2.4.1 Details of operation and maintenance of components of landfill facility

a. Turffing on the Finished Slope

Turffing on the finished slope is required for protection of the slope and mitigation of landscape.

b. Extension of Gas Ventilation Pipes

The gas ventilations will be placed at a spacing of 30m to 50m on the landfill cover. The gas ventilation pipes will be extended every layer of operation. The height of each layer is 2.0m; therefore, the length of each extended gas is required 3.0m.

c. Maintenance of Installed Facilities

Fence, access road will be maintained when these are damaged. The drain will be cleaned every one month in order to prevent from blocking.

d. Reception of Visitors

The site will welcome visitors because this will be a model for rehabilitated sanitary landfill site for Sri Lanka. Municipal Council staff will explain the design, operation and maintenance system for the landfill operation.

I.2.4.2 Management of sludge of Leachate & Gully suck treatment system

The leachate treatment facility requires the following O&M works.

1) Control and Operation of leachate pumps and aerators following the operational manual prepared by JICA study Team
2) Removing of sludge periodically from treatment facility and to be discharged to the landfill site whenever necessary

I.2.4.3 Details of usage of cover material

The term cell is described the volume of material placed in a landfill during one operating period, usually one day. A cell includes the solid waste deposited and the daily cover material surrounding it. The stockpiles soil that transported by KMC will be used in covering.

The advantages of using daily cover are primarily in preventing windblown litter and odours, birds and vermin and in improving the site's visual appearance. It is also advocated as a means of shedding surface water during the filling sequence, thereby leachate management by reducing infiltration. At sites where daily covered is spread by bulldozer, a thickness less than 150 mm will not be feasible, keeping in view the uneven surface of the waste.

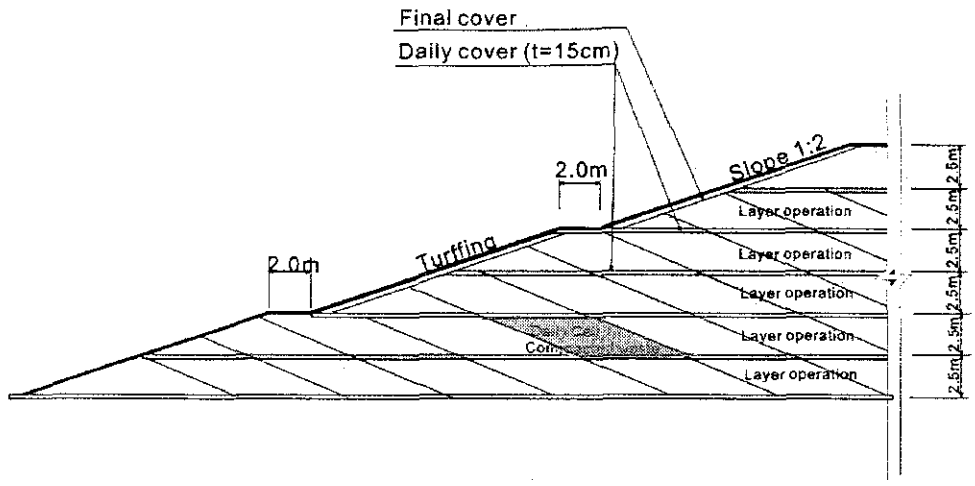


Figure I-9: Daily Cell and Daily Soil Cover

I.2.5 Work force, equipment and materials

I.2.5.1 Requirement of labour and employment of local people

No labour and employment of local people is required for preconstruction and construction. JICA project will arrange necessity labour for the construction.

Kandy Municipal Council will arrange following manpower for operation of landfill site.

- Manpower
  - Supervisor (not full time): 1 person
  - Operator of Bulldozer: 1 person
  - Foreman: 2 person
  - Guard & record keeping: 1 person
  - Labour: 4 persons

I.2.5.2 Heavy equipment

JICA donated bulldozer will be used in operation, while Kandy Municipal Council will supply fuel and lubricant oil for a bulldozer

- A bulldozer (full time) 1 unit

I.2.5.3 Availability of skilled labour in the area

Unskilled labours are available for operation of sanitary landfill site.

I.2.5.4 Occupational health and safety provided

Kandy Municipal Council as Occupational health and safety will provide following items

- Long rubber boot
- Gloves
- Helmet

I.2.5.5 Facilities required or provided

Required facilities are as follows,

- Control house
- Garage for Bulldozer

I.2.6 Evaluation of alternatives

Final disposal is essential component in solid waste management because some of waste will still remain even after being fully reused and recycled. The landfill disposal is, therefore, absolutely necessary component even though the processing or treatment technologies such as composting, incineration, biogas, recycling, etc. are fully employed.

However, the introduction of processing or treatment technology could be the right option, if the solid waste management cost including landfill disposal cost and transportation cost is very expensive due to the difficulty to acquire a new landfill site nearby. As for the Gohaogda Site, the site near from the town centre and has been used since 1970's. It is, therefore, the transportation cost and land acquisition cost will not affect the decision. Only the investment for the improvement of landfill facility and the operation and maintenance cost should be considered.

Therefore, the landfill operation and maintenance cost and the treatment cost with landfill cost will be examined.

I.3 Description of the exiting environment

I.3.1 Present Physical Environment Condition of Gohagoda Landfill Site- Kandy Municipal Council

The Gohagoda dumping site is located approximately 7 km away from the city centre, out of the Kandy Municipal Council limits. Further, the site is located within the limits of Harispaththuwa Pradeshiya Sabha (Local Authority) 200 m away from the Peradeniya – Katugasthota Main Road near the Village Gohagoda. The total land area own by the Kandy Municipal council is around 12 Hectares while nearly 2.5 hectares is active filling area. Rest of the land mainly consist of Old dumping sites and Residence area that distributed among the workers of Kandy Municipal Council. The Gohagoda site has been used since 1970's and remaining capacity is limited to active filling area..

Table I-3: Present Condition of Gohagoda Landfill Site- Kandy Municipal Council

Item	Description
1. Name of Landfill site	Thekkawatta Landfill Site, Gohagoda.
2. Since	1970's
3. Land ownership	Kandy Municipal Council, Situated within Harispaththuwa Pradeshiya Sabha area.
4. Surrounding land use	The Mahawali river flows 200 m below the site in it Western side beyond a paddy field. Other area mainly consists of paddy land and residence facilities for workers.

Item		Description
5. Topography		The active filling area is located in a steep slope area, which has already filled up to the access road elevation.
7. Meteorology		The site is situated in Mid Country wet zone, which receive annual rainfall of 2500 mm with Binomial distribution pattern.
8. Hydrology		There is a small stream at the bottom of the landfill site which connect to the Mahaveli River 300 m away from the site. The stream already contaminated with leachate and it has directly diverted to the Mahaveli river without using for Irrigation of paddy field or domestic use. The catchments area of the dumping site is approx 3.5 ha including the active filling area.
9. Land Use		Agricultural and Residential area
10. Surrounding Area		Dumping area: 2.5 ha Catchments area: 3.5 ha
11. Disposal site	-Disposal method	Controlled tipping No environmental protection measures are taken.
12. Waste discharged	-Municipal waste	**Executive organizations of collection:** -Carekleen Pvt. Ltd. & Kandy Municipal Council **Discharge amount:** -Daily average: 68.2 tons/day -Monthly average: 2,046 tons/month Municipal waste consists of household waste, market waste, commercial waste and waste from drains.
	-Health care waste	**Executive organizations of collection** -Kandy general hospital : Carekleen Pvt. Ltd. -Kandy Nursing Homes : Kandy Municipal Council -Lakeside Adventist: Kandy Municipal Council **Discharge amount** -Daily average: approx 1.0-1.1 tons/day -Monthly average: approx 30.0-33.0 tons/month The average waste amount is around one ton per day from each hospital and a small amount of (50kg-100kg) hazardous waste, including body parts and clinical waste, is also collected separately from each hospital. The hazardous waste is buried in the old landfill area and the excavation and covering of the pit is done manually. (Data source : Mr. Peter, supervisor)
	-Industrial waste	**Main discharge source:** -Bata Co. and Tobacco Co.: Collection by themselves -Garment factories: Collection by KMC **Discharge amount:** -Daily average: less than 1.0 ton/day -Monthly average: less than 30.0 tons/month
	-Sewage	**Executive organization of collection :** -Kandy Municipal Council **Discharge amount** -Daily average: 22.3 m3/day
13. Air Quality	Inventory of existing emission sources	The emission source is existing dumped waste。
13. Current condition of Environmental impact	-Odour	There is strong odour throughout the year mainly due to no soil cover.
	-Pests	There are many pests throughout the year mainly due to no soil cover.
	-Dogs	There are many dogs throughout the year mainly due to no soil cover.
	-Fire & Smoke	There is almost always fire and smoke from waste dumped.
	-Leachate	There is leachate flowing from waste dumped due to lack of covering soils and leachate treatment facilities, although the leachate amount is little.

<table>
<tr><th colspan="2">Item</th><th>Description</th></tr>
<tr><td></td><td>-Sewage</td><td>The discharge method of the gully sucker at the landfill site is as follows;
■ Make a pit which has a diameter of approx 3.0 meters and a depth of 2.0 meters at the landfill site once or twice a month by the excavator
■ Gully suckers discharge approx 22 m3/day into the pit.
■ Gully sucker effluent penetrates underground or flows out to the paddy field without any treatment
Next to the landfill site, part of a treatment plant was constructed for gully sucker waste by the KMC with the consultation of Peradeniya University, on January 2002. It was not completed due to financial constraints.
KMC discharged gully sucker waste to the treatment plant from February to March 2002 before completion of the construction work. However, the residents of the surrounding villages complained about the effluent from the treatment plant because of the improper treating. Therefore, KMC stopped this operation in April 2002 and is using the pit system again.</td></tr>
<tr><td>14. Facilities</td><td>-Control house</td><td>1 building</td></tr>
<tr><td></td><td>-Gate</td><td>None</td></tr>
<tr><td></td><td>-Fence</td><td>None</td></tr>
<tr><td></td><td>-Weigh bridge</td><td>None</td></tr>
<tr><td></td><td>-Leachate treatment</td><td>No facility</td></tr>
<tr><td></td><td>-Buffer zone</td><td>none</td></tr>
<tr><td></td><td>-Electricity</td><td>Available</td></tr>
<tr><td></td><td>-Water supply</td><td>Available</td></tr>
<tr><td></td><td>-Telephone line</td><td>None</td></tr>
<tr><td>15. Operation and Maintenance</td><td>-Executing organization</td><td>Kandy municipal Council</td></tr>
<tr><td></td><td>-Equipment</td><td><u>:Bulldozer (D4)</u>
-1 unit
-Property of KMC
-Fully employed at the landfill site
-Working hours (normal) 1.5-2 hours/day ,maximum 4 hours / day
-The bulldozer operator is also involved in other driving activities in the KMC, mostly in the evening.
-Operation & Maintenance cost
Diesel : 18,895 Rs/month
Lubricant : 675 Rs/month
Insurance :74,683.9 Rs/year</td></tr>
<tr><td></td><td></td><td><u>:Backhoe Loader (JCB 3CX SIDESHIFT)</u>
-1unit
-Property of KMC
-Dispatched from workshop 1-2 days per month
-Mainly involved in excavating pits for the disposal of gully sucker waste, excavating and loading of cover soils are also occasionally done.
-Operation & Maintenance cost (cost includes not only landfill site working but also the other earth work)
Diesel : 17,230 Rs/month
Lubricant : 386 Rs/month
Repair cost:18,289 Rs/month
Tiers: 98,000Rs/year
Insurance :74,683.9 Rs/year</td></tr>
<tr><td></td><td>-Staff allocation</td><td>
<table>
<tr><th>Position</th><th>Number of Workers</th><th>Duty</th><th>Working hours</th><th>Average Salary(Rs/Month)</th></tr>
<tr><td>Supervisor</td><td>1</td><td>Supervision</td><td>Day or night shift</td><td>7,800.00</td></tr>
<tr><td>Assistant supervisor</td><td>1</td><td>Supervision</td><td>Day or night shift</td><td>7,800.00</td></tr>
</table>
</td></tr>
</table>

Item		Description				
		Labour Group 1	2	Waste unloading	Day shift	6,600.00
		Labour Group 2	2	Waste unloading	Night shift	5,650.00
		Bulldozer operrater	1	Bulldozer Operation	Day Shift	
13. Surrounding villages or facilities	Thekkawatte village	-The whole village seems to be affected by the landfill site. -The total number of households is around 120. -Most of the households are middle and low income families. -Most of them are working as laborers in the KMC.				
	Polwatte village	-The households within the boundary of the village are mainly affected. -The number of households may be around 50 including high, middle and low income families.				
	Oliyahinne village	-The households within the boundary of the village are mainly affected. -The number of household may be around 25 including high, middle and low income families.				
	Previous workshop of water board	The previous workshop of the water board is located in the east of the landfill site. Buildings :approx 640m2 Concrete slab :approx 450m2 Others : approx 710m2 Total :approx 1,800 m2				

I.3.2 Present Ecological Environment Condition of the Gohagoda Landfill Site- Kandy Municipal Council

The site is surrounded by agricultural and residence area. Agricultural land mainly consists of lowland Paddy cultivations and home gardens while all the residences scattered around the village. Existent of natural habitat within or surround the site area is not evident.

I.3.3 Present Socio- Economic Condition of the Gohagoda Landfill Ste- Kandy Municipal Council

Socio –Economic Environment conditions of around the existing landfill site are summarized below.

Table I-4: Present Socio- Environment Condition of around Landfill Site

Item	Description
1. Location of centres of population and settlement (Surrounding Villages)	1. Thekkawatta Village -The whole village seems to be affected by the landfill site. -The total number of households is around 120. -Most of the households are middle and low income families. -Most of them are working as laborers in the KMC. 2. Polwatta Village -The households within the boundary of the village are mainly affected. -The number of households may be around 50 including high, middle and low income families. 3. Oliyahinne Village -The households within the boundary of the village are mainly affected. -The number of household may be around 25 including high, middle and low income families.

Item	Description
2. Existing Infrastructure facilities	Surrounding villages and Landfill site are facilitating with a domestic water supply and electricity facilities. There is a asphalt paved access road to the thekkawaththa village.
3. Water supply	The domestic water requirements are fulfilled by shallow wells and Water Board supply scheme. In addition Mahaveli river also use as a resource for washing and bathing.
4. Religious and cultural centres	Thekkawaththa Temple is located near the boundary of active landfill area which directly suffer from open dumping.
5. Transportation	**Road Network:** The main haulage route is Kandy-Gohagoda main road via Katugasthota. The access road to the site is started near Gohagoda Village 1 km away from Katugasthota extend approximately 1 km across the boundary of site.

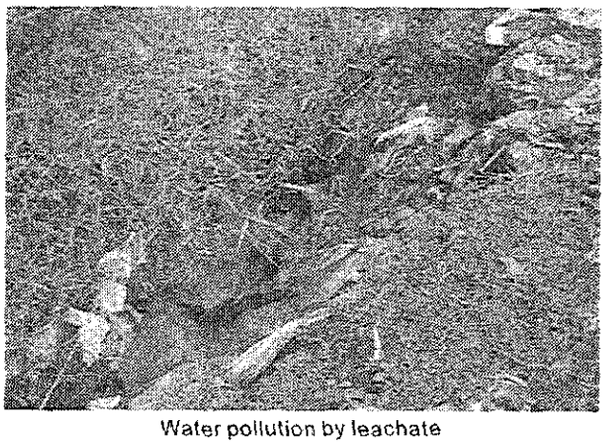
I.3.4 Existing Problems

The Gohagoda landfill site has been used since 1970's. The dumping method is open dumping rather controlled tipping which create adverse effect on the environment and sanitation.

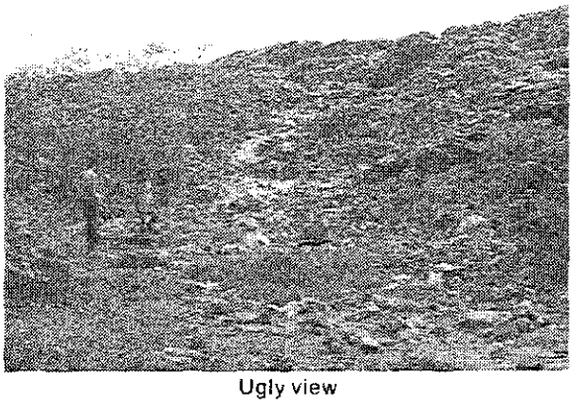
1) No remaining capacity
2) Offensive dour
3) Fire and smoke
4) Vermin, flies, mosquitoes, rats, crows, etc.
5) Waste scattering
6) Ugly view
7) Water pollution by leachate

8) Gas generation

Vermin, flies, mosquitoes, rats, crows, etc.



Water pollution by leachate



Ugly view

Waste scattering

Figure I-10: Existing Problem at Gohagoda Landfill Site

I.4 Proposed Mitigatory Measures for the Environmental Impacts

As the results of the environmental examination, the following measures will be required in order to mitigate the negative environmental impacts caused by the landfill operation.

I.4.1 During the construction

1) Careful construction planning and management with specification of standards/procedures to be followed for all excavation works in project documents.

2) Good excavation practice (e.g. minimising exposure of bare soils; timing of soil movements to suit season; careful storage of excavated soil, etc.).

3) Placement, restoration and after-care programmes to appropriate standards.

I.4.2 Landfill facility

1) Interceptor drain to minimize the entry of runoff water into the site
2) Leachate collection Pond
3) Leachate and Gully Suck treatment facility

4) Gas ventilation
5) Waste scattering prevention fence
6) Separate disposal pit for infectious waste

I.4.3 Landfill operation

1) Daily soil cover
2) Operation and maintenance of the leachate and Gully suck treatment facility
3) Extension of gas ventilation facilities
4) Maintenance of the planned gentle slope of the landfill site
5) Protection of the waste filling slope
6) Maintenance of the interceptor drain
7) Security control
8) Monitoring the landfill operation
9) Use of closed type trucks or trailers for waste transportation
10) Prohibition of the receipt of toxic / hazardous waste

I.4.4 Solid waste management policy

1) Promotion of 3 Rs, reduce, reuse and recycle to prolong the life year of the landfill site.
2) The introduction of processing or treatment technologies to prolong the life year of landfill site by reducing the waste final disposal amount will be examined ten years later.

I.5 Monitoring Plan

I.5.1 The monitoring committee

The monitoring committee will be established for the following purpose.

- To ensure the landfill operation in compliance with the method stated in the landfill operation manual.
- To keep the transparency of the landfill operation

I.5.2 Proposed member of the monitoring committee

The proposed monitoring committee members are as follows.

Table I-5: Members of the monitoring committee

Position	Eligibility
Chairman	Chairman of the health committee
Member 1	a municipal council member elected from the ward near the landfill site
Member 2	a municipal council staff in Health Department
Member 3	a municipal council staff in Works Department
Member 4, 5	representatives of neighbourhoods
Member 6	a Central Environmental Authority staff
Member 7	a staff in local environmental NGO

I.5.3 Monitoring frequency

The appointed members of the monitoring committee should jointly evaluate the operation and maintenance of the site. All the members should visit the site and should evaluate the conditions following the Monitoring Check List that prepared by JICA Study team. Frequency of monitoring is describe in following table.

Table I-6: Monitoring frequency

Period	Frequency
Before the construction The first monitoring will be executed before the commencement of the construction work in order to understand and to keep record the original condition.	1 time
During the first six months	every month
After six months If the monitoring committee judges that the monthly monitoring is not necessary, the monitoring frequency will be reduced after the six months landfill operation. However, the monitoring has to be done at least every three months.	every three months

I.5.4 Monitoring check list

JICA Study Team will prepare the checklist of the monitoring for the landfill operation. The monitoring committee shall execute according to the monitoring checklist.

Table I-7 : Check List for the Landfill Operation

Check list Monitoring Committee for the Gohagoda Landfill Site					Date: Time:	
Category A: Environmental effect (Before and after construction)						
No	Items	Acceptable	Medium	Terrible	Score	Notes
A1.	Fire & Smoking	0	1	2		
A2.	Offensive dour	0	1	2		
A3.	Waste water	0	1	2		
A4.	Withering of trees caused by discharged waste	0	1	2		
A5.	Waste scattering	0	1	2		
A6.	Animals (Dogs, monkeys, birds etc.)	0	1	2		
A7	Vermin (Flies etc.)	0	1	2		
A8.	View	0	1	2		
A9.	Entry of scavenger (If no scavenger is the site : select "0")	0	-	2		

	Total of Category A					
Category B : Function of facilities (After finishing of construction)						
No	Items	Functioning	Medium	No functioning	Score	Notes
B1.	Drainage system					
	B1-1. Rip pap	0	1	2		
	B1-2. Earth drain	0	1	2		
B2.	Leachate collection pond	0	1	2		
B3.	Gas ventilation system	0	1	2		
B4.	Discharge pit for the health care	0	1	2		
B5.	Gully suck & Leachate treatment facility	0	1	2		
B6.	Access road (Gravel road)	0	1	2		
B7.	Waste scattering prevention net fence	0	1	2		
B8.	Turffing	0	1	2		
	Total of Category B					
Comment: Name & Signature						