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City Maintenance and Public Utilities Agency

Municipality of Ulaanbaatar

Mongolia

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF
WASTE MANAGEMENT IN ULAANBAATAR CITY

May 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

KOKUSAI KOGYO CO.LTD.

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Preface

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct a basic design study on The Project for Improvement of Waste Management in Ulaanbaatar City in Mongolia and entrusted the study to the Japan International Cooperation Agency (jica).

Jica sent a study team to Mongolia from 3 September to 11 October, 2006.

The team held discussions with the officials concerned of the Government of Mongolia, and conducted a field study of the study area. After the team returned to Japan, further studies were made. Afterwards, a mission was sent in order to discuss a draft report from 14 January to 27 January 2007 and furthermore a mission was sent in order to discuss the draft final report from 13 March to 24 March 2007, with the present report finalised as a result.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Mongolia for the close cooperation which they extended to the teams.

May 2007

Masafumi KUROKI
Vice President
Japan International Cooperation Agency

May 2007

Letter of Transmittal

We are pleased to submit to you the basic design study report on The Project for Improvement of Waste Management in Ulaanbaatar City.

This study was conducted by Kokusai Kogyo Co., Ltd., under a contract to jica, during the period from September 2006 to May 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Mongolia 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,

Ichiro KONO
Project manager,
Basic design study team on
The Project for Improvement of waste Management in Ulaanbaatar City
Kokusai Kogyo Co., Ltd.

Summary

1. Background of the project

Mongolia is an inland country located in the north of East Asia with an area of 1.54 million km2. The population is 2.59 million people as of 2006 and GDP per capital for the same year is 482.8 US$. Ulaanbaatar City (UBC), which is the capital city of Mongolia, has an area of 4,704km^2 and a total population of around 965,000 in 2006. Due to a rapid population increase in Ulaanbaatar City (3.6% increase from 2001 to 2003) and a change in lifestyle following their transition to a market economy, the generation of waste has increased and problems related to solid waste management have become worse.

There are a number of issues in Ulaanbaatar City concerning the management of solid waste, such as the inadequate number of collection vehicles, which are already run down, in addition to the fact that capabilities of systematic planning for collection, treatment, and disposal are not up to standard.

Under these circumstances, the Government of Mongolia (GOM) requested the Government of Japan to carry out a development study for the improvement of Solid Waste Management (SWM) in Ulaanbaatar City in 2001. In response to the request, a Development Study (The Study on SWM Plan for Ulaanbaatar City in Mongolia) was conducted by Japan international Cooperation Agency (jica) between 2004 and 2007.

This project will be implemented following the Development Study recommendations. The GOM requested the following under the Japanese grant aid scheme: 1) Construction of Narangiin Enger disposal site (Area 27.8ha, Filling capacity 2,720,000 cubic meters, located in North-West, 10km from UBC), 2) Construction of Sorting yard at Narangiin Enger Recycle complex, 3) Procurement of waste collection equipment, and 4) Procurement of maintenance tools for the Central Workshop.

2. Results of field survey and contents of the project

In consideration of the circumstances set out above, the Government of Japan decided to conduct the Basic Design study and jica sent a study team to Mongolia as shown below.

Study team	Period
Field survey	3rd September 2006 – 12th October 2006
Explanation of draft report	13th January 2007 – 27th January 2007
Explanation of draft final report	13th March 2007 – 24th March 2007

The implementation of a separated waste collection system for recyclables is essential as a prerequisite for the requested construction of sorting yard at Narangiin Enger Recycle complex. According to the results of the field survey conducted from 3rd September to 12 October 2006, the introduction of the separated waste collection system has not yet been authorized by the GOM.

Therefore, the construction of sorting yard at Narangiin Enger Recycle complex is excluded as the project. The study team and the GOM discussed and agreed that the contents of the project consists of the construction of the disposal site at Narangiin Enger (NEDS), procurement of waste collection equipment and procurement of sanitary landfill equipment, and not including the construction of sorting yard at Narangiin Enger Recycle complex

A summary of facilities and major equipment procurement list is shown below.

Contents of facilities

	Specification	Quantity	Purpose
Narangiin Enger Disposal Site			
Lifespan : 11 years, landfill Area : Approximately 27.8 ha, Landfill Capacity: 3,176,000 m^3			
Landfill Facility			
Embankment Dam	Earth dam, width: 8m, Height: 10 m	1 no.	Proper landfilling
Rain Water Drainage	V shape concrete U shape concrete Earth drain	Approx.970m Approx.880m Approx.500m	Prevention of rainwater into landfill area and indication of boundary
On site road for collection trucks	Asphalt pavement	Approx.1,100m	Access to the landfill area
On site road for heavy equipment	Gravel Pavement	Approx.1,000m	Access to the landfill area
Environment Protection Facilities			
Leachate collection facilities	Perforated Steel Pipe with dia. 600mm Cut off Wall（Reinforce Concrete）	Approx.280m 1 place	Collection of Leachate
Leachate treatment facilities	Reinforced Concrete	1 place	Treatment of Leachate
Gas extraction facilities	Steel Pipe with crushed stone	18 places	Extraction of Methane gas
Wind fence to prevent waste from scattering	Inside: H=3.0m Outside: H=1.2m	Approx.2,400m Approx.2,200m	Prevention of lightweight wastes scattering due to strong winds.
Operation and Maintenance Facilities			
Control Building	Single story, RC structure, partially Steel Frame	1 no.	Administration, warm garage and social welfare for waste pickers
Weigh Bridge and Control House	RC structure	1 no.	Weighing incoming wastes and control of trucks
Public Toilet	3 for male and 3 for female	1 no.	Welfare facilities for workers in Disposal Site
Main Gate	Steel H=2.35 m	1 no.	Control of incoming trucks and indication of boundary
Telephone Line within Site		Approx.450m	Telecommunications
Electricity within Site		Approx.650m	Power supply

Major Equipment

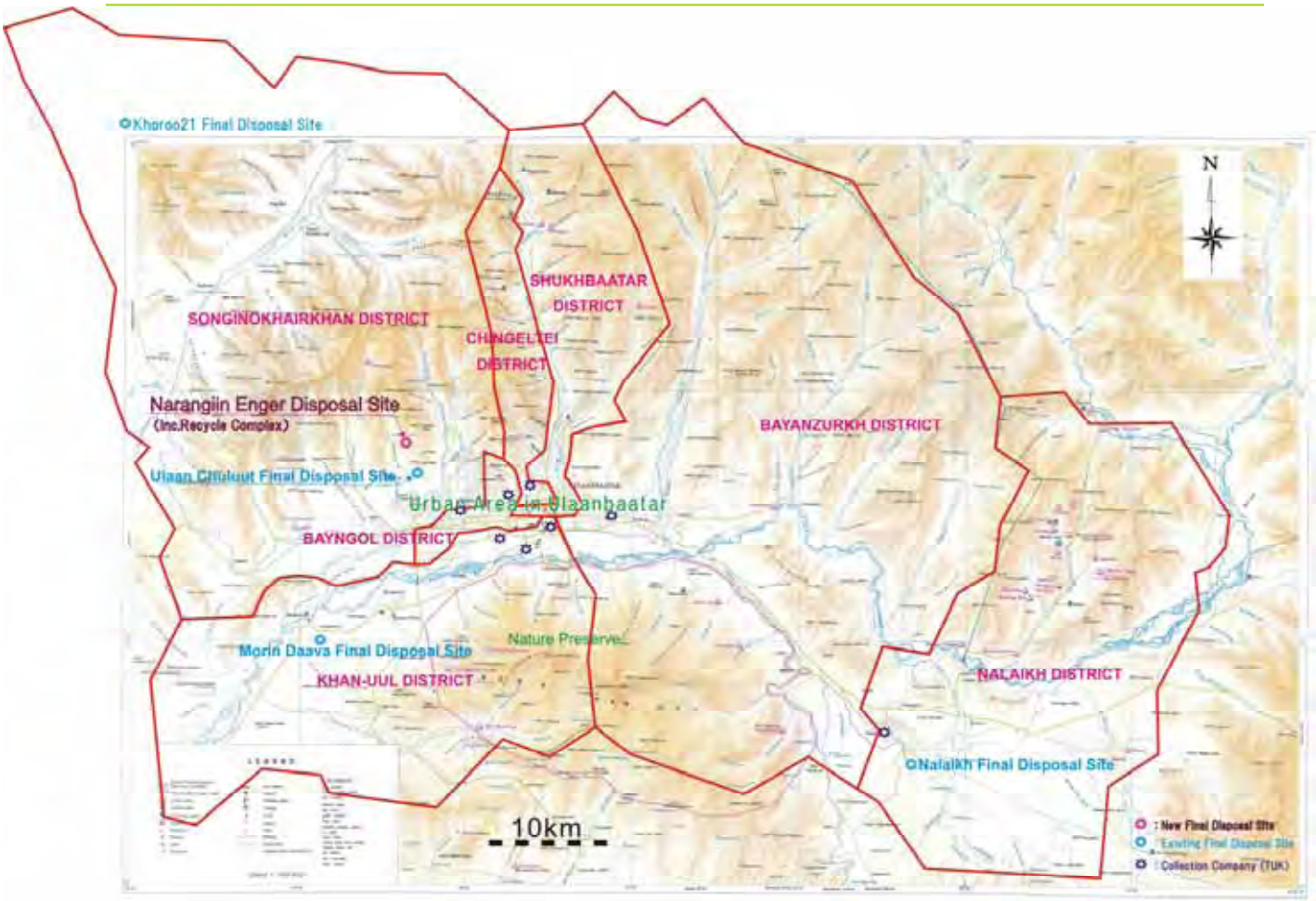
Equipment Name		Purpose of Use	Quantity
Collection and Transportation of Wastes	Compactor Trucks ($15m^3$)	Collection and transportation of residential wastes and business wastes in apartment area	23 no.
	Compactor Trucks ($8m^3$)	Collection and transportation of residential wastes and business wastes in apartment area	7 no.
	Dump Trucks ($6m^3$ with cover)	Collection and transportation of residential wastes in Ger area	13 no.
	Wheel Shovel with Backhoe	Collection of residential wastes in remote area	1 no.
Landfill Equipment at Naragiin Enger Disposal Site (NEDS)	Bulldozer (20 ton class)	Levelling, compaction of wastes. Soil cover, construction of embankment dam, construction of divider.	3 no.
	Excavator ($0.6m^3$ of bucket)	Excavation and loading soil for soil cover, maintenance of on site road, construction of embankment dam, construction of earth drain.	1 no.
	Dump Truck (10 tons)	Transportation of soil, construction of embankment dam, maintenance of on-site road, cleaning of illegal dump.	2 no.
	Water Truck （6kilo litters capacity with water gun）	Extinguish fires, transportation of clean water, watering for dust prevention, maintenance of green belt	1 no.
Landfill Equipment at Morin Davaa Disposal Site (MDDS)	Wheel Shovel with Backhoe	Levelling and compaction of wastes, soil cover, embankment.	1 no.
Operation and Maintenance	Tire Changer	Change tire for heavy equipment	1 no.

3. Implementation schedule and Project cost estimation

The implementation schedule consists of the Detailed Design (5 months), equipment procurement (8 months), facility construction (10 months) and implementing the soft component (10 months). The Project cost is estimated to total ¥1,057,000,000 Japanese yen (Japanese side = ¥1,005,000,000 Japanese yen, and Mongolian side = ¥5,200,000 Japanese yen)

Contents

[Appendices]



Location Map for the Basic Design Study
On the Project for Improvement of Waste Management
In Ulaanbaatar City

Perspective View for Narangiin Enger Disposal Site

Table Lists

Figure Lists

Abbreviations

A/P	Authorisation to Pay
CMPUD	City Maintenance and Public Utilities Division
CMPUA	City Maintenance and Public Utilities Agency
CSIA	City Specialized Inspection Agency
Duureg	District
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GOM	Government of Mongolia
IEE	Initial Environmental Examination
jica	Japan International Cooperation Agency
Khoroo	Subordinate organization of Duureg
Kheseg	Subordinate organization of Khoroo
MDDS	Morin Davaa Disposal Site
MNT	Mongolian Tugrug
MUB	Municipality of Ulaanbaatar
NEDS	Narangiin Enger Disposal Site
NERC	Narangiin Enger Recycling Complex
M/P	Master Plan
NGO	Non Governmental Organisation
Nuuts	Landfill Operations Company
O&M	Operation and Maintenance
PPM	Parts Per Million
RDF	Refuse Derived Fuel
SWM	Solid Waste Management
TUK	Renovation company which provides waste collection, street sweeping, park cleaning, greening services
UCDS	Ulaan Chuluut Disposal Site
WP	Waste Picker

1. Back Ground of Project

1 Background of the Project

1-1 Background of the Project

Mongolia is an inland country located in northern East Asia with an area of 1.54 million km^2. The population is 2.59 million people as of 2006 and GDP per capita of the same year is 482.8 US$.

Ulaanbaatar City is the capital city of Mongolia and has an area of 4,704km^2 and a total population of around 965,000 in 2006, around 40% of the national population. Due to a rapid population increase in Ulaanbaatar city (3.6% increase from 2001 to 2003) and change in lifestyle following their transition to a market economy, the generation of waste has increased and problems related to solid waste management have become worse.

Solid waste management in Ulaanbaatar City has been flush with a number of problems, such as an inadequate number of vehicles in their collection system, which are already run down and outdated, plus the issue of systematic planning capabilities for collection, treatment, and disposal that are not up to standard.

Under such circumstances, the Government of Mongolia (GOM) requested the Government of Japan to carry out a development study for Improvement of Solid Waste Management (SWM) in Ulaanbaatar City in 2001. In response to the request, a Development Study (The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia) was conducted by jica between 2004 and 2007. Under the Development Study, the Master Plan was formulated, which aimed to establish an environmentally sound SWM system in the Ulaanbaatar City by the target year of 2020, in addition to a feasibility study which was conducted for the priority projects.

The Ulaanbaatar City conducted Environmental Impact Assessment (EIA) for the priority projects in August 2005 and has been granted approval by the Ministry of Environment in February 2006.

Under such circumstances, The Government of Mongolia applied to the Government of Japan for Grant Aid for the following:

1. Construction of Narangiin Enger disposal site (NEDS)
2. Construction of Sorting yard at Narangiin Enger Recycle complex (NERC)
3. Procurement of collection equipment
4. Procurement of maintenance tools for the Central Workshop

This study for Basic Design was conducted upon the request of above application.

1-2 Natural conditions

New disposal site Naragiin Enger Disposal Site (NEDS) is located in the North-West of Ulaanbaatar city. The Environmental Impact Assessment (EIA) mentioned that strong winds in this area must cause waste scattering and smoke drifting into the city from NEDS. Therefore, countermeasures such as a wind fence and a green belt should be taken into account in the basic design.

During the field survey, the study team conducted a number of investigations of the natural conditions: 1) soil investigation for structure design, 2) permeability tests of the base rock, 3) survey for utilization of groundwater, and 4) a drawdown test at the drilling well. A summary of the results follows.

(1) Soil investigation for structure design

The soil investigation was executed in order to grasp geological feature information necessary for the structural design of the facility foundation of NEDS. Below are the details showing the places targeted for the test along with number of locations, and the testing items conducted for the geological survey.

1) Location

Control building and warm garage	: 6 Locations
Weight bridge scale and control building	: 4 Locations
Main road	: 2 Locations
Leachate treatment facility	: 4 Locations
Total	: 16 Locations

2) Testing item

Samples were taken in the soil investigation in order to analyze the items listed below:

Article size distribution, moisture content, specific weight in wet conditions and dry conditions, liquid limit, plastic limit, plastic index, liquid index, cohesion and internal friction angle, etc

3) Test result

The geological features at the target area show a surface layer (to depth of approximately 0.2m), gravel layer (to depth approximately 4.0m), relatively weathered rock (to depth of approximately 5.0m) which then turns into hard rock (from depth of approximately 5.0m). According to the laboratory analysis for this particular area, the ground is satisfactory to construct the building. The freezing depth during the winter season of the target area is approximately 3m from the surface of the ground, so it is necessary to make due considerations where the construction facility is planned. Also,

the seismic intensity in the area is 4 on the Meteorological Agency scale, which is equivalent to the Mongolian design standard MSK earthquake intensity level 7.

(2) Permeability test for rock bed

1) Purpose of test

The purpose of this test is to grasp the water permeability of the base rock in the area planned for construction of the waste disposal site.

2) Location

The borehole investigation and base rock permeability test (the Lugeon test) was carried out in 3 locations, established as No.P1~No.P3.

- No.P1: Landfill area downstream (at embankment location)
- No.P2: Landfill area in the middle
- No.P3: Landfill area upstream

3) Method of test

Boring was conducted by the Non-water drilling method with a 146mm drill at the surface, and further down in rock by mud circulation drilling method with a 76mm drill.

4) Result

The results of the borehole investigation showed that geological features are constituted of topsoil, sand, gravel (gravel mixed with clay), weathered rock and sandstone (a layer of alternating sandstone mudstone).

The base rock permeability test at 3 positions, No.P1~No.P3, was executed where a sandstone layer (sandstone & mudstone alternating strata) is distributed, in 2 stages G.L. - 5.00m and deeper.

The base rock permeability test, shown in the chart below, came back with Lugeon unit (conversion Lugeon unit) of 0.00 in all test sections. Therefore, it is judged that 0.00 is the coefficient of permeability required from now on in all test sections. The result of this investigation is that all 3 locations (No.P1~No.P3) are judged to be impermeable layers at the depth of G.L-5.0m which is a distribution of a sandstone layer, displaying the functionality of a sufficient waterproof layer.

Table 1.1: Result of permeability test in rock bed

Number	Testing depth	Lugeon	Pressure limit (MN/m^2)	Permeability Coefficient
No. P1	G.L. -5m to 6m	0.00	-	0.00E+00
	G.L. -6m to 10m	0.00	0.70	0.00E+00
No. P2	G.L. -5m to 6m	0.00	0.50	0.00E+00
	G.L. -6m to 10m	0.00	-	0.00E+00
No. P3	G.L. -5m to 6m	0.00	0.30	0.00E+00
	G.L. -6m to 10m	0.00	0.30	0.00E+00

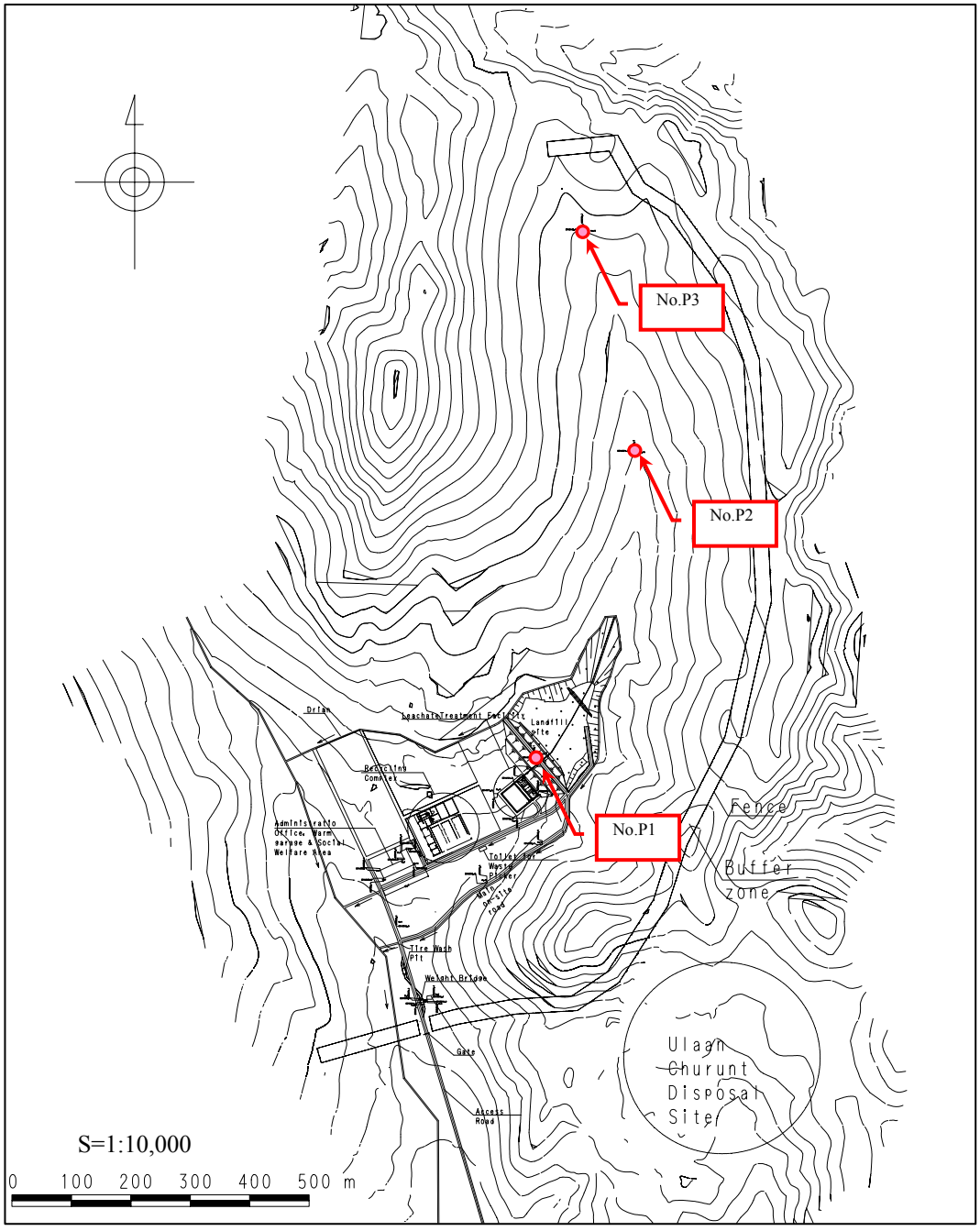


Figure 1-1: Location map of permeability test

(3) Survey for utilization of groundwater

1) Confirmation of environmental monitoring implementation

Based on Initial Environmental Examination (IEE) of NEDS conducted by the Ministry of Nature and Environment, EIA of NEDS was implemented by the authorized environment consultant arranged by Ulaanbaatar city. The EIA Report was formally approved by the Ministry of Nature and Environment in February 2006. As published in the EIA report, and based on the facility design plan and monitoring plan for NEDS established in the Development Study, the monitoring of items where there is a chance of impact depending on operation, such as the groundwater quality (might it contain leachate), gas from the release facility, the atmosphere, soil, groundwater (the observation well, etc.) and surface water will be carried out, as well as the proposal of monitoring standards.

2) Supplemental survey

In order to acquire the baseline data used to appraise the monitoring results from the Ulaanbaatar EIA survey (above), two surveys were completed during the field survey of the basic design study:

- Survey of the utilization of groundwater downstream of NEDS
- Water quality analysis of existing wells located downstream of NEDS

3) Survey of the utilization of the groundwater downstream of NEDS

The figure below shows 8 locations where wells alongside a small river exist downstream from NEDS, an area which could possibility be affected if leachate were to leak into the groundwater. The results of the groundwater utilization and location map are shown in below.

Table 1.2: Results of groundwater utilization research

Well No	Coordinate	Depth	Summary of households that utilize well (per day)	Address
1	N 470 55’15.8’’ E 1060 47’39.3’’ h-1298m	43m	52 families	School of #65. south, 3-th Khoroo/last sample wells/
2	N 470 55’25.0’’ E 1060 47’ 41.9’’ h-1306m	30-35m	40 families	Baga Naran street 43
3	N 470 55’ 22.9’’ E 1060 47’39.5’’ h-1306m	35-40m	Nursery school and public citizen's hall	North of 3-th Khoroo /World vision /
4	N 470 55’ 48.3’’ E 1060 47’18.9’’ h-1340m	76m	35 families	Baga Naran Street 48, ¹9
5	N 470 55’ 48.3’’ E 1060 47’18.9’’ h-1340m	16m	12-13 families	Baga Naran Street 50, ¹12

6	N 470 55’ 46.9’’ E 1060 47’ 32.5’’ h-1322m	20m	non-commercial	Baga Naran 50-10/last sample wells/
7	N 470 55’ 43.7’’ E 1060 47’ 32.9’’ h-1320m	9m	35-37 families	Baga Naran Street 46, ¹1/last sample wells/
8	N 470 55’ 57.7’’ E 1060 47’ 31.6’’ h-1336m	8m	26-28 families	Ikh Naran Street 9, ¹6

Figure 1-2: Location map of survey point of utilization of groundwater

4) Result of Analysis of the existing well water quality of those located downstream of NEDS

The No.4 well is the deepest and the No.8 well is the shallowest of the 8 wells. The No.6 well, which is of intermediate depth, was selected for water quality analysis for base-line data. The on-site water quality analysis was executed on 26 September 2006; the items for water quality analysis and the analysis results are shown in the table below.

Table 1.3: On-site water quality test items and result (Tested on 26th September 2006)

Item	No.4	No.6	No.8
Arsenic	0.00mg/l	0.00 mg/l	0.00 mg/l
Fluorine	0.4ppm	0.00ppm	0.00ppm
pH	7.05	6.24	6.61

Table 1.4: Result of laboratory water quality analysis

no	Analysis item	unit	No.4	No.6	No.8	Mongolian standard
1	Taste	score	0	0	0	0,1,2
2	Effluvium	score	0	0	0	0,1,2
3	Colour	degree	0	0	0	20,0
4	Turbidity	mg/l	0.0	0.0	0.0	1.5
5	Molybdic	mg/l	0.028	0.019	0.007	0.07
6	Barium	mg/l	0.021	0.035	0.010	0.7
7	Boron	mg/l	0.01	0.01	0.01	0.5
8	Copper	mg/l	0.047	0.045	0.035	1.0
9	Calcium ion (Ca^{2+})	mg/l	56.06	98.10	100.10	100.0
10	Magnesium ion (Mg^{2+})	mg(as Mg)/l	20.67	21.89	21.89	30.0
11	Manganese	mg/l	0.01	0.01	0.01	0.1
12	Natrium	mg/l	20.12	20.58	24.48	200.0
13	Phosphoric ion ($PO4^{2+}$)	mg/l	3.00	4.40	4.40	3.5
14	Selenium (Se)	mg/l	0.000	0.000	0.000	0.001
15	Strontium (Sr)	mg/l	0.01	0.04	0.02	2.0
16	Sulphuric ion ($SO4^{2+}$)	mg(as SO4)/l	43.23	72.05	57.64	500.0
17	Hardness	mg-equivalent/L	4.5	6.7	6.8	7.0
18	Chlorine ion (CL^{-})	mg(as CL)/L	16.84	70.74	90.95	350.0
19	Chrome	mg(as Cr)/L	0.0	0.0	0.0	0.05
20	Hydrogen sulfide	mg/l	0.22	0.37	0.30	0.1
21	Solid material	mg/l	0.390	0.517	0.557	1000.0
22	Uranium	mg/l	0.000	0.000	0.000	0.015
23	Bacteria	number/ml	1 x 102	8 x 103	1 x 101	20
24	Coliform group	number/100ml	1	6	0	0
25	Sulfer dioxide	number/100ml	0	1	0	0
26	Bacteria	number/100ml	1	11	0	0
27	pH		7.05	6.24	6.61	6.5-8.5
28	Arsenic	p.p.m.	0.0	0.0	0.0	0.05
29	Fluorine	p.p.m.	0.4	0.0	0.0	0.7-1.5
30	Nitrogen	mg/l	0.28	0.27	0.19	10

According to the results of the analysis, it can be seen that No.4 and No.6 showed values that exceeded the Mongolian drinking water standard for phosphoric acid and the hydrogen sulfide as well as the detection of the bacterium which begins the coliform bacilli.

(4) Pumping test

1) Test proposal

This test is intended to secure the necessary water source for the operational purposes at the waste disposal site (drinking water, water for washing vehicles, and sprinkler purposes), to check permissible water pumping volume of the groundwater.

2) Testing location

Boring for the test had been executed downstream of new landfill site, which is shown in the figure.

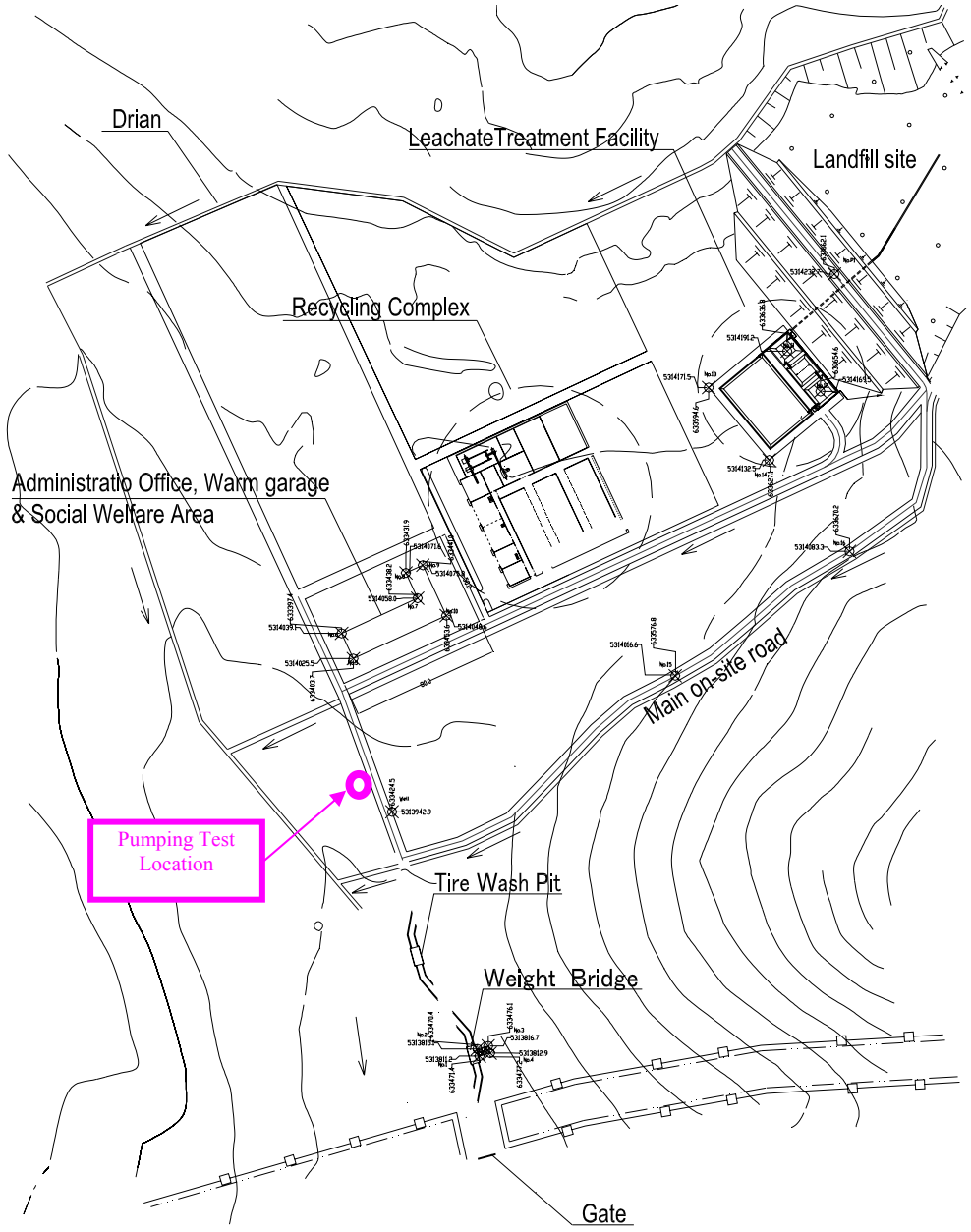


Figure 1-3: Location of pumping test

3) Method of test

The well for the pumping test was excavated in the surface layer (8.0m below G.L.) using a 168mm tri-cone bit, and for lower depths, the mud circulation method was used with a diamond bit. When a depth of 65m was reached, the well was developed and then the pumping test and water quality test were executed.

4) Result of water pumping test

Prior to conducting the water pumping test, in order to roughly estimate the permissible water pumping capacity, a primary water pumping test was executed. During the excavation stage, underground water was found flowing at a depth near 30m, therefore the submersible pump was installed at 30m. The groundwater level prior to the primary pumping test was 6.6m, and setting the pump to maximum capacity yielded 60 liters/minute, yet due to an insufficient water recovery rate, no water could be pumped after a five minute period. Thus, afterwards, we checked the recovery of the groundwater level, and found the water level recovered to 50cm in 30 minutes.

Converting the above figures into volume, it is 31.5 litter/hour, or 0.52 litter/min. According to the water pumping ratio, because it could not continue drawing up water by submersible pump, we may assume the ultimate pumping volume from water level recovery time.

Based on water recovery time, the limit of water suction volume its 28 litter/hour to 32 litter/hour, permissible pumping of water is 70% of the water pumping volume limit, and therefore the permissible pumping rate will be 19.6 litter/hour to 22.4 litter/hour.

5) Result of water quality analysis

During the pumping test, a water quality test sample was also taken, and analyzed by a public laboratory. In addition, a field water quality test was carried out for arsenic, fluorine, nitric acid and the iron content using a portable tester. The result is as follows.

Table 1.5: Result of field water quality analysis

Item	Result (mg/l)
Iron	0
Nitric acid	3.5
Fluorine	0.8
Arsenic	0

6) Conclusion

The permissible volume of pump discharge was obtained conducting a pumping test where 24-hour continual pumping was limited to a discharge of 500liter/day, well below the 6000 litter/day required. It was decided that this well can not provide the required volume of water, and therefore the well will be used for water quality monitoring after starting operations of the disposal site.

1-3 Environmental and social consideration

(1) Environmental Category and Reasoning

Environmental Category: Category B

Reason: This is a new construction project for a disposal site, and some environmental and social impacts such as water pollution, offensive odors and the loss of employment of waste-pickers are assumed, so that the results based on field investigations must be considered.

(2) Summary of Targeted Area

The targeted area for Narangiin Enger disposal site and sorting yard at Narangiin Enger recycling complex is in the capital of Mongolia, Ulaanbaatar City (population 894 thousand, area 4,704 km^2, population density 1.8 person/ha). The site is located in the north-west of the Ulaanbaatar city in the Songinokhairkhan District (population 182 thousand, area 1,201km^2, population density 1.5 person/ha), located in the south-east sector of Khoroo 4 (population 9,041, area 22.3km^2, populations density 4.1 person/ha). The targeted area is a small valley with a catchments area area of 100 ha, with absolutely no forest and is not used for agricultural purposes. The rate of precipitation is exceedingly low (avg. annual 233mm, approx 1/6 that of Japan) and the catchments area is extremely small so that the only time water can be seen flowing through the bottom of the valley is during heavy rains. This is municipal land, however, at present there are two nomadic families of 7 people living in temporary housing (Ger) at the west end of the current target area. During the summer, nomads occasionally use this targeted area as grazing pastures. In the catchments area and the surrounding area, the only residents are these two families. Also, with no one living on the north end of the target area, it is nearby the city about 1.3km from the south side, and can be made into a new Ger area. In order to

halt the expansion of the Ger area and preserve the area for its future use as the disposal site, Ulaanbaatar City enacted an ordinance that designated the site and surrounding land as a special conservation area in November 2005. In the valley of a separate catchments area in the southern end of the target area lays the Ulaan Chuluut disposal site (UCDS) which receives at least 90% of the current waste. There are approximately 300 waste-pickers who earn their living by retrieving goods of value from the waste at UCDS. Also, as mentioned above, many of the residents in the nearby developed area are waste-pickers who make their living by retrieving valuables from the UCDS. This disposal site and recycling sorting yard cause not only environmental issues but also social aspect issues, therefore countermeasures, particulary employment measures of waste pickers should be considered to mitigate the issues.

(3) Reason for implementing study on environmental and social considerations

A system for Environmental Impact Assessment (EIA) has been established in Mongolia. Provisions for the EIA system are contained in the constitution, the Mongolia Law on Environmental Protection and the Environmental Impact Assessment Law. These laws mentioned that when the project includes a disposal site in the vicinity of a residential area with a population of over 10,000 people, an EIA of the project shall be implemented and made available to the public.

The Initial Environmental Examination (IEE) was carried out by the Ministry of Nature and Environment and Ulaanbaatar City, the responsible body for this project, showed the contents of the EIA on 20 June 2006 in connection with the jica Development Study implemented between December 2004 and March 2007. Based on the IEE, Ulaanbaatar City employed the consultant AGRAR upon approval from the Ministry of Nature and Environment to undertake the EIA, which was executed and received approval on 6 February 2006.

(4) Measures to avoid/mitigate for major impact on environment and society, and monitoring effects

Assessment of the impact of environmental and social aspects from the project are reported in the EIA, and the result mentioned there are several minor impacts in 11 categories including air quality, soil, water quality, landscape, fauna and foliage.

For categories where impact can be expected, it is basic protocol to make proposals for avoidance or reduction measures as well as monitoring plans based on the jica Development Study plan, and receive approval from the Ministry of Nature and Environment. Here we list the avoidance/mitigation measures based on the EIA report.

Table 1.6: Avoidance/Mitigation Measures for Major Environmental and Social Impacts

Environmental & Social Impacts	Avoidance/Mitigation Measures from EIA Report	Avoidance/Mitigation Measures from this Study
Air pollution due to methane gas from disposal site	Monitoring	Monitoring Measurements will be taken with simple analysis measurement, and increase the frequency and measurements that can be taken on-site.
Soil Contamination/Landscape	Monitor leachate, vegetation	Monitor leachate, vegetation Regularly analyze the ground water of monitoring wells is regularly analyzed with simple measurement instruments. Vegetation A ridge along the wind fence is established to prevent damage from grazing animals, along with UBC plans for planting, and the leachate processing facility.
Water Contamination	Cleaning System for leachate from disposal site, monitoring	Cleaning System for leachate from disposal site, monitoring A leachate processing system is establihed. Also, regular measurements are taken with simple instruments similar to air quality analysis.
Impact on Waste-pickers	No negative impact	Propose landfill methods for new disposal site to enable co-existence with waste-pickers, and undertake soft component for training and guidance.

(5) Result of Discussion with Local Stakeholders

Ulaanbaatar City, acting as the implementing body for this project, held a public hearing for plans concerning the surrounding residents based on the results of the IEE produced by the Ministry of Nature and Environment and gathered their opinions on the EIA study and project plans. There have been 3 public hearings held thus far, the first one held on 4 August 2005 prior to the basic study for the EIA, where the opinion of local residents was reflected in the EIA basic study and project design. The second public hearing, held 19 October 2005, allowed the opinion of those local residents to be reflected in the EIA Report (draft) and revisions to the project design. At the second hearing, there were not many opposing views from the residents of the surrounding area, but rather a strong expectation for the possibility of new employment opportunities was expressed. After receiving approval for the EIA on 6 February 2006, Ulaanbaatar City held the third public hearing on 10 May 2006 to report the results of the EIA to the residents of the area surrounding the target site to reconfirm their agreement.

(6) Monitoring

Ulaanbaatar City shall ensure that monitoring of the Narangiin Enger disposal site, to be constructed in this project, will be carried out according to the proposal in the EIA and Development study for measurement items, as well as secure the budget and personnel that will be required.

(7) Result of Discussion with Government of Mongolia

A soft component scheme will adopt to raise the capacity to implement environmental and social considerations. The contents of the soft component scheme are as follows.

Approximately 300 waste-pickers who make their living by retrieving valuable materials from the waste are present at the current disposal site, and it is assumed that they will transfer to the new disposal site upon its completion. Whilst opportunities for their livelihood are ensured it is necessary to use heavy machinery to conduct sanitary landfill operations. Therefore, a soft component is conducted for the project in order to train and educate the waste-pickers accordingly. Also, in order to establish their good cooperation, Ulaanbaatar City holds bi-weekly meetings and offer advice and support according to the outcome.

Environmental monitoring of the disposal site will be conducted several times per year as obligated in the EIA. Analysis will be commissioned to a third-party in principal, in addition to the site attendant using simple instruments frequently and repeatedly for the purpose of early detection of any poisonous gas released from the site, or seepage of leachate. The soft component for this project also includes training for site personnel to conduct the monitoring as mentioned above.

(8) Reflecting on the Basic Policy and Design

1) Environmental considerations

The EIA had been completed and approved by the Ministry of Nature and Environment Mongolia in February 2006, so with those results from the Mongolian counterpart, the layout of the new Narangiin Enger disposal site was designed during the Development Study. The EIA was carried out in collaboration with the Development Study team according to Mongolian laws and regulations so that mitigation for environmental impact was proposed, such as gas removal, leachate treatment and establishing a green belt. When the facility and equipment plans are made for this study, environmental considerations are made based on proposals from the Development Study and the EIA for the facility installations.

2) Establishing the green belt

The establishment of a green belt (a buffer area of trees) that surrounds the perimeter of the

Narangiin Enger disposal site is proposed in the EIA to mitigate the environmental impacts. In this project, the fence would be provided on behalf of Japan, with the tree planning provided on the interior side on behalf of Mongolia.

3) Plan for leachate treatment

For measures to treat the leachate, considerations are made for the climate characteristics of the target site of Ulaanbaatar, where extreme cold average annual temperatures are -0.3 degrees Celsius and the ground is frozen for 7 months of the year. Due to this fact, no data of leachate flow is available between October and April because of the little amount of evaporation. Also, while the ground is frozen between October and April, it is a feature that there is no outward flow of leachate.

Furthermore, in comparison to other areas, there is an extremely small amount of moisture in the landfill waste, in addition to the fact that the amount of evaporation is three times that to relative rainfall, meaning that the generation of leachate is greatly limited. For the results from the Development Study, the seepage of leachate from the disposal site is limited to August when precipitation is at its greatest, and in addition there is only a once-in-three-year chance for seepage of leachate according to analysis of climate data limited to the past 6 years.

The results of the geological survey conducted in this study clarified that the landfill site is constituted of topsoil approximately 3 meters thick, with weathered rock approximately 3 meters thick, and then the existence of hard bedrock, where an impermeability test resulted in a coefficient of “0” cm/sec so it acts as a natural impermeable layer. Accordingly, judging from the terrain and geology, the small amount of leachate seepage will naturally collect at the lowest point of the landfill site where a catchments container can be installed to capture most of the leachate runoff from the landfill layer.

The leachate that is collected will be treated using a pump to circulate it, until it evaporates so that it is not discharged outside the site.

4) Environmental Monitoring

Environmental monitoring is largely divided between the obligations set forth in the EIA report, and that recommended by the Development study report. The former is required several times a year, and as a general rule, budget allocations are necessary to entrust the analysis to be done by a suitable, outside specialist. On the other hand, the latter is carried out by the site caretaker using portable instruments, frequently and repeatedly. This serves as an early warning and necessary protection measure against the escape of leachate or release of poisonous gas, yet has almost no related cost. Ulaanbaatar City has made plans to execute both of these.

Table 1.7: Narangiin Enger Disposal Site Monitoring Plan and Costs

Item	Environmental Monitoring which prescribed in EIA report.			Environmental Monitoring which Development study recommended.		
	Monitoring Item	Frequency	Annual cost[1] x1000MNT	Monitoring Item	Frequency	Annual Cost x1000MNT
1. Air	NH3, CO2, CH4, SO2	4 times a year	400	CH4, CO2, H2O, Gas Temperature	Once a week	0
2. Soil	Joint Order by Ministry of Nature and Environment and Ministry of Health. (# 68/A/61, June 22, 1989, Appendix 5, Ministry of Nature and Environment and Ministry of Health	2 times a year	450	nil	-	0
3. Under ground Water	Drinking water standard (Mongolian Standard UST 0900-92)	2 times a year	2,300	Electric conductivity, Cl-, pH、water temperature	Once a week (except winter)	0
4. Surface Water	Nil	-	-	Electric Conductivity, Cl-, pH、water temperature	Once a week (except winter)	0
5. Noise	Nil	-	-	Noise level	Once a year	10
6. Odor	Nil	-	-	Personal check	Once a year	0
7. Settlement	Nil	-	-	Settlement of landfill site	Once a year	20
Total			3,150			30

5) In consideration of Waste-Pickers (WP)

There are approximately 300 waste pickers earning their living by retrieving baluables materials from waste at te UCDS where is adjacent to the new Narangiin Enger waste disposal site. UCDS is expected to be filled by 2008 and promptly closed so that it is estimated that the waste-pickers will continue their activities at the new Narangiin Enger site. However, due to the fact that heavy machinery is used to conduct the sanitary landfill operation, it will be necessary to limit the entry of the waste-pickers onto the site.

This plan calls for the administration method which is compatible with both the activities of the waste-pickers and that of sanitary landfill (a. unloading, b. waste-picking, c. compacting, soil preparation, topsoil at regular intervals, and guarantee time for waste-picking before the topsoil stage),

[1] These costs are presented in the EIA report.

along with plans for a soft component using technical support to carry out education and training activities in this project.

6) Organize the waste-pickers, create employment opportunities, improve living environment

During the Development Study, the waste-pickers were organized into ten groups with a group leader that attended weekly meetings. A total of 16 meetings were held as of 21 September 2006. During these weekly meetings, the group organization steadily progressed such as the fire brigade was formed, a mutual waste-picker fund was created, and a negotiation group to deal with recycler dealers was formed. These proceedings are important to continue in the future. Ulaanbaatar City representatives participate in the weekly meetings (twice per month), and are planning to monitor the organization of the waste-pickers group.

Also, concerning the improvement of the living environment, at the disposal site there is no toilet or sink and even in the extremely cold winters there is no indoor eating area, making for extremely poor conditions at present. Thus, the Mongolian side has requested that at the administration building at the Narangiin Enger disposal site an assembly room is constructed for the waste-pickers.

7) Confirmation corresponding to involuntary resettlement

It has been confirmed that the planned site for Narangiin Enger disposal site is currently occupied by seven people that make up two families of the waste-picker community who are living in Ger residences they have set up. This land is municipal land and was designated as a special conservation area in November 2005, so that Ulaanbaatar City has decided to take the necessary steps for the two families to relocate by the end of August 2007 to an alternative location offered to them. Also, after the current disposal site is closed and operations are moved to the new site, it will be possible for them to continue to make their living retrieving valuables as before.

Because the site for NEDS is municipal land and the residents are there illegally, Ulaanbaatar City will explain the situation so that no problems arise from the transfer.

2. Contents of the Project

2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Goal

(1) Overall Goal

The "Development Strategies for Ulaanbaatar City" contains five Strategies for Vision which are aimed to be achieved by the year 2020. Out of the five "visions", the third is the "Improvement of Living Environment and Social Life" which describes the following goals:

1. Reduction of pollution in the environment.
2. Formulation of integrated solid waste management
3. Recovery and increase of the city green belt
4. Maintenance clean water sources
5. Protective countermeasures against natural disasters
6. Reduction of poverty and generation of employment opportunities.

The procurement of waste collection vehicles to provide waste collection service for Ulaanbaatar citizens and carry out the sanitary landfill of waste at the Narangiin Enger disposal site will contribute to achieve items 1 and 2 stated above.

Furthermore, a Master Plan for Solid Waste Management in Ulaanbaatar City, targeted for the year 2020, was formulated by the Development study in 2007. One of the goals for 2010 is that 100% of the residents will be offered waste collection services and 90% of the wastes will be disposed in a sanitary landfill. Implementation of this project aims to achieve the goals set under the Master Plan of Ulaanbaatar City.

(2) Project Goal

With consideration to the aforementioned overall goal, the project goal to be established is "Solid Waste shall be properly collected, transported, and disposed in Ulaanbaatar City"

(3) Outputs of the Project

By implementing the Grant Aid project, 100% of the residents in the apartment area and 80% of the residents in the Ger area will receive collection services. Furthermore, the Ulaanbaatar City will purchase its own dump trucks and attempt to provide waste collection services to the rest of the residents in the Ger area.

Narangiin Enger Disposal Site will be constructed to replace the existing Ulaan Chuluut Disposal Site, which will be closed after reaching capacity in 2008.

Landfill equipment will be procured and sanitary landfill (level 4) at NEDS, semi-sanitary landfill (level 2) at MDDS will be executed. As a result, 95% of the waste generated in Ulaanbaatar City will undergo disposal in a sanitary manner.

Table 2.1: Criteria of sanitary landfill

Items	Level of Sanitary Landfill				Remarks
	1	2	3	4	
1 Site Development					
1.1 Main Facilities					
a. Enclosing Structures					
• Enclosing dikes		A	A	A	
• Dividers		B	A	A	B means a dike made of refuse and soil
b. Drainage System					
• Surrounding drains		A	A	A	
• On-site drains (surface water)		A	A	A	
• On-site drains (spring)		A	A	A	If necessary
• Drains for reclaimed area		A	A	A	
c. Access					
• Approach roads	A	A	A	A	
• On-site roads	A	A	A	A	
• Others	A	A	A	A	Improvement of road network to access sites
1.2 Environmental Protection Facilities					
Buffer zones		A	A	A	
Litter control facilities		B	A	A	Movable fences, etc.
Gas removal facilities		B	A	A	
Leachate collection facilities			A	A	
Leachate circulation facilities			A	A	
Seepage control facilities			B	A	
Leachate treatment facilities				A	
1.3 Building and accessories					
Site office	B	A	A	A	
Weighbridge	A	A	A	A	
Store			A	A	
Safety facilities		A	A	A	Gate, fence, lights, etc.
Fire prevention facilities		B	A	A	Water tank, extinguisher, etc.
Monitoring facilities			A	A	Monitoring well, etc.
Car washer			A	A	
2 Equipment					
Landfill Equipment	A	A	A	A	
Others			A	A	Water truck, inspection vehicles, etc.
3 Operation and Maintenance					
3.1 Operation					
a. Personnel	A	A	A	A	
b. Cover material	B	A	A	A	B means insufficient soil cover.
c. Utility					
• Fuel tank	A	A	A	A	
• Water		A	A	A	
• Electricity	B	A	A	A	
d. Chemicals					
• Insecticide	A	A	A	A	
• Monitoring chemicals			A	A	
e. Others		A	A	A	Divider, drain for reclaimed area, leachate collection pipes, etc.
3.2 Maintenance					
• Main facilities		A	A	A	
• Environmental protection facilities		A	A	A	
• Building and accessories	A	A	A	A	
• Equipment	A	A	A	A	

A: mandatory condition B: advisable condition

Overall, the project aims for the collection, transportation and final disposal of waste generated in Ulaanbaatar City will be carried out in an appropriate manner, and contribution to the improvement of the living environment.

2-1-2 Description of the Project

(1) Description of the Project

This project consists of the procurement of waste collection equipment, construction of Narangiin Enger disposal site, procurement of landfill equipment, procurement of tools and equipment for the central workshop, procurement of equipment for environmental monitoring in NEDS and technical assistance for proper solid waste management that will be implemented in order to properly collect, transport, and finally dispose waste generated in Ulaanbaatar City and contribute to the improvement of the living environment for 7 districts in Ulaanbaatar city.

The wastes targeted for this project are non hazardous wastes and are summarized as follows. The methods for dealing with hazardous wastes are explained and agreed on the Minutes of Discussion signed on 18 January 2007.

Table 2.2: Target Waste

Area	Source of Discharge	Type of Wastes
Apartment Area	Apartment	Residential Waste
	Shop, restaurant, school, office, market, hotel	Business Waste
	Road and Park	Tree branch, leaf, soil
	Construction Site	Brick, stone, cement, timber
	Factory	Non hazardous wastes
	Medical Facility	Non hazardous waste
Ger Area	Ger	Residential waste, ash

This project also contains a soft component for various forms of training, such as that for sanitary landfill methods at the new disposal site, operation and maintenance of equipment, proper operational procedures of the collection system, environmental monitoring and cooperation with waste pickers.

(2) Contents and scale of the Project

The contents of the project are construction of new disposal site, procurement of collection equipment, maintenance equipment and monitoring equipment related to disposal site operation. The table below (Table 2.3 and Table 2.4) shows the contents of the construction and procurement of major equipment.

Facility Construction

Specifications, quantities and purpose of the facility components are as follows.

Table 2.3: Contents of the Facility

	Specification	Quantity	Purpose
Narangiin Enger Disposal Site			
Land Fill Life Span: 11 years, Disposal Area : 27.8 ha			
Landfill Facility: 3,176,000m^3			
Embankment Dam	Earth dam, width: 8m, Height: 10 m	1 no.	Proper landfilling
Rain Water Drainage	V shape concrete U shape concrete Earth drain	Approx.970m Approx.880m Approx.500m	Prevention of rainwater seeping into landfill area and indication of boundary
Access road for collection trucks	Asphalt pavement	Approx.1,100 m	Access to the landfill area
Access road for heavy equipment	Gravel Pavement	Approx.1,000 m	Access to the landfill area
Environment Protection Facilities			
Leachate collection facilities	Perforated Steel Pipe with dia. 600mm Cut off Wall (Reinforce Concrete)	Approx.280m 1 place	Collection of Leachate
Leachate treatment facilities	Reinforced Concrete	1 place	Treatment of Leachate
Gas extraction facilities	Steel Pipe with crushed stone	18 places	Extraction of Methane gas
Landfill wind fence to prevent litter	Inside : H=3.0m Outside : H=1.2m	Approx.2,400 m Approx.2,200 m	Prevention of litter, such as plastic bags, due to heavy winds.
Operation and Maintenance Facilities			
Control Building	Single story, RC structure, partially Steel Frame	1 no	Administration, warm garage and social welfare for waste pickers
Weigh Bridge and Control House	RC structure	1 no	Weighing incoming wastes and control of trucks
Public Toilet	3 for male and 3 for female	1 no	Welfare facilities for workers in Disposal Site
Main Gate	Steel H=2.35 m	1 no	Control of incoming trucks and indication of boundary
Telephone Line within Site		Approx.450m	Telecommunications
Electricity within Site		Approx.650m	Power supply

Procurement of Equipment

Main Equipments to be procured under the project are as follows.

Table 2.4: Major Equipment

	Equipment Name	Purpose of Use	Quantity
Collection and Transportation of Waste	Compactor Trucks ($15m^3$)	Collection and transportation of residential wastes and business wastes in apartment area	23 no.
	Compactor Trucks ($8m^3$)	Collection and transportation of residential wastes and business wastes in apartment area	7 no.
	Dump Trucks (6t with canopy)	Collection and transportation of residential wastes in Ger area	13 no.
	Wheel Shovel with Backhoe	Collection of residential waste in remote area	1 no.
Landfill Equipment at NEDS	Bulldozer (20 ton class)	Levelling, waste compaction. Soil cover, construction of embankment dam, construction of divider.	3 no.
	Excavator ($0.6\ m^3$ of bucket)	Excavation and loading soil for soil cover, maintenance of access road, construction of embankment dam, construction of earth drain.	1 no.
	Dump Truck (10 tons)	Transportation of soil, construction of embankment dam, maintenance of access road, cleaning of illegal dump.	2 no.
	Water Truck （6kl with water gun）	Fire extinguish, transportation of clean water, watering for dust prevention, maintenance of green belt	1 no.
Landfill Equipment at MDDS	Wheel Shovel with Backhoe	Levelling and compaction of wastes, soil cover, embankment.	1 no.
Operation and Maintenance	Tire Changer	Change tires on heavy equipment	1 no.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The basic policy for the project design described below was made with consideration to Minutes of Discussion with the Mongolian side and further study in Japan.

1. Priority is given to the construction of facilities and procurement of equipment, especially those urgently required to conduct appropriate SWM by The Ulaanbaatar City.
2. Target year for this basic design is set for 2010.
3. Target area of this basic design covers 7 districts (Sukhbaatar, Chingeltei, Bayanzurkh, Songinokhairkhan, Bayangol, and Khan-Uul, Nalaikh) in Ulaanbaatar City
4. Population and waste generation forecasts in the Development study were used for this basic design study.
5. Nagiin Enger Disposal Site (NEDS) which was selected as the new disposal site by the Mongolian side and approved through necessary procedures, including a public hearing and EIA applications under Mongolian law, . NEDS was approved under the EIA by the Ministry of Nature and Environment in February 2006.
6. Sorting yard at Narangiin Enger recycling complex (NERC) to be constructed in future beside the NEDS disposal site by Government of Mongolia shall be omitted from this project, the reason being that a system for separated collection has not established.

(2) Policy for Natural Conditions

Ulaanbaatar City is located in a sandy, alluvial plain with an elevation height of 1,350m surrounded by hills and mountains with an elevation that varies between 500–700m. The temperature reaches an average of approximately -20 degrees Celsius in winter (from Dec. to Feb.), and +20 degrees Celsius in summer (from Jun. to Aug.). At times in the winter season, temperatures can drop to bitterly cold temperatures of -30 degrees Celsius. In addition, there is little rainfall; the average yearly precipitation is 225mm (average 2001-2005), and 60 to 80% of the rainfall occurs in the summer season from Jun to Aug.

1) Consideration for Cold Weather

Considering the severe weather in the winter season, equipment specifications shall need to comply with extreme cold weather conditions. However, such equipment often has a very high technology

mechanism which requires high maintenance technologies. Based on the field survey, the existing equipments specification did not comply with extreme cold weather condition however they were working without fail. Therefore, the specification of equipment will comply with cold weather conditions. Also, the design of facilities such as insulation, heating facilities and water supply facilities shall comply with Mongolian standards.

2) Consideration for High Elevation

Ulaanbaatar City is at 1,350meters elevation. In spite of thin atmosphere at Ulaanbaatar City, existing waste collection trucks and heavy equipment are operating under normal specifications, and therefore, no special considerations for high elevation have been made.

3) Consideration for Coal Ash

A large amount of ash was discharged during the winter season from the Ger area because there is no hot water supply and they are using a coal stove for heating. This ash is ultimately transported to the landfill site. The particle size of this ash is very small and causes engine trouble in landfill equipment. Therefore, proper intake filters shall be installed in order to avoid damages.

Waste collection for the Ger area shall use a dump truck with an canopy for body due to concern that ash can damage mechanical parts of the compactor truck should it be used for collection.

4) Consideration for Strong Winds in Spring

There is a strong North-West wind during spring seasons in Ulaanbaatar City and NEDS is also located north-west of the city centre. As a lot of plastic and paper is contained in the waste, those materials are easily scattered by strong winds due to their light weight. Therefore mitigation measures will be taken such as installing a fence to prevent litter from being scattered, as well as constructing the green belt, both of which are recommended by the EIA.

5) Consideration for the Earthquake

Ulaanbaatar City is located in an earthquake-prone zone with previous seismic activity reaching 4 on the Japanese seven-stage seismic scale. Therefore, the design load will take into consideration earthquake force equivalent to 4 on the Japanese scale, which is 7 on the Mongolian scale.

(3) Policy for Social and Environment Conditions

1) Consideration for Waste Pickers

There are around 300 waste pickers living at Ulaan Chuluut Disposal Site (UCDS), located beside the Narangiin Enger disposal site (NEDS), who salvage valuables and sell them as their livelihood.

UCDS will be full and subsequently closed in 2008, so the waste pickers are expected to shift to NEDS to continue their activities. The sanitary landfilling operation will be conducted at NEDS with the operation of landfill heavy equipment. The waste picking at NEDS needs to be restricted in order to avoid accidents between waste pickers and heavy equipment.

Once a manual sorting yard in NERC is constructed by the Mongolian side, separated wastes which contain more valuable material will be transported to the sorting yard in the NERC. Waste pickers can work under significantly improved working conditions and safety conditions at the sorting yard instead of the landfill site.

It is feasible that when NEDS is constructed, waste pickers will enter the landfill site to try and collect valuables as they did at UCDS. In such cases, a new operation method must be applied in which collaboration will take place concerning waste picking activities and sanitary landfill operations. In order to implement the above operation method (unloading, waste picking, and landfilling activities are given a timed schedule), it is necessary to pursue further capacity development for the landfill operation staff which will help avoid people working in close proximity to heavy equipment, such as administration and supervision of the waste dumping area, control of waste picker activities, control of waste collection trucks, directing the landfill equipment within the site.

2) Consideration for Environment

According to the approved EIA, the Ulaanbaatar City shall conduct environmental monitoring during the landfill operation at NEDS for the quality of leachate, gas from the gas extraction pipes, air quality, soil quality and water quality of the monitoring well. Furthermore the development study recommended monitoring water quality of downstream rivers, noise, ground settlement, odor, spontaneous combustion and established a watchdog committee of disposal sites, consisting of Ulaanbaatar city, NGOs, citizens.

Monitoring Plan by Mongolian side

Ulaanbaatar City will conduct the following environmental monitoring and secure the required budget and staff.

Table 2.5: Environmental monitoring plan recommended by EIA

Target objects	Monitoring items
1. Air pollution	Measure gas concentration generated by landfill activities of NH_3, CO_2, CH_4 and SO_2
2. Soil pollution	Joint Order by Ministry of Nature and Environment and Ministry of Health. （# 68/A/61, June 22, 1989, Appendix 5, Ministry of Nature and Environment and Ministry of Health
3. Grand water pollution	Drinking water standard （Mongolian Standard UST 0900-92）
4. Surface water pollution	Electrical conductivity, Chlorine iron concentration and pH
5. Sound	Sound
6. Odor	Human feeling
7. Land subsidence	Settlement of surface of landfill

Monitoring plan, organization and cost

The above monitoring plan is arranged in a table separating those items based on EIA recommendations and those of Development study recommendations. The EIA recommendations obligate yearly monitoring and calls for analysis by external experts, which could incur high costs. The other recommendation calls for the use of portable equipment by a landfill supervisor to frequently carry out measurements. It will be possible to quickly detect the generation of poisonous gas or leaking of leachate, and furthermore does not require an extensive budget.

Table 2.6: Environmental Monitoring Plan

Item	Environmental Monitoring prescribed in EIA report			Environmental Monitoring recommended by the Development study		
	Monitoring Item	Frequency	Annual cost[2] x1000MNT	Monitoring Item	Frequency	Annual Cost x1000MNT
1. Air	NH3, CO2, CH4, SO2	4 times a year	400	CH_4, CO_2, H_2O, Gas Temperature	Once a week	0
2. Soil	Joint Order by Ministry of Nature and Environment and Ministry of Health. (# 68/A/61, June 22, 1989, Appendix 5, Ministry of Nature and Environment and Ministry of Health	2 times a year	450	N/A	-	0
3. Ground Water	Drinking water standard (Mongolian Standard UST 0900-92)	2 times a year	2,300	Electric conductivity, Cl^-, pH、water temperature	Once a week (except in winter)	0
4. Surface Water	N/A	-	-	Electric Conductivity, Cl^-, pH、water temperature	Once a week (except winter)	0
5. Noise	N/A	-	-	Noise level	Once a year	10

[2] Costs were presented in the EIA report

Item	Environmental Monitoring prescribed in EIA report			Environmental Monitoring recommended by the Development study		
	Monitoring Item	Frequency	Annual cost[2] x1000MNT	Monitoring Item	Frequency	Annual Cost x1000MNT
6. Odor	N/A	-	-	Personal response	Once a year	0
7. Land subsidence	N/A	-	-	Settlement of landfill site	Once a year	20
Total			3,150			30

(4) Policy for Construction and Procurement Conditions, and Business Customs

All of the civil and building works in Mongolia are designed and constructed in accordance with the Mongolian standards, which were applied from former Soviet standards. All of the facility constructions follow Mongolian standards. In this project, the civil and building works are designed and constructed based on the Mongolian standards. The major standards and regulations of design and construction in Mongolia are as shown in the following table:

Table 2.7: The Major Standard and Regulation of Design and Construction

	BNbd Code	Standard and Regulation
1	BNbd 3.03.02.90	Structure of Reinforced Concrete Building
2	BNbd 3.02.01.90	Foundation Structure of Building
3	BNbd 3.0'5.03.95	Pipeline System of Heating Supply
4	BNbd 21.01.02	Standard of Fire Presentation
5	BNbd 12.01.03	Organization of Building process
6	BNbd 11.03.02	Regulation of Facility Construction in Mongolia conducted by a Foreign Company
7	BNbd 41.01.02	Standard of Heating Supply and Air Conditioning
8	UBB 12.01:01	Regulation Regarding Construction Client
9	BNbd 3,1.02.03	Standard of Roofing
10	BNbd 31.0'4.03	Standard of the Construction for the Office
11	BNbd 11.01.98	Regulation of Format of Design Drawings & Inspection
12	BNbd 11.06.03	Regulation of Contractor
13	BNbd30.01.04	Standard and Regulation of Urban Plan
14	UBB 30.201.03	Regulation of Construction Planning at Urban Area
15		Regulation of Construction supervision

The building and construction materials that can be supplied in Mongolia are used in this project. The sand, crushed stone, reinforced bar, cement and so on are manufactured in Mongolia and can be supplied sufficiently. In addition, those materials not made in Mongolia but imported from Russia or China are easily available in Ulaanbaatar city. Those materials may be considered as Mongolian-made materials and used for this project.

There are many civil works and building construction projects undertaken these days; therefore common and skilled laborers are available in Ulaanbaatar city. The majority of these workers are Mongolian, with virtually no foreign laborers such as those from China, etc.

(5) Policy of Utilization of Local Contractor

Recently, there are a number of consultants and contractors in Ulaanbaatar city which have experience with construction of building and civil works projects. Some of them have even engaged previously in Japanese Grand Aid projects. Those consultancies and contractors possess competent civil engineers and architects; however most of the staff cannot communicate in English. Therefore, an interpreter who is familiar with the technical terms of civil engineering and architecture must be employed in order to facilitate communication.

(6) Policy for Operation and Maintenance

All of the procured equipment and facilities to be constructed will be operated and maintained by the City Maintenance and Public Utility Agency (CMPUA). At this moment, a company, Nuuts Co, operates disposal sites and handles equipment maintenance under Ulaanbaatar City. This company will be merged under CMPUA administration in the near future. Nuuts Co. has basic knowledge of operating heavy equipment from technical and financial aspects. However, the amount of equipment will increase, and therefore further capacity development and strengthening of the organisation will be required when they start sanitary landfill operations at NEDS.

Equipment procured by this Grant Aid Scheme will be maintained by CMPUA directly, and in addition the CMPUA will prepare the Central Workshop and warm garage, for which they intend to control the entire system. Strengthening of CMPUA shall be required using equipment such as that which was procured through grassroots grant aid scheme for recycling. Planning the distribution of collection equipment, regular maintenance and repair will be carried out through the technical assistance scheme, such as under the soft component.

(7) Policies for Facility/Equipment

1) Facilities

Policy for Leachate Treatment

Leachate generated from landfilled waste at the disposal site shall be collected so as not to allow seepage to underground water or outside of NEDS. This leachate shall be collected at the Leachate Treatment Pond and will be pumped up to the landfill site for recirculation. Due to the climate conditions and quality of wastes in Ulaanbaatar, the amount of leachate to be recalculated will be expected to be very little and chances of pump up leachate to disposal site will be extremely low. Therefore, the pump shall be a movable type and not be a permanent one. The movable pump shall be procured and kept by the Mongolian side.

Policy for Waste Water from NEDS

This design policy states that any leachate from waste, treated human waste and domestic waste water is not to be discharged from NEDS. A sewerage tank for human waste and domestic effluents will be provided, and this waste water will be collected with a vacuum truck and transported to a designated discharge point provided by the waste water treatment plant in Ulaanbaatar City.

Policy for Water Supply

During the field survey, a test well was made near NEDS and a drawdown test was carried out in order to secure the necessary quantities of water for NEDC operation. Test results showed that the amount of water available is only approximately 20 litters per hour, and is not sufficient for the required amount of water volume at NEDS (approx. 6,000 litters per day). Considerations were given to installing a water supply pipe, however, this would place an unreasonable investment burden on the Ulaanbaatar City considering cost effectiveness, so it was decided that water will be supplied once or twice in a day from water kiosk by a water tanker which has a 6,000 litters capacity.

Policy for Design of Building Foundation

Temperatures in winter have dropped as far as -40 degrees Celsius at times and it is said that around 3 meters into the ground will be frozen during the winter season. Therefore attention will be paid to the design of facility foundation in order to avoid any negative effects from frozen soil.

Policy for Building Service Facilities for Control Building

The staff will work comfortably in the severe winter conditions and to provide enough warm air to the warm garage the heating facilities are provided according to Mongolian standards. A heating system will be provided for relevant rooms using warm water from the boiler room with a capacity of $30m^3$.

When vehicles and equipment are started in the warm garage, the door will be closed to prevent warm air from escaping outside. In such situations, the exhaust gas from vehicles and equipment are toxic to humans and therefore a ventilation system will be provided in the warm garage in order to release the exhaust from vehicles to the outside.

Structural Design of Control Building

There has been no large scale damage due to earthquakes thus far in Ulaanbaatar City, however the control building will be designed taking into consideration the earthquake load based on the Mongolian standard. Considerations will also be taken into account for wind load due to the frequency of strong winter winds.

Ceiling Height of Control Building

The ceiling height of the administration office and waste picker welfare room is 3m as standard. The warm garage will be a structural steel frame used daily to service equipment estimated at approximately 4.0m, so that the warm garage will be built to 4.5m from the floor level.

2) Equipment

Appropriate Planning considering Future Demand

The number of collection trucks is calculated based on the collection rate of 100% in the apartment area and 80% in Ger area and disposal site operation in 2010. The number of collection trucks necessary for this operation are not provided only by this project, but is added to existing trucks as well as trucks which will be purchased by the Ulaanbaatar City itself in collaboration to achieve this target.

Appropriate Equipment Planning considering O&M Capacity of Ulaanbaatar City

The number and type of equipment shall be designed based on the O&M capacity and budget of the Ulaanbaatar City.

Equipment Planning considering Local Weather Conditions

The temperature of the project site in Ulaanbaatar city will reach -20 to -30 degrees Celsius in the winter season (January, February). Considering these weather conditions, specifications call for compliance with extreme cold conditions, which requires high technology maintenance. However, results from the field survey reveal that the existing equipment is operational and without any major problems, yet does not comply with extreme cold conditions. Therefore, equipment specifications shall be in compliance with cold weather conditions.

Equipment with Appropriate Maintenance Levels

The technical ability of local staff for the operation and maintenance of equipment is appropriate according to the site investigation carried out during the Basic Design Study and Development Study. However, existing equipment is made up of rather old models from Russia and China, and operators and mechanics are accustomed to these old equipment models. Therefore, equipment that utilizes electronic devices will be eliminated from the proposal as much as possible so that operation and maintenance are easily carried out by the existing operators and mechanics.

Equipment with Spare Parts Supply

When equipment is selected, the availability of spare parts in Ulaanbaatar City will be taken into

consideration.

Number of Collection Trucks

In principle, the plan for the number of collection trucks by replacing current dump trucks with compactor trucks will improve the efficiency of the collection rate in the apartment area. Dump trucks currently owned and useable by Ulaanbaatar City will also be accounted for use in this project. Any further shortage of trucks will be covered by the procurement of new trucks by Ulaanbaatar City itself. Thus, both countries will collaborate to achieve this goal.

(8) Policy of Method and Schedule of Construction/Procurement

1) Policy of Method and Schedule of Construction

Since the civil and building work planned in this project does not require special construction methods, a policy is taken that common construction methods of the locale will be adopted.

The construction schedule of civil and building work will be carried out according to a prepared schedule. The procurement of material and arrangements with related organizations to commence construction are executed during the preparation period from January to March. All civil and building work, such as earth-moving, preparing the foundation and the external wall, are executed from April to October in consideration of otherwise ground freezing conditions. Any construction work which is not restricted by environmental factors may be continued until December.

2) Policy of Procurement Method and Schedule

Manufacturing period of equipment

Although most of equipments to be procured in this project are ready-made goods, some are planned as order-made goods. It is assumed that it takes approximately one month to complete manufacturing of ready-made goods upon placing the order, while order-made goods can take approximately five to six months.

Transportation Period and Timing of Delivery

The procured equipment is loaded on a ship at main ports in Japan and transported to the Tianjin port by cargo liner. It is reloaded at Tianjin port to rail transportation headed for Ulaanbaatar station. The period of transportation of sea freight requires two to three weeks, while rail requires three to four weeks. Hence, it is assumed that the total required period of transportation is approximately six weeks.

Assessment of Procurement Schedule

It is assumed that it takes approximately four months to complete manufacturing equipment upon placing an order, and another four months to transport by sea and land, and inspect the equipment. The total period of procurement of equipment requires approximately eight months.

2-2-2 Basic Plan

(1) Overall Plan

Application of the Japan's Grant Aid was submitted by the Mongolian Government in May 2005. At that time, the development study had begun in December 2004 and had just completed the survey of winter conditions and the quantities of disposal of construction waste related to economic activities in summer. Therefore there was no reliable data regarding the amount and quality of solid wastes in Ulaanbaatar City. The basic design was carried out from September 2006 based on the latest data[3] of solid waste amount. Finally, some differences arose between the original application and this basic design. The details of difference are shown in Table 2.8.

Table 2.8: Comparison of Equipment and Facilities

Item		Quantity		Reason of change
		Application	Basic Design	
A	Equipment for Landfilling			
	For NEDS			
	1. Bulldozer (21t class)	2 no.	3 no.	I
	2. Excavator (0.7m^3)	1 no.	1 no.	
	3. Dump truck (10 ton class)	3 no.	2 no.	II
	4. Water tanker (6000Liter)	1 no.	1 no.	
	5. Pickup Truck	1 no.	−	III
	For NDS and MDDS			
	6. Bulldozer(13 ton class)	1 no.	−	IV
	7. Wheel loader	1 no.	−	IV
	For MDDS			
	8. Wheel loader	1 no.	−	IV
	9. Wheel loader with back hoe	−	1 no.	
B	Equipment for Collection			
	Compactor (15m^3)	14 no.	23 no.	V
	Compactor (8m^3)	6 no.	7 no.	V
	Dump Truck with canopy (6 t)	13 no.	13 no.	V
	Skip Loader	2 no.	−	VI
	Container	40 no.	−	VI
	Truck (2t)	2 no.	−	VII
	Wheel loader with back hoe	−	1 no.	VIII
C	Equipment and tools for central W/S	1 Ls	1 Ls	

[3] The study on solid waste management for the Ulaanbaatar City in Mongolia implemented from Nov. 2004 to Mar. 2007

Item		Quantity		Reason of change
		Application	Basic Design	
D	Equipment for Environmental Monitoring			
	Portable Gas Analyzer (CH_4,H_2S,CO)	–	2 no.	IV
E	Facilities			
	Construction of NEDS	1 Ls	1 Ls	X
	Construction of Sorting Yard	1 Ls	–	

The background and reason for each of the changes outlined above are detailed below according to the number given in the right-hand column of the table.

I: The generation of waste, as well as waste collection volume and waste disposed volume are completely different in the summer and winter season in Ulaanbaatar City. Also, the study was able to identify different characteristics of waste quality, whereas a large amount of coal ash is generated in the winter season from the Ger area, and in the summer season a large amount of construction waste is generated. The site survey on the Development Study started from December 2004, the winter season study of waste volume and waste quality was executed in January 2005, with a similar study for summer season carried out in July 2005. Also, in order to comprehend the amount of waste brought into the disposal site, a pilot project was carried out at the existing disposal site, installing a weigh bridge (a scale which measures the weight of the trucks) with which the waste volume could be at last be accurately measured from December 2005. Meanwhile, when submitted for the application of Japan's Grant Aid, there were not available to obtain of the reliable data for amount of waste and generation. The total amount of waste data was collected by the Basic Design Study based on the figures recorded in the truck scale data. The basic Design Study was carried out based on the latest data.

II: Dump trucks for the disposal site will use mainly for transportation of the covering soil. The required number of trucks are reduced by the changing borrow pit location.

III: A pick-up truck is required to conduct facility maintenance inspections, monitor for illegal dumping in the vicinity of the disposal site, and so on. However, the versatility of this vehicle translates into likelihood that it will be used for other purposes. Therefore procurement of the pick-up truck is omitted from this project, its purchase by Mongolia side themselves.

IV: There are three small scale disposal sites in Ulaanbaatar City, in addition to UCDS where over 90% of the waste is disposed. At beginning of the Basic Design Study, one small bulldozer and two wheel loaders are planning to procure for them. However, based on the results of incoming waste quantities in each disposal site, one wheel loader with backhoe unit is sufficient to operate for each disposal site.

V: The number of compacter trucks, which will collect the waste, was calculated from analysis of the latest data from the Development Study based on figures for waste volume and quality in winter (January 2005), the waste volume and quality for summer (July 2006) and the data from the weigh bridge installed at UCDS. Furthermore, the number of dump trucks to be used primarily for collection in the Ger Area was calculated using the same methods. The grand total is calculated by subtracting those existing vehicles that are still operable, the dump truck that is currently used in the apartment area which will be transferred to the Ger area, as well as the vehicles to be supplied by Ulaanbaatar City itself.

VI: Concerning the skip loader and containers are omitted from this project. Reason is the temperature in winter will reached -20 degree Celsius, it can cause waste to freeze in the container therefore the advantage of skip loader is not fully utilized.

VII: This item was omitted from the application because the Mongolian side is able to procure the truck (2t) themselves.

VIII: It is necessary to collect waste from remote areas or areas which are difficult to access.

IV: The Ministry of Nature and Environment approved the EIA report in February 2006 which recommended for the implementation of environmental monitoring. The monitoring will be carried out by the disposal site staff. The Mongolian side will procure the instruments to test the water quality, however, the instruments for gas analysis is not difficult to procure by Mongolia side, therefore the instruments will be procured in this project.

X: Sorting yard activity is introducing from separated waste collection, however separate collection is uncertain at present moment. Therefore proposed sorting facility is omitted from this project.

(2) Facility Plan

1) Policy of Sealing at the Disposal Site

As the result of three borehole tests at the proposed disposal site, the stratum of the investigation area is constituted of the topsoil, sand with gravel (gravel mixed with clay), weathered rock and sandstone (alternation of sandstone and mudstone strata). Furthermore, as the result of the LUGEON test at the base rock, the permeability coefficient of the base rock is clarified as 0.00cm/sec. Therefore, the sandstone layer, which is the base rock of the landfill site area, sufficiently functions as an impermeable layer, and consequently there is no need to install any artificial layer at the proposed disposal site.

2) Contents of Facility Planning

Facilities planned for this project consist of a facility for the disposal site, an environmental protection facility and operation & maintenance facility.

Facility for Disposal Site

- Embankment
- Rainwater Drainage
- Road for common vehicles and waste collection vehicles
- Road for heavy equipment

Environmental Protection Facility

- Leachate collection facility
- Leachate treatment facility
- Gas removal facility
- Wind fence for prevention of waste scattering
- Buffer zone (Mongolian side obligation)
- Monitoring well (the test well drilled for the basic design study is utilized)

Operation & Maintenance Facility

- Disposal Site Administration Office
- Weight Bridge & Control House
- Public toilet for waste pickers
- Main gate
- Utility pole and electric wire

3) Detail of Facility Planning

The details of each facility are described as follows:

1. Total area of disposal site:
   Approximately 27.8ha (the total area is divided in ten phase, this project is covered first phase it is approximately 3ha)
2. Landlord :Ulaanbaatar City
3. Embankment :filling with compacted soil

Construction of the Embankment

The embankment is installed in the lowest point of the disposal site. The purpose of this facility is to prevent waste from scattering and to easily relocate and compact the discharged waste. The

embankment is constructed by first stripping approximately 3m of surface layer to expose the weathered rock layer, and using excavated soil from the disposal site, compacting it layer-by-layer, to fill. The height of the finished embankment is approximately 10m above ground elevation, with berm shelves provided every 5m in height.

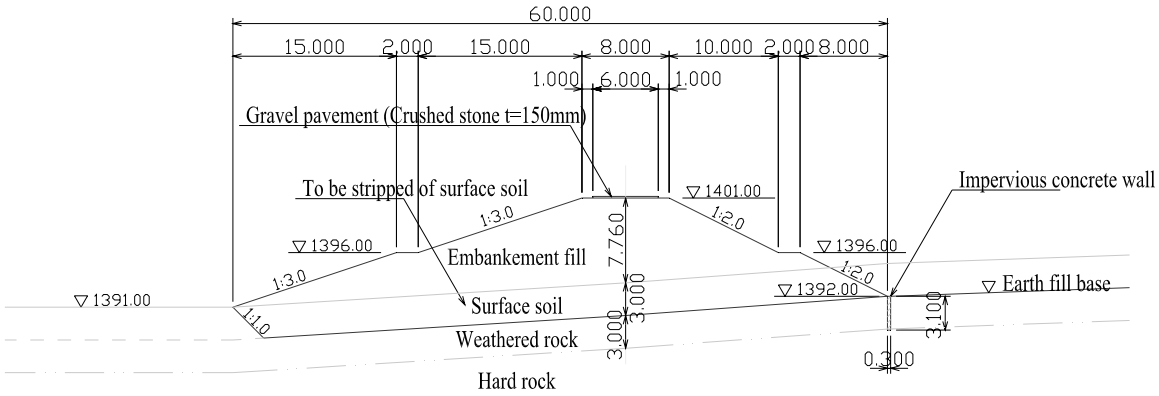


Figure 2-1: Cross Section of Embankment

Rainwater drainage: U shape & V shape concrete drainage

The rainwater drainage is installed along the disposal site. There are two purposes of rainwater drainage; firstly to divert rainwater which flows from the catchments area to the disposal site in order to decrease the amount of leachate generated by discharged waste. Secondly, the installation of the rainwater drainage will clarify the boundary of the disposal site.

The structure of the rainwater drainage is basically designed as a concrete "U" shape, with a "V" shape drainage design for the steep slope of the north side of the embankment and along the recycling complex candidate site.

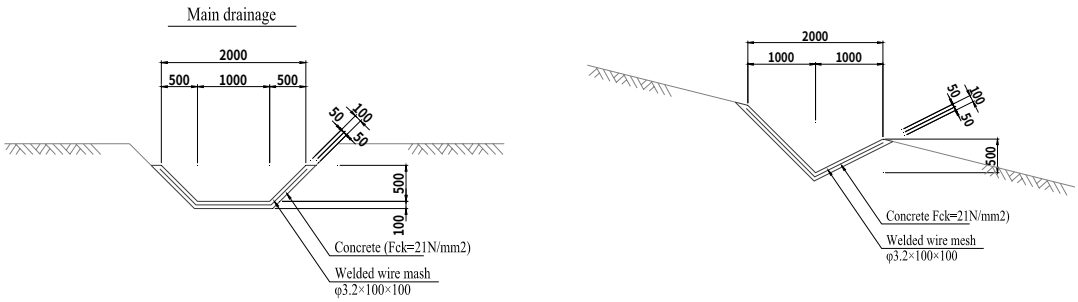


Figure 2-2: Structure of Concrete U- and V-Shape Drainage

Road for common vehicles and waste collection vehicles

The road for common vehicles and waste collection vehicles is constructed from the main gate of the disposal site to the dumping site and disposal site administration office. The purpose of the road

is that waste collection vehicles can easily access the dumping site, and the water tanker, exhauster and administration vehicles can access the disposal administration office. Asphalt pavement is used on the road in order to avoid deterioration due to the frequency of vehicles passing and weather in the winter. Along the road, "V" shape drainage is used in order to divert rainwater.

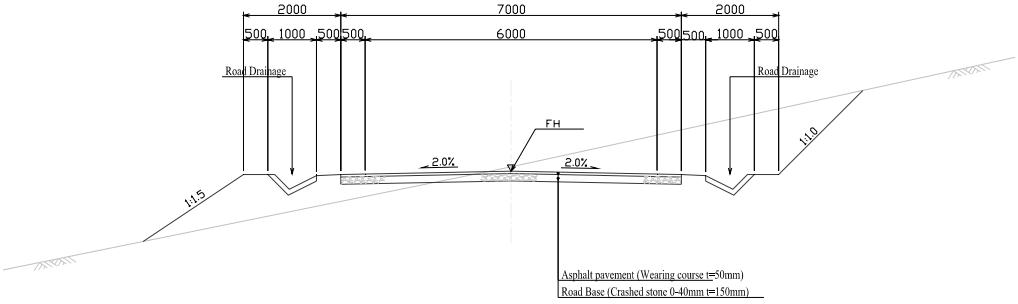


Figure 2-3: Cross Section of Road for Common Vehicles and Waste Collection Vehicles

Road for heavy equipment

The road for heavy equipment is constructed from the dumping site to the disposal administration office. The road allows the bulldozer and excavator parked at the disposal administration office to gain easy access to the dumping site. The heavy equipment is able to traverse poor road conditions, however the track of crawler vehicles will cause damage to asphalt pavement. Therefore the road for heavy equipment will be paved with gravel.

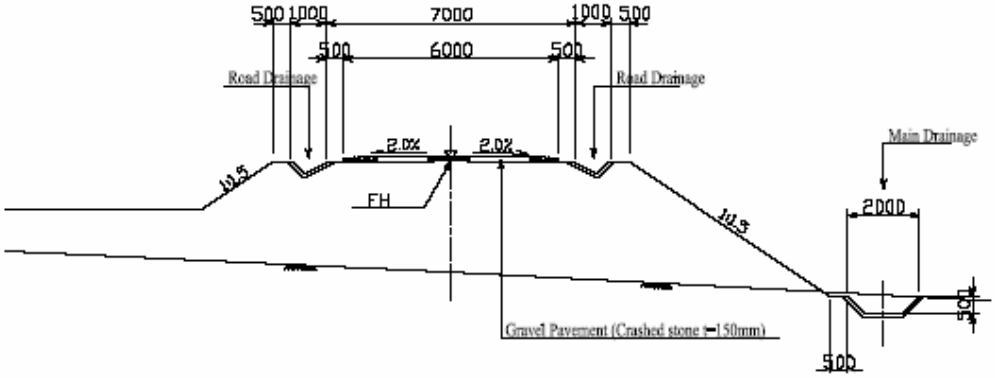


Figure 2-4: Cross Section of Road for Heavy Equipment

Leachate Collection Facility: Perforated pipe, Impervious wall (Reinforced concrete)

The leachate collection facility consists of four parts: 1) a natural impermeable layer of sand rock which is lies at the bottom of disposal site, 2) newly installed perforated leachate collection pipe, 3) impervious wall constructed at the upstream side of the embankment, and 4) a leachate collection pipe at the bottom of the embankment. In accordance with results of the geological survey conducted in

this study, the layer at the landfill site is constituted of topsoil approximately 3 meters thick, weathered rock approximately 3 meters thick and impermeable rock with an impermeability coefficient of "0" and which is also approximately more than 3 meters thick. Hence, the impermeable rock located approximately 6 meters below ground level is adopted as the impermeable layer.

The purpose of the perforated pipe is to smoothly transfer the leachate collected from the top of the impervious rock layer to the leachate treatment facility. The area surrounding the perforated pipe is surrounded with gravel in order to prevent becoming blockage. The purpose of impervious wall is to collect and transport leachate, which flows on the impermeable layer at the disposal site except for leachate flowing through perforated pipe, to the leachate treatment facility. The perforated pipe is made of steel, 600mm in diameter, and the impervious wall is made of reinforced concrete. The pipe installed on the downstream side of the impervious wall and below the embankment is not perforated, but covered by reinforced concrete in order to prevent the leachate from leaking from the collection pipe.

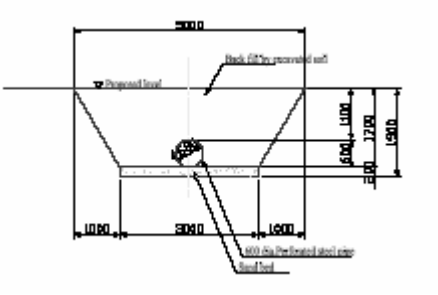


Figure 2-5: Typical Cross Section of Leachate Collection Pipe on the Disposal Area

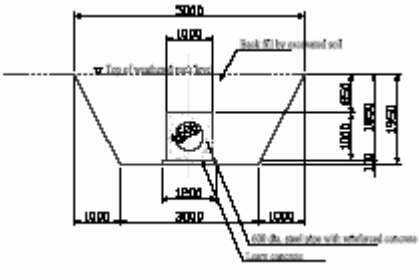


Figure 2-6: Typical Cross Section of Leachate Collection Pipe below the Embankment

Leachate Treatment Facility, Pumping for Recirculation of Leachate: 1unit

The treatment facility of leachate is constructed downstream of the impervious wall. The purpose of this facility is to keep the leachate in reserve for a given length of time and to then pump up the leachate to the disposal site for recirculation treatment. The structure of leachate treatment facility is made of reinforced concrete. The circulation pump is available in the Mongolian market and therefore the circulation pump will be procured by the Mongolian side.

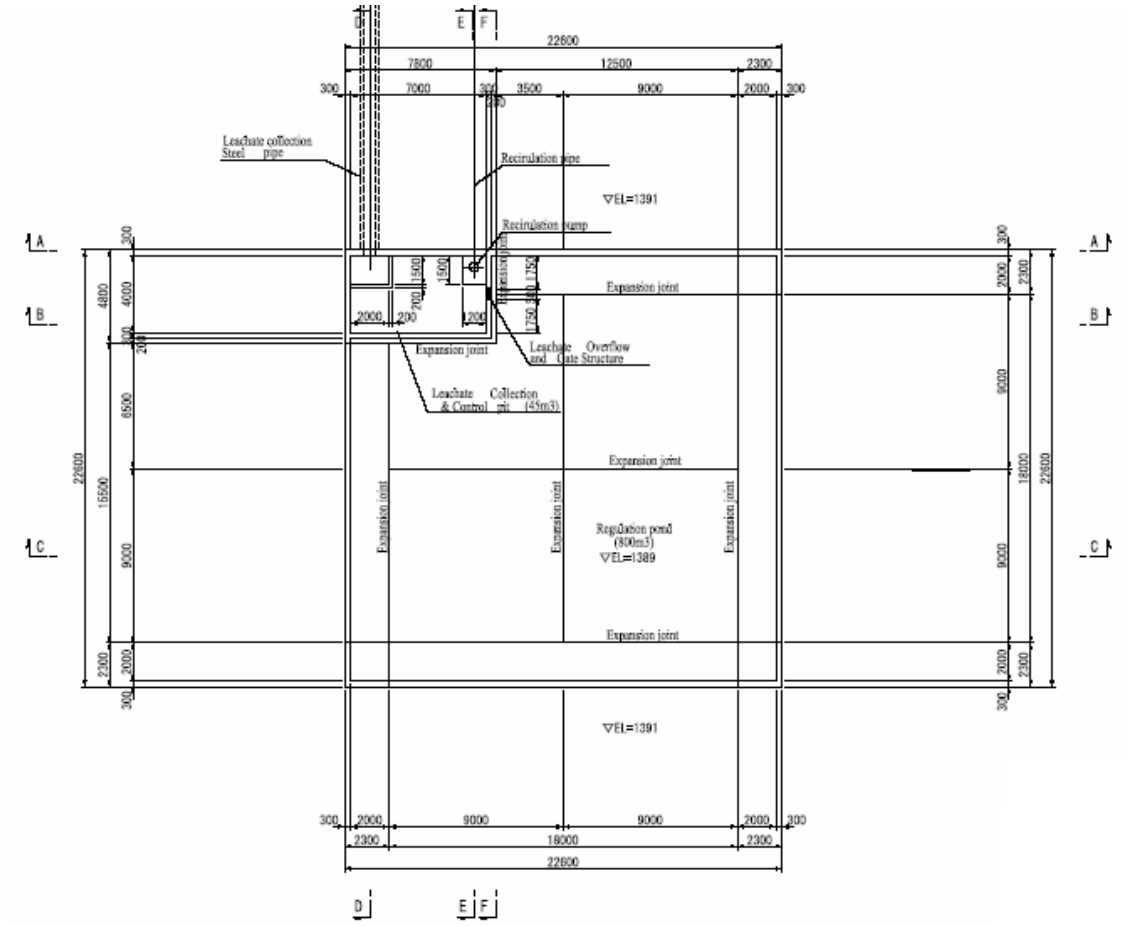


Figure 2-7: Plan of Leachate Treatment Facility

Figure 2-8: Cross Section of Leachate Treatment Facility

Gas Removal Facility

A gas removal facility is installed at the disposal area. This facility serves to smoothly discharge methane gas generated from the waste into the ambient air. The structure of the gas removal facility consists of steel perforated pipe surrounded by rubble stone.

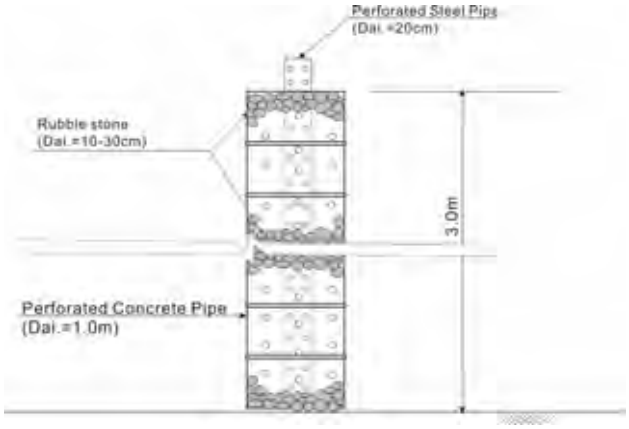
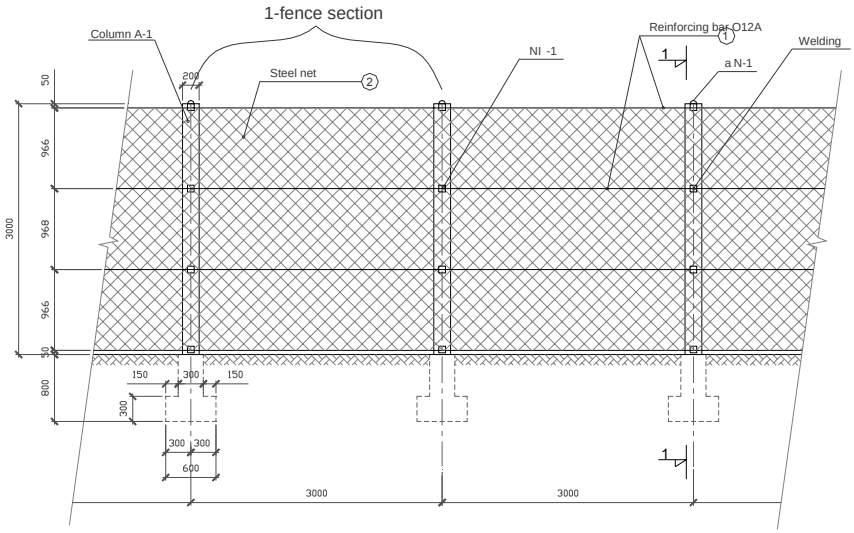


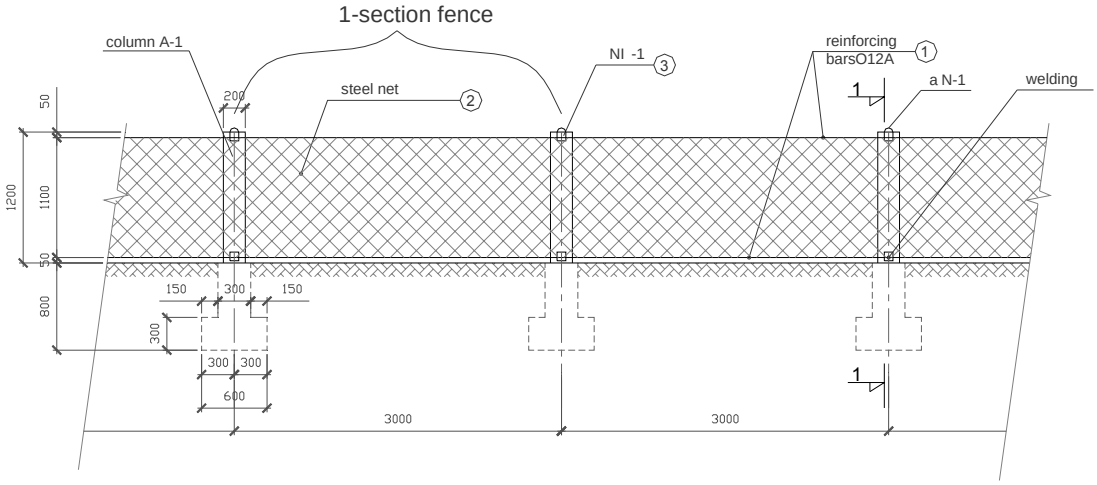
Figure 2-9: Cross Section of Gas Removal Facility

Wind Fence for Prevention of Waste Scattering

A wind fence to prevent waste from scattering is installed on the boundary of the disposal site. The purpose of this facility is to prevent waste being littered outside of disposal site due to strong winds. Furthermore, it functions as a prevention measure to keep livestock, such as wild dogs, goats, cows and sheep, from entering of disposal site. The structure of the wind fence consists of concrete columns and steel net.



Scattering Privation Fence (Internal side)



Protection Fence (External side)

Figure 2-10: Structure of Fence for Prevention of Waste Scattering

Buffer Zone (Mongolian side obligation)

A zone planted with trees is constructed as a buffer zone on the outside of the scattering privation fence as a measure against scattered waste, to preserve environmental aspects, and control the proliferation of odours and pests. The organization responsible for constructing the buffer zone will be carried out by the Mongolian side.

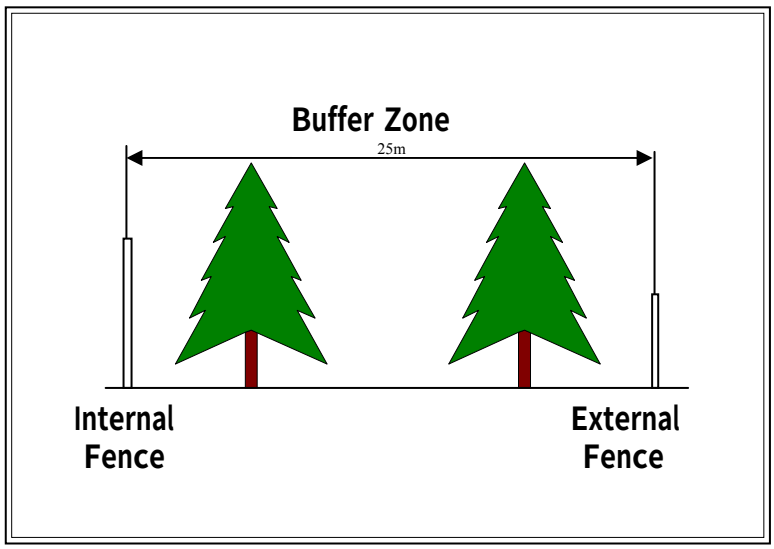


Figure 2-11: Cross Section of Buffer Zone

Disposal Site Administration Office

The administration office is at the center of the disposal site in order to organize the operation of the site and planned recycling complex. The function of this facility is mainly operation & maintenance,

including the warm garage for heavy equipment and vehicles, a social welfare area for waste pickers and a boiler room. The structure of the disposal site administration office is a single story building of reinforced concrete (partially steel structure), and footing foundation.

Weight Bridge and Weight Bridge Control House: 1 place and 1unit

A weight bridge and its control house are constructed near the main gate in the disposal site. The purpose of these facilities is to weigh the waste collected and transported to the disposal site, and to obtain the basic data for the proper operation of the disposal site. The structure of the weight bridge is at ground level, which can be maintained easily, and a weighing capacity of 40 tons. Meanwhile, the control house is made by reinforced concrete, and is a one-story building.

Public Toilet for Waste Pickers: 1 unit (3 stalls for each men and women)

A public toilet for waste pickers is on the east side of the road for heavy equipment. The purpose of this facility is to provide toilet facilities to approximately 300 waste pickers who work at the disposal site. The structure of the toilet is a reinforced concrete, one-story building.

Main Gate

The main gate is installed at the entrance on the road for common and collection vehicles. It serves as a control measure for all incoming and outgoing vehicles and personnel and prevents illegal dumping in the night. The main gate is a manually operated, made by steel.

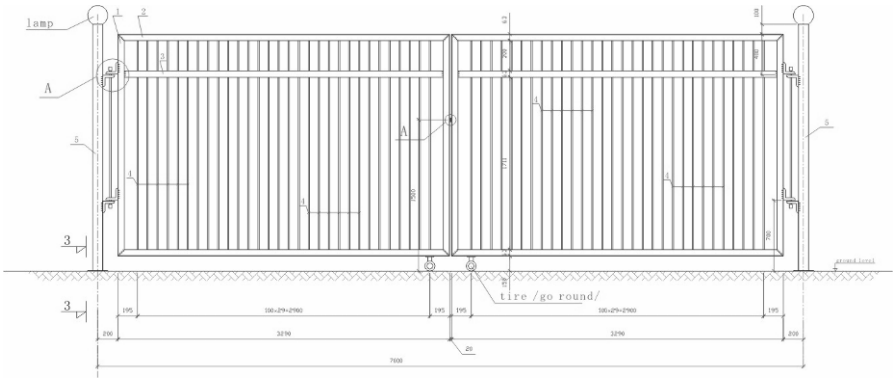


Figure 2-12: The Structure of Main Gate

4) Details of Building Planning

The details of the disposal site administration and the weight bridge control house are listed below:

Function and area of each room of disposal site administration office

The disposal site administration office consists mainly of the operation and maintenance section, the warm garage for heavy equipment and vehicles, and a social welfare area for waste pickers. The

total floor area of the office is 857m^2.

Operation and maintenance section (floor area: approximately 207m^2)

The purpose of this section, which is outlined room-by-room below, is to operate and maintain the entire disposal site.

- Office room (floor area: approximately 41m^2)

  The purpose of this room is to provide office space for the seven staff members responsible for the operation and maintenance of the entire disposal site. The seven staff members are composed of two engineers, two clerks and three disposal site supervisors.

- Section chief room (floor area: approximately 18m^2)

  The purpose of this room is to provide office space to the director of disposal site, and includes the director's workspace and an area for up to four guests.

- Meeting room (floor area: approximately 18m^2)

  The purpose of this room is for staff meetings and accommodates six persons.

- Multi-purpose room for the staff (floor area: approximately 45m^2)

  This room serves the multi-purpose as a break room and changing room for staffs. The members are made up of eight heavy equipment operators, one mechanic and two common laborers.

- Security room (floor area: approximately 10m^2)

  The security guard for the disposal site occupies this room.

- Store room (floor area approximately 17m^2)

  The purpose of this room is to store administrative documents and machine shop tools or parts for daily maintenance for the warm garage.

- Water tank room (floor area: approximately 14m^2)

  The water which is bought from the water kiosk to use for disposal site will be stored here. The water tank is installed inside the building to prevent it from freezing in the winter.

- Kitchen, toilet & corridor

The kitchen, toilet and corridor are for the operation and maintenance staffs.

Warm garage (Floor area: approximately 495m^2)

The purpose of the warm garage is to park heavy equipment and vehicles, and to keep the temperature above 0 degree Celsius in the winter in order to start the engines of heavy equipment and vehicles smoothly. The heavy equipment and vehicles parked at the warm garage are as follows:

Bulldozer:	Width approx. 4m x Length approx. 6m x Height approx. 3.5m	3 no.
Excavator:	Width approx.3m x Length approx 9m x Height approx. 3m	1 no.
Dump truck:		2 no.
Water tanker:		1 no

Social Welfare area for waste pickers

- Common room for the Waste pickers (floor area: approx. 92m^2)

  The purpose of this area is for waste pickers to take a rest. The common room accommodates a maximum of approximately 30 persons.

- Meeting room (floor area: approx. 30m^2)

  This room accommodates approximately 15 persons and is for waste pickers to assemble.

The breakdown of the area of each room of the disposal site administration office is shown in the following table.

Table 2.9: Breakdown (by Room) of Disposal Site Administration Office

Room		Position		no.	Unit	Area per unit	Requried Area (m2)	Designed Floor Area(m2)
Administration				19			**178.0**	**207.45**
	Section Chief room						**16.0**	**18.12**
		Section Chief		1	person	8.0	8.0	
		Gust space		4	person	2.0	8.0	
	Office						**35.0**	**41.87**
		Engineer		2	person	5.0	10.0	
		Clerk		2	person	5.0	10.0	
		Supervisor		3	person	5.0	15.0	
	Meeting room			6	person	3.0	**18.0**	**18.72**
	Common room for staffs						**44.0**	**45.55**
		Operator	Bulldozer	3	person	4.0	12.0	
			Excavator	1	person	4.0	4.0	
			Dump truck	2	person	4.0	8.0	
			Water tanker	1	person	4.0	4.0	
			Pick up	1	person	4.0	4.0	
		Mechanic		1	person	4.0	4.0	
		Worker		2	person	4.0	8.0	
	Store room			1	unit	15.0	15.0	17.76
	Water tank room			1	unit	12.0	12.0	14.47
	Security room			1	Unit	10.0	10.0	10.45
	Kitchen & Toilet			1	unit	12.0	12.0	14.56
	Corridor			1	unit	25.95	25.95	25.95
Warm garage				7			**480.0**	**495.58**
	BD	4mx12m		3	unit	48.0	144.0	
	EX	3mx12m		1	unit	36.0	36.0	
	DT	3mx12m		2	unit	36.0	72.0	
	WT	3mx12m		1	unit	36.0	36.0	
	Margine	2mx(6+2)span		1	Unit	192.0	192.0	
Social Welfare room							**120.0**	**122.71**
	Common room for workers			30	person	3.0	90	**92.19**
	Meeting room			15	person	2.0	30	**30.52**
Heating plant				1	Unit	30	31.47	**31.47**
							809.4	**857.21**

Exterior at Disposal Site Administration Office and Other Facilities

- Parking lot

The parking lot can be used by vehicles for operation and maintenance, waste collection vehicles, and the coal truck to transport boiler heating plant fuel. Since the parking lot is used frequently, the pavement should be made with asphalt.

- Water supply facility

As a result of the draw down test during the basic design study, the ground water at the well cannot provide a sufficient quantity of water for the disposal site administration office. Therefore, a water tanker periodically obtains the necessary amount of water at the water kiosk and provides it to the water tank at the disposal site administration office.

- Drainage facility

The waste water and grey water generated at the disposal site administration office cannot discharge outside of disposal site in accordance with the EIA. All waste water and sewage water is stored in the waste water tank constructed under the parking lot. Stored waste and sewage water is collected by a vacuum tanker periodically and it is discharged at a sewage treatment facility in the city.

- Electrical equipment (utility pole, electric wire)

Utility poles, street lamps, electric wire and other electrical equipment are installed at the site. The installation of electric wire, pole and transformer from the city to the disposal site are carried out by Mongol side. The installation of electrical equipment, street lamp, electric wire and utility poles from the transformer to the inside of the disposal site are installed in this project.

- Telephone line

The installation of a telephone line from the city to the disposal site is carried out by Mongol side, while the installation of a telephone line from the inside boundary of the disposal site is installed as part of this project.

- Lightning conductor

Since there are frequent thunderstorms expected at the disposal site, a lightning conductor is installed to avoid any damage caused by lightning at the disposal site administration office and weight bridge control house.

- Water tank for fire control

A water tank for fire control is constructed at the disposal site administration office in accordance with Mongolian fire prevention law. The tank is located under the north end of the parking lot at a depth to avoid it freezing during the cold winters.

Function and Area of Each Room of Weigh Bridge Control House

The Weight Bridge Control House consists of an administrative room (floor area: 15m^2) and heating room (6m^2). The staffs at the administrative room direct waste collection vehicles to the weigh bridge to weigh and obtain the data.

(3) Equipment Plan

1) Waste collection equipment

Target population for waste collection

The expected target population for waste collection was taken from the increasing rate of population following the “Population Projection of Mongolia: National Statistical Office of Mongolia, 2020” and using “Statistical Handbook of Ulaanbaatar 2004” as well.

Table 2.10: Population Forecast for 7 Duureg in Ulaanbaatar City

Duureg	2005	2010	2015	2020
Bayangol	160,982	205,521	254,782	306,958
Bayanzurkhl	178,809	212,120	246,811	281,332
Songinokhairkhan	185,634	200,274	211,575	218,496
Sukhbaatar	108,480	118,848	127,699	134,371
KhanUul	82,787	90,068	96,042	100,219
Chingeltei	124,640	133,058	138,898	141,499
Nalaikh	25,259	27,791	29,998	31,723
Total	866,591	987,680	1,105,805	1,214,598

Source: Development study.

Target populations in the apartment area and Ger area in 2010 are shown below:

Table 2.11: Population in Apartment and Ger Area in 2010

Duureg	Apartment Area	Ger Area	Total
Bayangol	179,361	26,160	205,521
Bayanzurkhl	151,131	60,989	212,120
Songinokhairkhan	97,549	102,725	200,274
Sukhbaatar	62,400	56,448	118,848
KhanUul	45,743	44,325	90,068
Chingeltei	61,297	71,761	133,058
Nalaikh	14,881	12,910	27,791
Total	612,362	375,318	987,680

Source: Development study.

Target waste

The following wastes are the targets of Ulaanbaatar City collection services at present for this equipment plan.

Table 2.12: Targeted Wastes

Area	Generation Source	Wastes
Apartment	Apartment	Residential waste
	Business Waste	shop, restaurant, school, office, market, hotel
	Road and Park	Tree, leaf, soil, package
	Construction Waste	Brick, stone, cement, timber
	Non-Hazardous Industrial Waste	
	Non-Hazardous Medical Waste	
Ger	Ger	Residential waste, ash

Waste Flow

To compare differences in the waste generated in summer and winter, the waste volume and content (quality) were surveyed in the development study in December 2004 and July 2005. Also, accurate data is collected since Dec 2005 employing the Weigh Bridge installed at UCDS, used to predict the waste flows for 2010 in each season, as presented below.

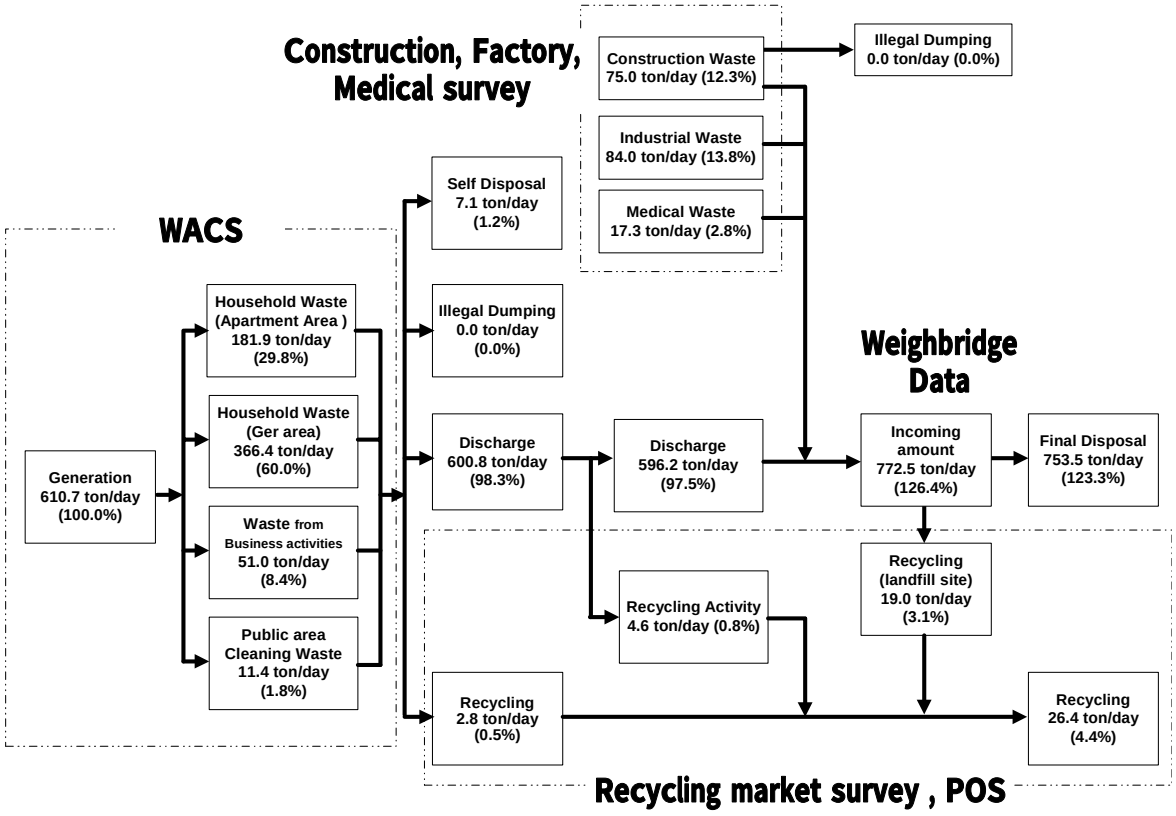


Figure 2-13: Waste Flow in 2010 in Winter

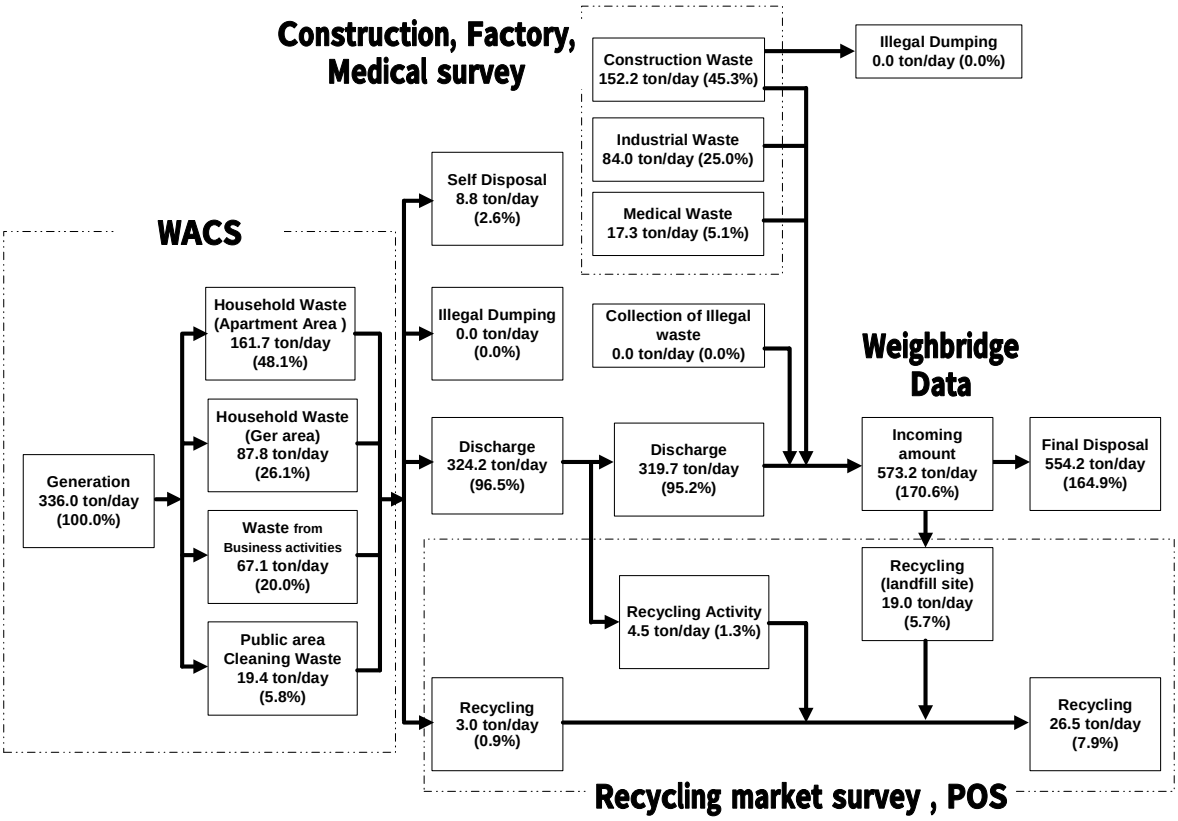


Figure 2-14: Waste Flow in 2010 in Summer

Based on the above waste flow, the collective waste amount in 2010 by area, source and season is shown in Table 2.13 below.

Table 2.13: Daily Discharge Amount by area, by source and by season in 2010 (t/day)

Area	Source	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
		Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Apartment area	18.0	16.1	17.7	15.8	43.7	38.7	28.2	25.1	51.8	46.1	13.2	11.8	4.3	3.8	176.9	157.4
	Business area	8.7	10.9	8.2	10.2	11.0	16.4	5.3	6.7	10.9	14.4	4.8	6.0	0.5	0.5	49.4	65.1
	Roads and Parks	2.7	4.5	1.8	3.1	1.8	3.1	1.3	2.0	2.3	3.9	1.4	2.4	0.2	0.4	11.5	19.4
	Construction waste	9.5	19.2	10.9	22.1	15.3	31.2	16.2	33.0	13.7	27.7	7.2	14.6	2.2	4.4	75.0	152.2
	Non-Hazardous Industrial waste	11.2	11.2	7.9	7.9	12.8	12.8	9.5	9.5	17.1	17.1	24.2	24.2	1.3	1.3	84.0	84.0
	Non-Hazardous Medical waste	2.2	2.2	2.5	2.5	3.5	3.5	3.8	3.8	3.1	3.1	1.7	1.7	0.5	0.5	17.3	17.3
	Sub-Total	52.3	64.1	49.0	61.6	88.1	105.7	64.3	80.1	98.9	112.3	52.5	60.7	9.0	10.9	414.1	495.4
Ger	General	10.4	11.8	13.2	14.8	11.2	12.7	18.9	21.3	4.8	5.4	8.1	9.3	2.4	2.7	69.0	78.0
	Ash	43.5	0.0	55.3	0.0	47.1	0.0	79.1	0.0	20.2	0.0	34.2	0.0	10.0	0.0	289.4	0.0
	Sub-Total	53.9	11.8	68.5	14.8	58.3	12.7	98.0	21.3	25.0	5.4	42.3	9.3	12.4	2.7	358.4	78.0
Total		106.2	75.9	117.5	76.4	146.4	118.4	162.3	101.4	123.9	117.7	94.8	70.0	21.4	13.6	772.5	573.4

Selection of collection equipment

At the time the collection vehicle selection, the waste quality was taken into consideration; for apartment waste, business waste and non-hazardous medical waste, a large amount is bulky, lightweight plastic and paper such that compressing the waste would improve collection efficiency using a compactor vehicle. As for other waste, a dump truck will be used for construction waste, such as concrete, brick and coal ash which is discharged in the winter season from the Ger area. Dump truck specifications call for a canopy to be installed to prevent coal ash from scattering during transportation.

Skipper truck is requested, however, a container is leaving at a designated point in the night and collecting it the following day during the winter season caused the rubbish to freeze in the container, resulting in a great deal of effort to remove it. Due to this circumstance, a container system can not fully utilise therefore the skipper truck and container are omitted from procurement equipment list.

When selecting the compactor truck used for the apartment area, the full-sized vehicle ($15m^3$) is most effective based on economic efficiency. However, this vehicle cannot access small, narrow roads in some areas. In these areas, a medium-sized vehicle ($8m^3$) is currently used for collection, and the vehicle allocation plan is classified by the capacity of the large ($15m^3$) compactor and the medium ($8m^3$) utilized together depending on the condition of the roads at that time. The vehicle allocation ratio classified by compactor vehicle capacity (quantity ratio) is shown in

Table 2.14. In addition, based on the vehicle ratio, the waste collection quantity for 2010 as classified by the vehicle used, the area, and the source of discharge is shown in Table 2.15.

Table 2.14: Utilisation of existing compactor truck based on specification

Area	Collection Equipment	Specification	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh	
			Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Compactor Truck	15㎥	63%	63%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%
		8㎥	37%	37%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%

Table 2.15: Necessary waste collection weight based on Area, Source and collection equipment in 2010

Unit: t/day

収集車両	Area	Source	Specification	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
				Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Compactor Truck	Apartment	Apartment	$15m^3$	11.3	10.1	0.0	0.0	43.7	38.7	28.2	25.1	51.8	46.1	13.2	11.8	0.0	0.0	148.2	131.8
			$8m^3$	6.7	6.0	17.7	15.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	3.8	28.7	25.6
			Sub Total	18.0	16.1	17.7	15.8	43.7	38.7	28.2	25.1	51.8	46.1	13.2	11.8	4.3	3.8	176.9	157.4
		Office	$15m^3$	5.5	6.9	0.0	0.0	11.0	16.4	5.3	6.7	10.9	14.4	4.8	6.0	0.0	0.0	37.5	50.4
			$8m^3$	3.2	4.0	8.2	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	11.9	14.7
			Sub Total	8.7	10.9	8.2	10.2	11.0	16.4	5.3	6.7	10.9	14.4	4.8	6.0	0.5	0.5	49.4	65.1
		Road, Park	$15m^3$	1.7	2.8	0.0	0.0	1.8	3.1	1.3	2.0	2.3	3.9	1.4	2.4	0.0	0.0	8.5	14.2
			$8m^3$	1.0	1.7	1.8	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	3.0	5.2
			Sub Total	2.7	4.5	1.8	3.1	1.8	3.1	1.3	2.0	2.3	3.9	1.4	2.4	0.2	0.4	11.5	19.4
		Non-Hazardous Medical waste	$15m^3$	1.4	1.4	0.0	0.0	3.5	3.5	3.8	3.8	3.1	3.1	1.7	1.7	0.0	0.0	13.5	13.5
			$8m^3$	0.8	0.8	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	3.8	3.8
			Sub Total	2.2	2.2	2.5	2.5	3.5	3.5	3.8	3.8	3.1	3.1	1.7	1.7	0.5	0.5	17.3	17.3
	Sub Total			31.6	33.7	30.2	31.6	60.0	61.7	38.6	37.6	68.1	67.5	21.1	21.9	5.5	5.2	255.1	259.2
Dump Truck	Apartment	Non-Hazardous Industrial waste	6t	11.2	11.2	7.9	7.9	12.8	12.8	9.5	9.5	17.1	17.1	24.2	24.2	1.3	1.3	84.0	84.0
		Construction Waste	6t	9.5	19.2	10.9	22.1	15.3	31.2	16.2	33.0	13.7	27.7	7.2	14.6	2.2	4.4	75.0	152.2
	Ger	General	6t	10.4	11.8	13.2	14.8	11.2	12.7	18.9	21.3	4.8	5.4	8.1	9.3	2.4	2.7	69.0	78.0
		Ash	6t	43.5	0.0	55.3	0.0	47.1	0.0	79.1	0.0	20.2	0.0	34.2	0.0	10.0	0.0	289.4	0.0
	Sub Total			74.6	42.2	87.3	44.8	86.4	56.7	123.7	63.8	55.8	50.2	73.7	48.1	15.9	8.4	517.4	314.2
Total				106.2	75.9	117.5	76.4	146.4	118.4	162.3	101.4	123.9	117.7	94.8	70.0	21.4	13.6	772.5	573.4

Necessary waste collection weight by collection equipment

The above necessary collection weight per one day for 2010 is summarised based on type of collection equipment and weight of waste in the area in Table 2.16. Under present conditions, the waste is collected 7 days/week, but after the solid waste management plan improvement, waste collection will be designated on 6 days/week. The necessary waste collection quantity classified by area when waste is collected on the 6 day/week plan is shown per day in

Table 2.17.

Table 2.16: Expected generated waste weight per day in 2010 (by collection and by area)

Unit: t/day

Area	Collection equipment	Specification	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
			Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Compactor Truck	15㎥	19.9	21.2	0.0	0.0	60.0	61.7	38.6	37.6	68.1	67.5	21.1	21.9	0.0	0.0	207.7	209.9
	Compactor Truck	8㎥	11.7	12.5	30.2	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	5.2	47.4	49.3
	Dump Truck	6t	20.7	30.4	18.8	30.0	28.1	44.0	25.7	42.5	30.8	44.8	31.4	38.8	3.5	5.7	159.0	236.2
Ger	Dump Truck	6t	53.9	11.8	68.5	14.8	58.3	12.7	98.0	21.3	25.0	5.4	42.3	9.3	12.4	2.7	358.4	78.0
Total			106.2	75.9	117.5	76.4	146.4	118.4	162.3	101.4	123.9	117.7	94.8	70.0	21.4	13.6	772.5	573.4

Table 2.17: Required waste collection weight in a day in 2010 (by collection and by area)

Unit: t/day

Area	Collection equipment	Specification	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
			Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Compactor Truck	15㎥	23.2	24.8	0.0	0.0	70.0	72.0	45.0	43.9	79.5	78.8	24.6	25.6	0.0	0.0	242.3	244.9
	Compactor Truck	8㎥	13.6	14.5	35.2	36.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	6.1	55.3	57.5
	Dump Truck	6t	24.2	35.5	21.9	35.0	32.8	51.3	30.0	49.6	35.9	52.3	36.6	45.3	4.1	6.7	185.5	275.6
Ger	Dump Truck	6t	62.9	13.8	79.9	17.3	68.0	14.8	114.3	24.9	29.2	6.3	49.4	10.9	14.5	3.2	418.1	91.0
Total			123.9	88.6	137.1	89.1	170.8	138.1	189.4	118.3	144.6	137.3	110.6	81.7	25.0	15.9	901.3	669.0

Frequency of waste collection per day in area

Collection work is managed in each Duureg, and the distance from each Duureg to the disposal site is different, it is affecting the frequency of collection per day. The development study designated the frequency of collection based on the time and the motion findings which is executed along with quantity calculations. The frequency of waste collection per day in each area is shown below.

Table 2.18: Frequency of waste collection in a day (by area and equipment)

Unit: Time/day

Area	Collection equipment	Specification	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
			Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Compactor Truck	15㎥	2	2	0	0	2	2	2	2	2	2	2	2	0	0	10.0	10.0
	Compactor Truck	8㎥	3	3	3	3	0	0	0	0	0	0	0	0	4	4	10.0	10.0
	Dump Truck	6t	2	2	2	2	2	2	2	2	2	2	2	2	2	2	14.0	14.0
Ger	Dump Truck	6t	2	2	2	2	1	1	2	2	2	2	2	2	2	2	13.0	13.0

Specific gravity at each stage

The specific gravity of waste is set as follows in the 4 stages of time of discharge, collection and transport, discharge at the disposal site, and sanitary landfilling at the disposal site in order to decide the capacity of the disposal site and the specification of collection equipment. The results of the on-site survey conducted are shown below. Stage 2 “transport” is employed for the specific gravity which pertains to collection equipment supply targets.

Table 2.19: Specific gravity of waste at each stage

Unit: t/m^3

Type of waste	Method of collection	1 discharge	2 transport	3 discharge at disposal site	4 sanitary landfilling at disposal site
Apartment waste, business waste, Non-hazardous medical waste	Compactor truck	0.11	0.45	0.40	1.00
Ger waste, Non-hazardous industrial waste, construction waste	Dump truck	0.20	0.40	0.40	1.00

Method of survey 1. Survey of waste volume and content 2. Survey of specific gravity in collection equipment 3,4 Survey of specific gravity at disposal site

Transportable waste weight by type of collection equipment

Based on the above specific gravity, transportable weight by type of collection equipment is shown as follows. 90% of maximum pay load has been adopted as efficiency of transportable weight.

Table 2.20: Transportable waste weight by collection equipment

Collection Equipment	Specification	Maximum pay load (m3)	Specific gravity in transport (t/m3)	Efficiency	Transportable weight (t)
Compactor	15㎥	15.0	0.45	90%	6.08
Compactor	8㎥	8.0	0.45	90%	3.24
Dump Truck	6t	10.0	0.40	90%	3.60

Required number of collection equipment

Taking the above required collection weight (t/day), frequency of collection (time/day) and transportable weight (t/time), the necessary number of waste collection equipment in 2010 is calculated as follows.

Table 2.21: Required number of collection equipment by area in 2010

Unit: nos.

Area	Collection equipment	Specification	Description	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
				Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Apartment	Compactor Truck	15㎥	Required waste collection (t/day)	23.2	24.8	-	-	70.0	72.0	45.0	43.9	79.5	78.8	24.6	25.6	-	-		
			Number of time for Collection	2	2	0	0	2	2	2	2	2	2	2	2	0	0		
			Transportable waste weight	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08		
			Number of required collection	**2**	**3**	**-**	**-**	**6**	**6**	**4**	**4**	**7**	**7**	**3**	**3**	**-**	**-**	**22**	**23**
		8㎥	Required waste collection (t/day)	13.6	14.5	35.2	36.9	-	-	-	-	-	-	-	-	6.4	6.1		
			Number of time for Collection	3	3	3	3	0	0	0	0	0	0	0	0	4	4		
			Transportable waste weight	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24	3.24		
			Number of required collection	**2**	**2**	**4**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**7**	**7**
	Dump Truck	6t	Required waste collection (t/day)	24.2	35.5	21.9	35.0	32.8	51.3	30.0	49.6	35.9	52.3	36.6	45.3	4.1	6.7		
			Number of time for Collection	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
			Transportable waste weight	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60		
			Number of required collection	**4**	**5**	**4**	**5**	**5**	**8**	**5**	**7**	**5**	**8**	**6**	**7**	**1**	**1**	**30**	**41**
Ger		6t	Required waste collection (t/day)	62.9	13.8	79.9	17.3	68.0	14.8	114.3	24.9	29.2	6.3	49.4	10.9	14.5	3.2		
			Number of time for Collection	2	2	2	2	1	1	2	2	2	2	2	2	2	2		
			Transportable waste weight	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60		
			Number of required collection	**9**	**2**	**12**	**3**	**19**	**5**	**16**	**4**	**5**	**1**	**7**	**2**	**3**	**1**	**71**	**18**

Existing waste collection equipment

When the details are investigated for the existing collection vehicles in each Duureg, the distance travelled by each compactor vehicle were already exceeded 200,000km excluding 1 unit in Bayangol Duureg. Also the compactor compressor mechanism is not worked sufficiently, negating their function as a compactor, so they were excluded from the list of useable equipment for 2010. In addition, 8 compactor vehicles (4t) from Kawasaki city, and 5 compactor vehicles (4t) from Kashiwa city are supplied by a grassroots grand aid, however each of them will be exceed a travel distance of 200,000km in 2010. Although Ulaanbaatar city plans to use this equipment as much as possible, the vehicles are excluded from 2010 useable quantities as they will not be durable as compactors by then. Among the dump trucks in each Duureg, 28 units were produced after 1995 and considered in a relatively good condition, thus judged operational for the 2010 year. Below are the vehicles in possession of each Duureg which are produced after 1995, operational and in good working order.

Table 2.22: Quantities of waste collection equipment manufactured after 1995 in workable condition or under repair in each Duureg

Unit: no

Duureg	Compactor	Dump Truck	Skipper	Total
Bayangol	1	5	0	6
Bayanzurkhl	3	2	0	5
Songinokhairkh	2	6	0	8
Sukhbaatar	0	10	3	13
KhanUul	0	1	0	1
Chingeltei	0	4	0	4
Nalaikh	0	0	0	0
Total	6	28	3	37

Number of procurement collection equipment

In the M/P proposed in the development study, the target collection ratio by population in 2010 is 100%; however the 2006 collection ratio in the Ger area is less than 50%, so it will be necessary to make far-reaching improvements in the present conditions (management system and collection conveyance system) in order to achieve the 2010 collection ratio of 100% in such a short period of time. Therefore, the collection ratio target to 80% in this project and the remaining target collection ratio of 20% to be established as the amount of self-reliant improvements made by Mongol side themselves. In fact that 100% collection is presently executed in the apartment area, this collection ratio will be deferred to 2010. In the Ger area, the quantity of collection equipment required when the collection ratio is set to 80% is shown below

Table 2.23: Required number of Dump Truck with canopy at collection rate set to 80% in Ger area

Unit: no

Area	Collection Equipment	Specification	Description	Sukhbaatar		Chingeltei		Bayanzurkhl		Songinokhairkhan		Bayangol		KhanUul		Nalaikh		Total	
				Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
Ger	Dump Truck	6t	Required waste collection (t/day)	50.3	11.0	63.9	13.8	54.4	11.9	91.5	19.9	23.3	5.0	39.5	8.7	11.6	2.5		
			Number of time for Collection	2	2	2	2	1	1	2	2	2	2	2	2	2	2		
			Transportable waste weight	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60		
			Number of required collection	**7**	**1**	**9**	**2**	**15**	**4**	**12**	**3**	**4**	**1**	**5**	**1**	**2**	**1**	**54**	**13**

From the description above, the quantity of dump trucks with canopy required in 2010 for this project is 84 (30 units/apartment area, 54 units/Ger area, winter season). However, the useable units of existing vehicles for 2010 (28 units) and the supply of vehicles that will be procured by Mongol side (43 units) are deducted from the required quantity, finally a total of 13 dump trucks with canopy to be procured in this project.

Table 2.24: The Number of Dump Truck with canopy to be procured

Unit: no

	Winter	Summer
Apartment Area	30	41
Ger Area	54	13
Sub Total	84	54
Total		84
Existing Equipment		28
To be procured by Ulaanbaatar City		43
To be procured by Japanese Grant		13

Collection of waste for summer homes and poor access in Ger area

There are summer houses located at far distances from Ulaanbaatar city, in the suburban area. In addition to the Ger area which is difficult for collection vehicles to access in the winter months. In these areas waste is disposed of along the road illegally. It is necessary to periodically collect this waste with respect to public health concerns and prevent of scattering of waste. Also, a large amount of coal ash is discharged from the Ger area which is very heavy and difficult for personnel to carry and transport. Therefore, one unit of wheel loader with backhoe will be procured in this project.

Summary of procurement equipment (for collection) is shown as below.

Table 2.25: Summary of to be procured equipment (for Collection)

Type of collection equipment		Number	Target waste
A.1	Compactor truck 15m^3	23	Apartment waste, Non-hazardous medical waste
A.2	Compactor truck 8m^3	7	Apartment waste, Non-hazardous medical waste
A.3	Dump truck with canopy 6t	13	Apartment waste, Ger waste
A.4	Wheel loader with backhoe	1	Remote area waste, Ger waste

2) Disposal site equipment

B. Equipment for the disposal site

The followings are the waste disposal amount in 2010.

Table 2.26: Waste Disposal Amount in 2010

Landfill Site	Daily Disposal Amount (t/day)	Daily Disposal Amount (m^3/day)	Annual Disposal Amount (t/year)	Annual Disposal Amount (m^3/year)	Total (m^3/year)
Naragiin Enger	704.7	1,762.0	221,400	553,500	553,500
Morin Davaa	38.6	96.5	12,114	30,285	52,155
Naraikh	21.4	53.5	6,300	15,750	
Khoroo 21	7.8	19.5	2,448	6,120	
Total			236,592	605,655	605,655

B.1 Bulldozer (Capacity 19t~22t, Crawler): 3 no.

These bulldozers are used for NEDS. Based on the standard formula of the Ministry of Construction in Japan, daily workload capacity of this bulldozer set as 600 m^3/ day, therefore, the required number of bulldozers is calculated as follows:

1762 m^3 ÷ 600 m^3/day/No = 2.93 → 3 bulldozers

B.2 Excavator (0.6m^3): 1 no.

This excavator is used for excavating and loading cover soil. The required number of excavators is calculated as follows:

(daily waste) ÷ (landfill height) × (soil cover thickness) = (Volume of soil cover)

1,762m^3 ÷ 2.5m × 0.25m = 176.2m^3

Based on the Japanese standard, capacity of excavating and loading earth is set at 300 m^3/day. The capacity of this excavator exceeds the required volume of earth to be handled, but this excavator will also be used for other purposes, such as drainage extension, extension of leachate collection pipe, shaping the embankment dam and so on.

One excavator is considered adequate for this work.

B.3 Dump Truck (10t): 2 no.

These dump trucks are used for transporting cover soil. Based on the Japanese standard, this type of truck can transport 166 m^3/day. The number of trucks required is calculated as follows:

176.2m^3 ÷ 166m^3/day = 1.057 no.

Dump trucks are required not only for transporting earth, but also other works such as transporting embankment dam materials, clearing illegal dumping along the access road, and so on. Thus, two dump trucks will be required.

B.4 Water Tanker (6,000 litters): 1 no.

More than 100 trucks are expected to come into the NEDS site. This truck is required in order to control dust on the road and extinguish any initial fires at the landfill site.

B.5 Wheel Loader with back hoe (1.0m^3) : 1 no.

A wheel loader with back hoe is used for MDDS, Kh21 and NADS. Semi-sanitary landfill

establishments will be conducted at these three disposal sites.

3) Central workshop and warm garage equipment

C. Equipment for workshop and warm garage

C.1 Equipment for central workshop

【Washing equipment】

C.1.1 Warm water car washer: 1 unit

The equipment is used to wash vehicles which come into the central work shop for regular maintenance. In particular, compactor trucks are highly susceptible to body rust from the waste and therefore car washing is a high priority. The equipment use warm water to be used in the winter season.

C.1.2 Parts cleaner: 1 unit

It is used for washing of small parts such as a bolts and nuts. Water and oil can be used for washing liquid.

【Maintenance tools】

C.1.3 Hydraulic jack (for dump truck): 2 units

This is used to lift the dump truck for maintenance and changing tires. The maximum lifting capacity shall be 15t based on dump truck vehicle weight. The equipment shall be attached with casters to easily move it around, and the number to be procured will be based on the central work shop bay number.

C.1.4 Potable hydraulic jack (for compactor truck): 2 units

It is used for the same purpose as the hydraulic jack. The applicable equipment is compactor truck and maximum lifting capacity is 10t. The number to be procured will be 2 units based on the Central workshop bay number.

C.1.5 Rigid rack: 8 units

It is used to hold vehicles for maintenance. The number to be procured will be eight sets for two vehicles and the maximum holding capacity will be 6t.

【Equipments for oil and lubricating oil】

C.1.6 High pressure grease pump: 1 unit

It is used for injection of lubricating oil for scheduled maintenance. One unit will be procured.

C.1.7 Oil bucket pump: 1 unit

It is used for oil changes of compactor vehicle and dump truck. One set is employed in order to increase work efficiency by allowing for oil to be poured directly.

C.1.8 Oil change kit: 1 unit

These tools include each an oil filter wrench required for oil changes, an oil measure, and one drum pump.

【Equipment for tire replacement and maintenance】

C.1.9 Air compressor: 1 unit

It is a multi-purpose tool with such functionality as filling tires with air, power source for pneumatic tools, to paint sheet metal and so on.

C.1.10 Air impact wench (small size), C.1.11 Air impact wench (large size): 1 set each

It is used for tire deflation and parts removal. Since the large and medium-size vehicles are intermingled, it supplies one set of each size.

C.1.12 Tire changer: 1 unit

It is used for tire deflation. Since this is difficult to do manually, one unit for large-size vehicles is supplied.

C.1.13 Tire maintenance tools: 1 set

One set consisting of a tire lever, tire bead hammer, air fastener and air pressure gauge to check and change tires will be procured.

【Tools for parts replacement and repair】

C.1.14 Basic Tools: 2 sets

The basic tools for both metric and inch sizes are supplied for repair and parts replacement. Two sets shall be procured to accommodate the two repair bays of the central workshop.

C.1.15 Tools Storage Box: 2 units

Two tools storage boxes are supplied to store the above-mentioned basic tools.

C.1.16 Torque wrench set: 1 sum

It is used in order to check the torque of fastened bolts after regular inspections and simple repairs. The torque scale shall cover 10 to 500 N m.

【Equipment for Battery, electrical component】

C.1.17 Battery fast charger: 1 unit

This is procured in order to charge batteries.

C.1.18 Battery repair kit: 1 sum

One set of auxiliary tools, such as a battery liquid specific gravity meter, fluid injector (for fluid replacement) and battery cables, shall be procured.

C.1.19 Digital circuit tester: 1 unit

This will be procured to test electrical equipment circuits, and measure voltage.

【Welding and metal plating tools】

C.1.20 Arc welder: 1 unit

It is used for minor repairs and metal plating. The ARC welder will be powered by AC current at the Central workshop and able to accommodate filler rods up to 4mm. Also, associated tools such as the welding cable and earth cable will be procured. It is expected that this equipment will not be used as often, and therefore one unit is adequate.

C.1.21 Gas cutter/welding kit: 1 unit

It is used for thin steel plate welding and cutting of vehicle bodies. The welding set components are a regulator (for oxygen and acetylene), a welding tip and cutting tip. One set will be procured.

C.1.22 Disk sander: 1 unit

It is used for grinding metal plating and welded areas. Efficiency is taken into consideration so that the equipment will be equipped with a 100mm diameter grinding disk. One unit will be procured.

C.1.23 Electric drill: 2 units

It is used for drilling and plating vehicle bodies. Based on the thickness of vehicle body steel, the selected drill is applicable for at least 6.5mm thick steel plate. Its multi-purpose use requires that two

units be procured.

C.1.24 High speed cutter: 1 unit

It is used for cutting steel materials and plating work. It was decided to procure a desk-top cutter equipped with a high 300mm class disk. Taking into consideration operation frequency, one unit is seen as adequate.

C.1.25 Work bench: 2 units

It is used to dismantle and assemble small parts, and hold small instruments. The bench is made of oil-resistant steel. Two units are procured to accommodate two standard tool sets.

C.2 Equipment for NARANGIIN ENGER warm garage

【Washing equipment】

C.2.1 Warm water car wash: 1 unit

The equipment will be used to wash vehicles that are operated at the disposal site. The vehicle is required to wash prior to carry out scheduled maintenance. A warm water type was chosen for use during the winter season.

4) Environmental monitoring equipment

D. Environmental Monitoring Equipment

D.1 Portable gas detector (to monitor combustible gases, hydrogen sulphide gas, and carbon monoxide gas): 2 units

Decomposition of waste will generate combustible gas, hydrogen sulphide gas and carbon monoxide gas, etc. The possibility of combustion due to these gases could be detrimental to personnel. Since waste pickers are commonly working in the disposal site, regular monitoring of those gases is essential. Due to the size of the disposal site, two gas detector units will procure.

Equipment which will be procured in this project is shown below.

Table 2.27: List of Major Equipment

No	Equipment name	Procured Country	Origin Country	Major specification and component	Q'ty	Purpose
A.1	Compactor Truck	Japan	Japan	Compactor volume : At least 15.0 cubic meters Hopper volume : At least 1.0 cubic meter Maximum pay load : At least 8.0 tons	23	Collection of apartment, business and Non-hazardous waste
A.2	Compactor Truck	Japan	Japan	Compactor volume : At least 8.0 cubic meters Hopper volume : At least 0.5 cubic meter Maximum pay load : At least 4.0 tons	7	Collection of apartment, business and Non-hazardous waste
A.3	Dump Truck with canopy	Japan	Japan	Bed volume : At least 10.0 cubic meters Canopy : Side development type or folding type Maximum pay load : At least 9.0 tons	13	Collection of Ger waste
A.4	Wheel loader with back hoe	Mongolia	Belgium	Shovel volume : At least 1.0 cubic meter Gross engine power : At least 95PS Machinery weight : At least 7.5 tons	1	Collection of waste in remote area and areas with difficult access
B.1.1	Bulldozer	Japan	Japan	Machinery weight : Between 19 tons to 22 tons Crawler track : Dry-type Engine output : At least 180PS	3	To lay waste, compaction, laying of covered soil, construct of earth embankment and construct of divider
B.1.2	Excavator	Japan	Japan	Bucket capacity : At least 0.5 m3 in plat, 0.8 m3 in bulk Gross engine power : At least 135PS Machinery weight : At least 19.0 tons	1	Excavation and unloading of covered soil, maintenance of inner road, construct of drainage
B.1.3	Dump Truck	Japan	Japan	Driving handle (steering) : left hand drive Gross vehicle weight : At least 21.0 tons Maximum pay load : At least 10.0 tons	2	Transport of covered soil, earth embankment soil, maintenance material and cleaning of illegal dumping
B.1.4	Water Tanker	Japan	Japan	Driving handle (steering) : left hand drive Spray head : Manual, discharge at least 400ltr/min and distance 20m Tank capacity : At least 6000liters	1	Extinguish small-scale fires, transport drinking water, spay water on roads and maintain greenbelt
B.2.1	Wheel loader with back hoe	Mongolia	Belgium	Shovel volume : At least 1.0 cubic meter Gross engine power : At least 95PS Machinery weight : At least 7.5 tons	1	To laying of waste, compaction, laying of covered soil, construct of earth embankment and construct of divider
C.1.12	Tire change machine	Japan	Japan	Applicable Rim size : 16 inches to 26 inches Maximum wheel diameter : At least 1500mm Maximum wheel width : At least 700mm	1	To remove tires from wheel

2-2-3 Basic Design Drawing

Basic design drawing as shown following;

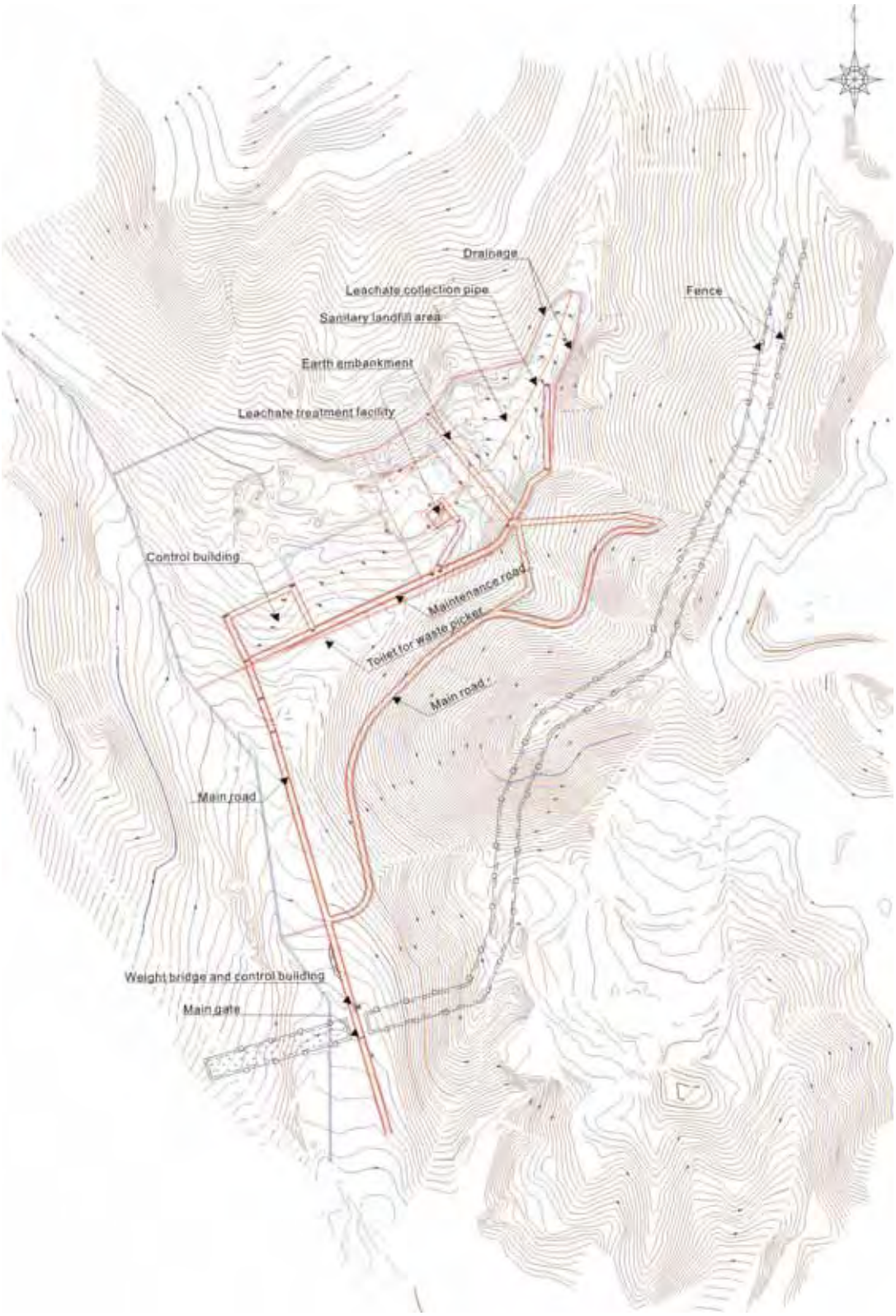


Figure 2-15: Layout Plan of Narangiin Enger Disposal Site

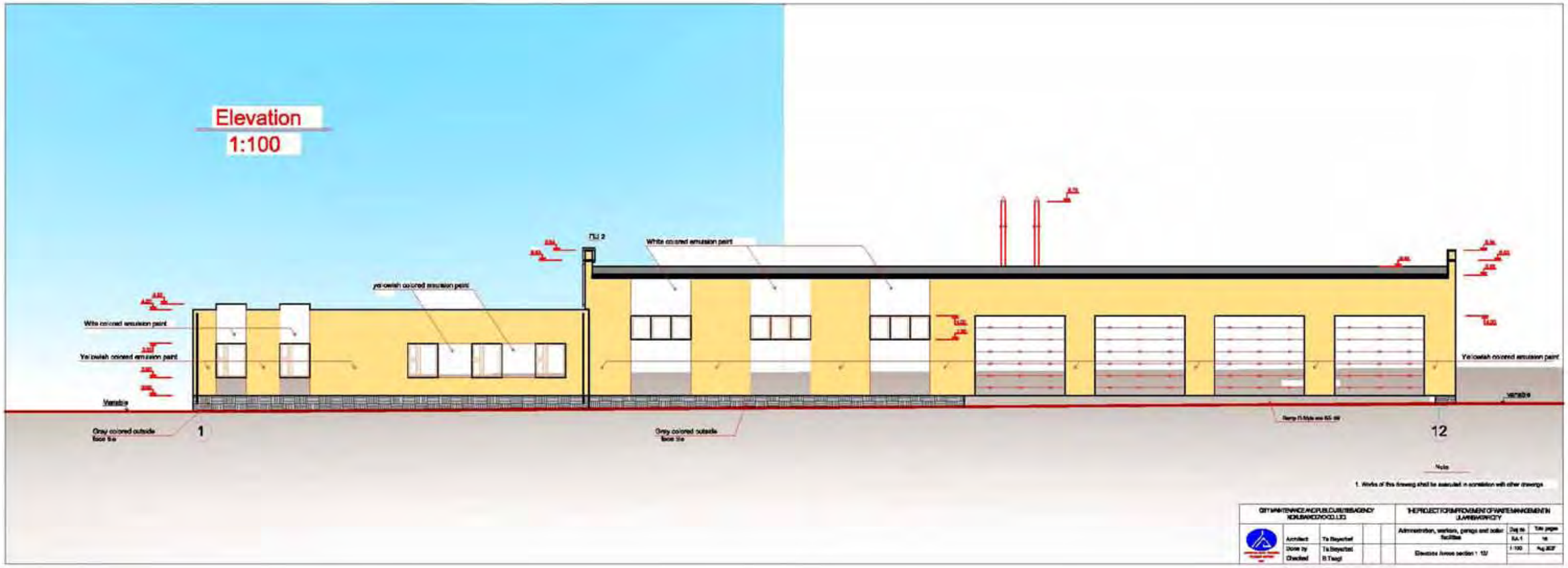


Figure 2-16: Elevation of Control Building at NEDS

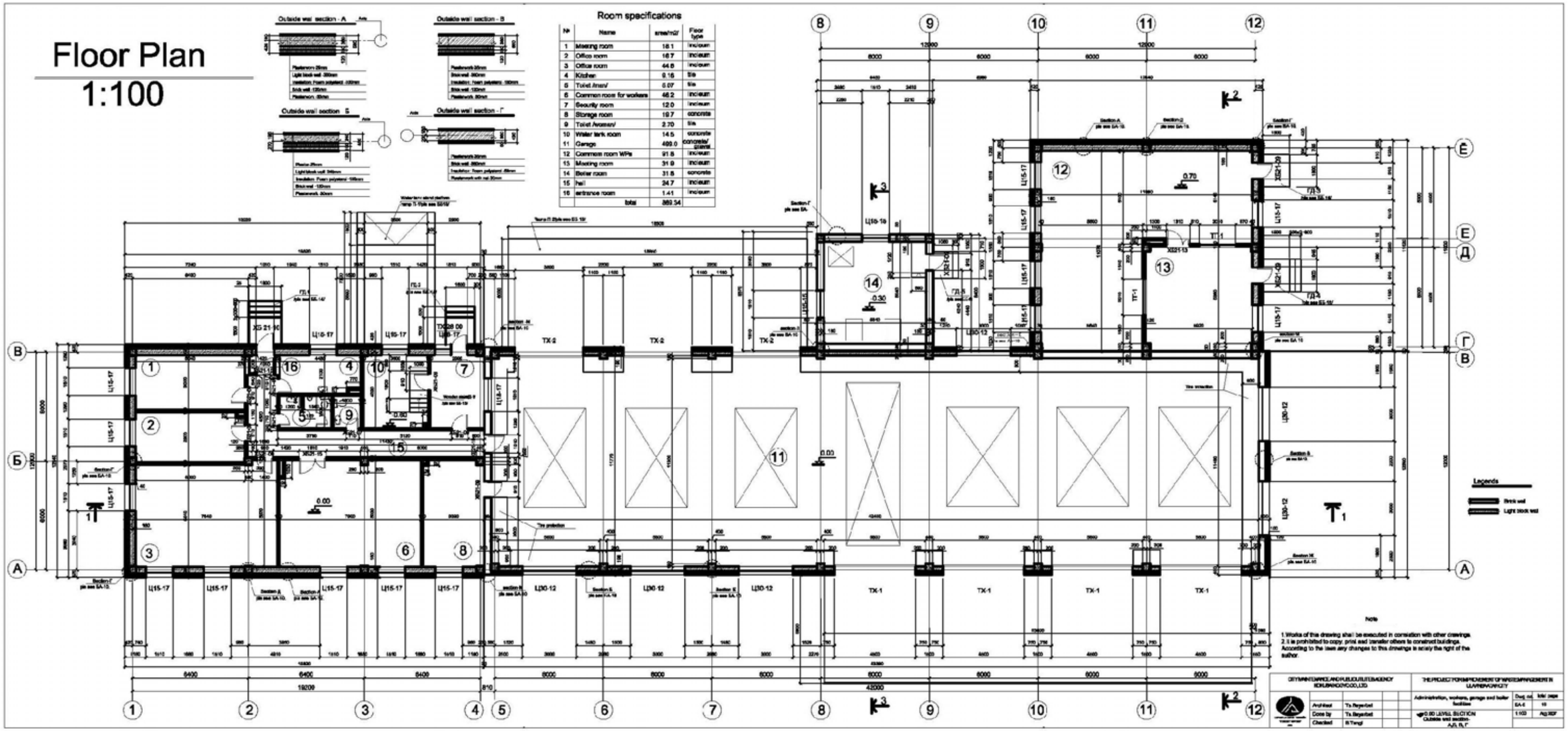


Figure 2-17: Layout Plan of Control Building at NEDS

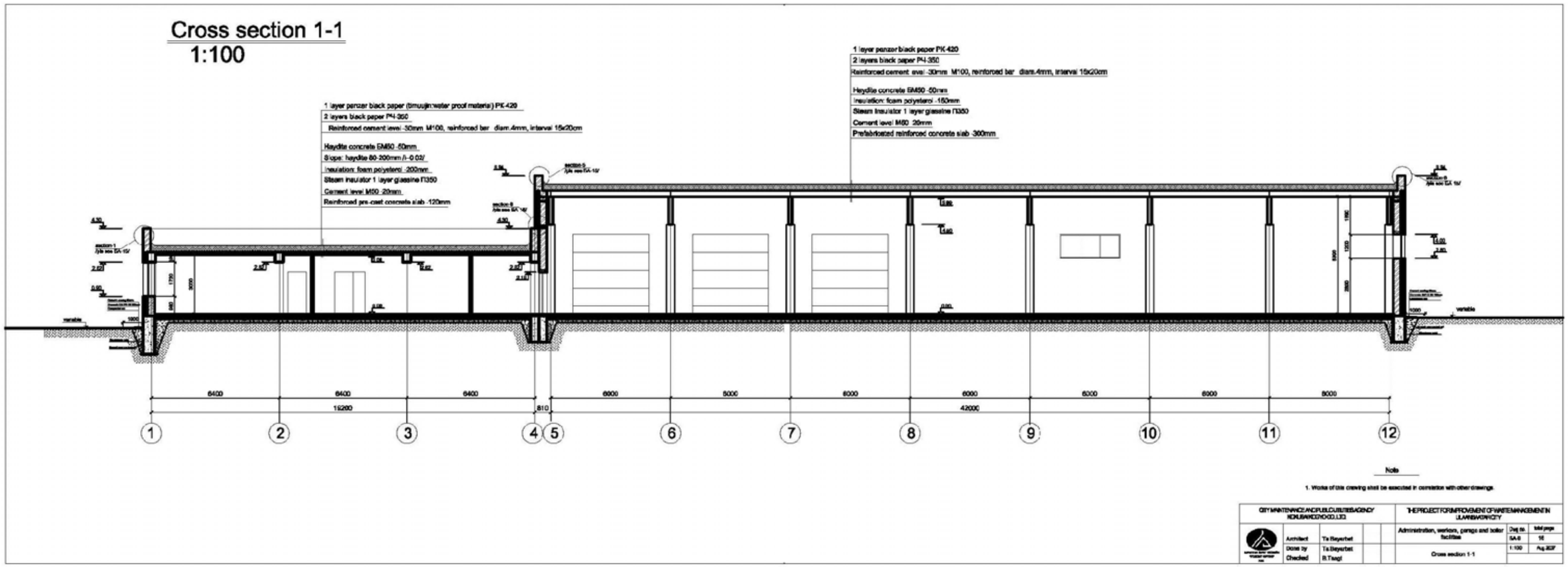


Figure 2-18: Cross Section of Control Building

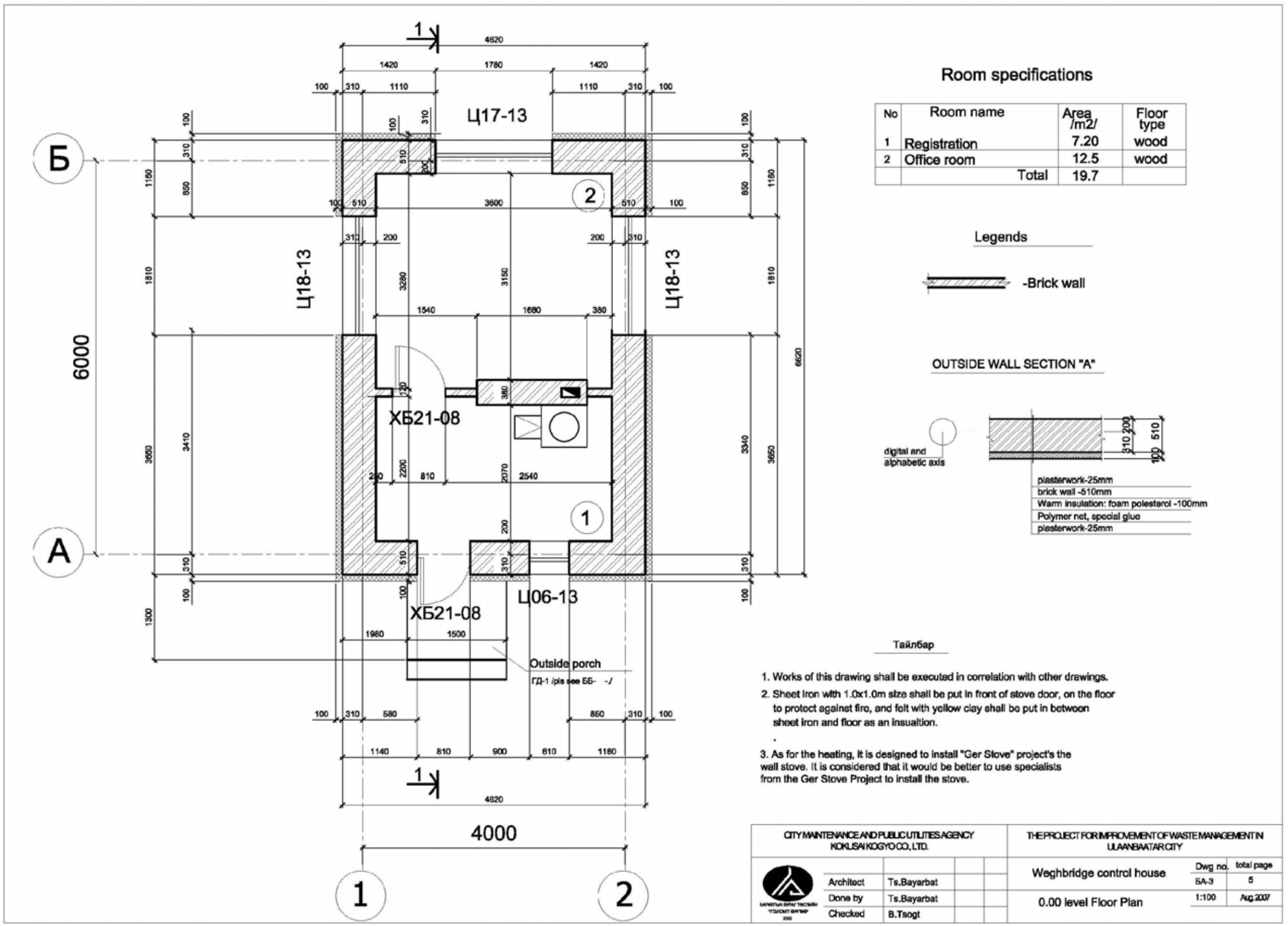


Figure 2-19: Layout Plan of Weigh Bridge House

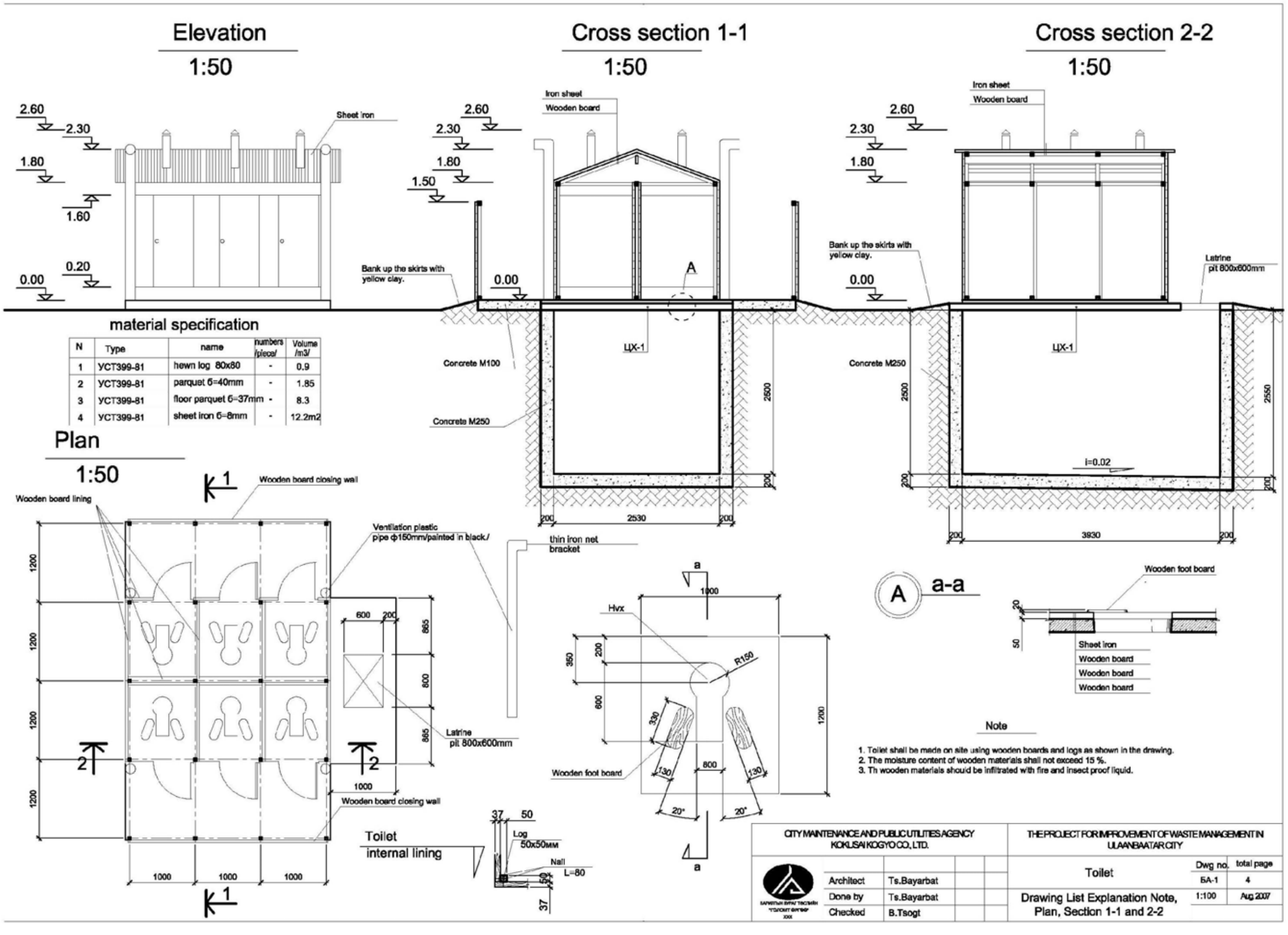


Figure 2-20: Public Toilet at NEDS

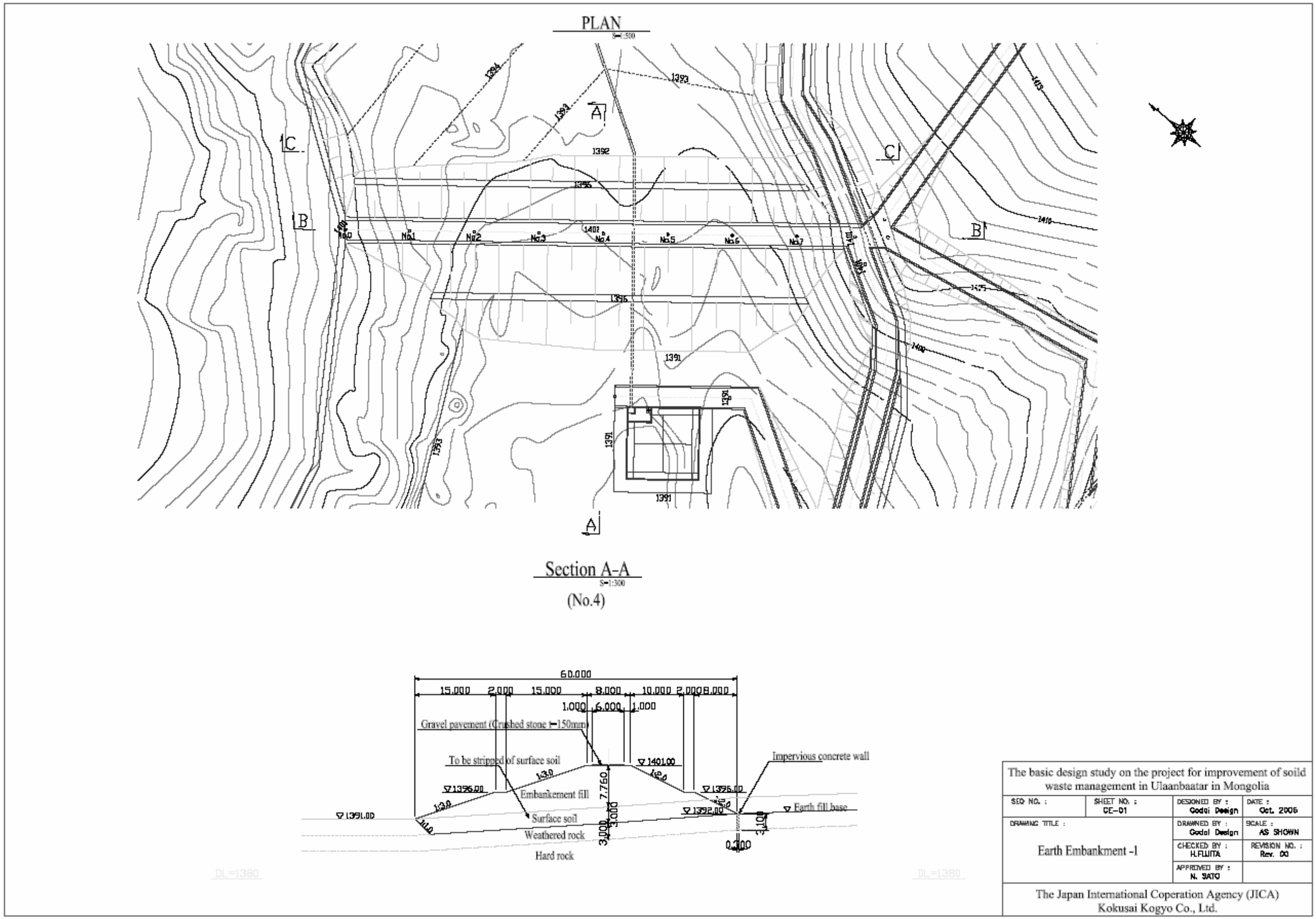


Figure 2-21: Earth Embankment

Plan

S=1:4000

Main Road (Asphaltic Pavement) L=7300.00m

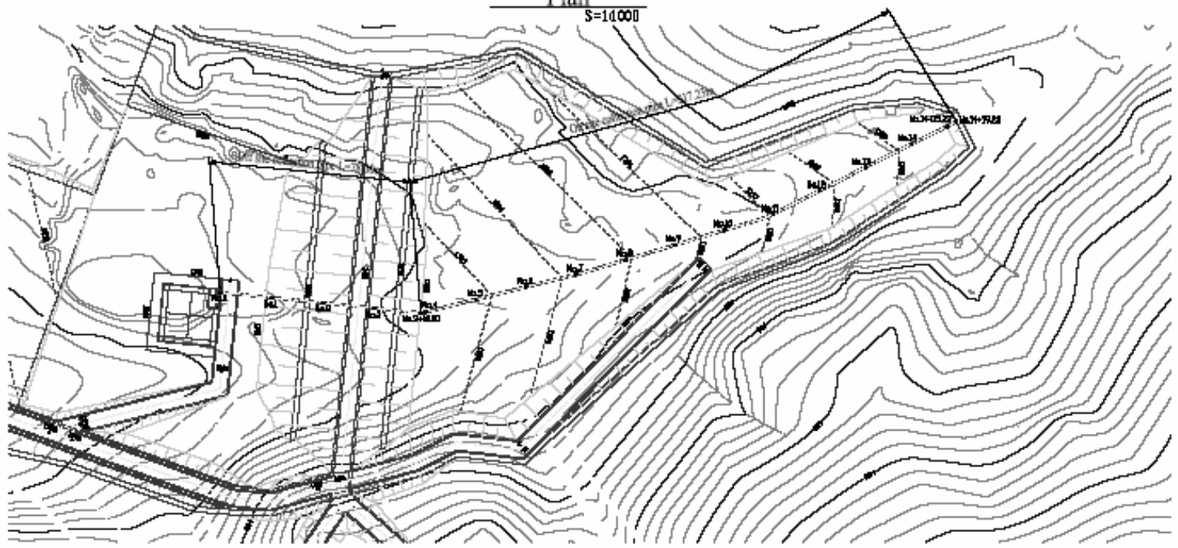
The basic design study on the project for improvement of soild waste management in Ulaanbaatar in Mongolia

SEQ NO. :	SHEET NO. : CR-01	DESIGNED BY : Gadal Design	DATE : Oct. 2006
DRAWING TITLE : Plan of Main Road		DRAWNED BY : Gadal Design	SCALE : AS SHOWN
		CHECKED BY : H.FUJITA	REVISION NO. : Rev. 00
		APPROVED BY : N. SATO	

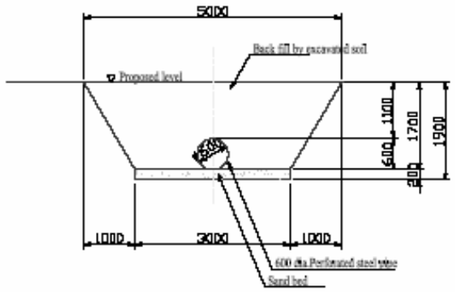
The Japan International Coperation Agency (JICA)
Kokusai Kogyo Co., Ltd.

Figure 2-22: Main Road Plan

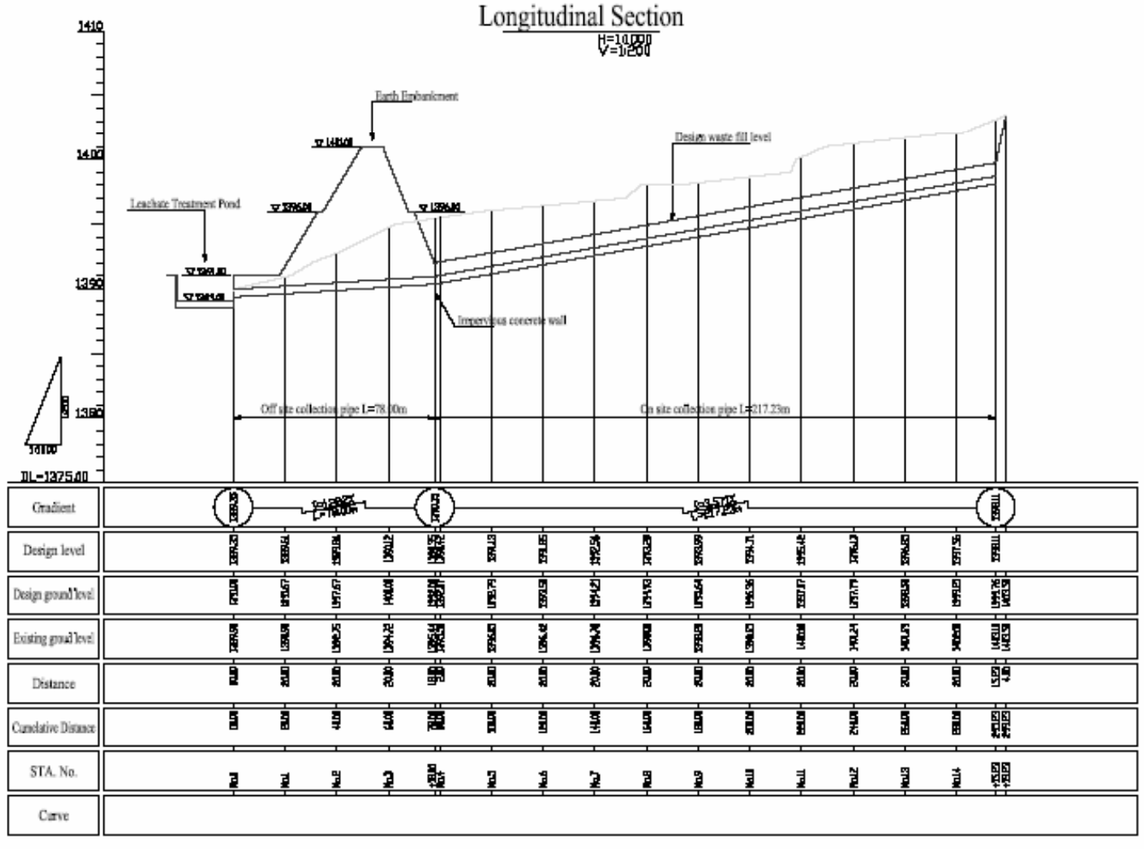
Plan
S=1:1000



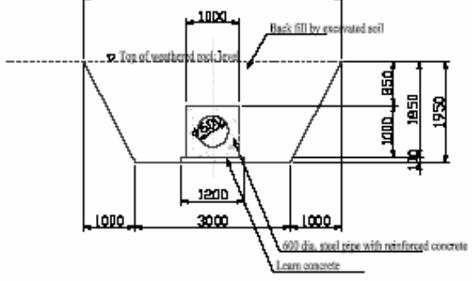
Cross section of On site collection pipe
S=1:50



Longitudinal Section
H=1:1000
V=1:200



Cross section of Off site collection pipe
S=1:50



The basic design study on the project for improvement of soild waste management in Ulaanbaatar in Mongolia

SEQ NO. :	SHEET NO. : CL-01	DESIGNED BY : Godoi Design	DATE : Oct. 2005
DRAWING TITLE : Typical Drawing of Leachate collection Pipe		DRAWN BY : Godoi Design	SCALE : AS SHOWN
		CHECKED BY : H.FUJITA	REVISION NO. : Rev. 00
		APPROVED BY : N. SATO	

The Japan International Coperation Agency (JICA)
Kokusai Kogyo Co., Ltd.

Figure 2-23: Leachate Collection Pipe

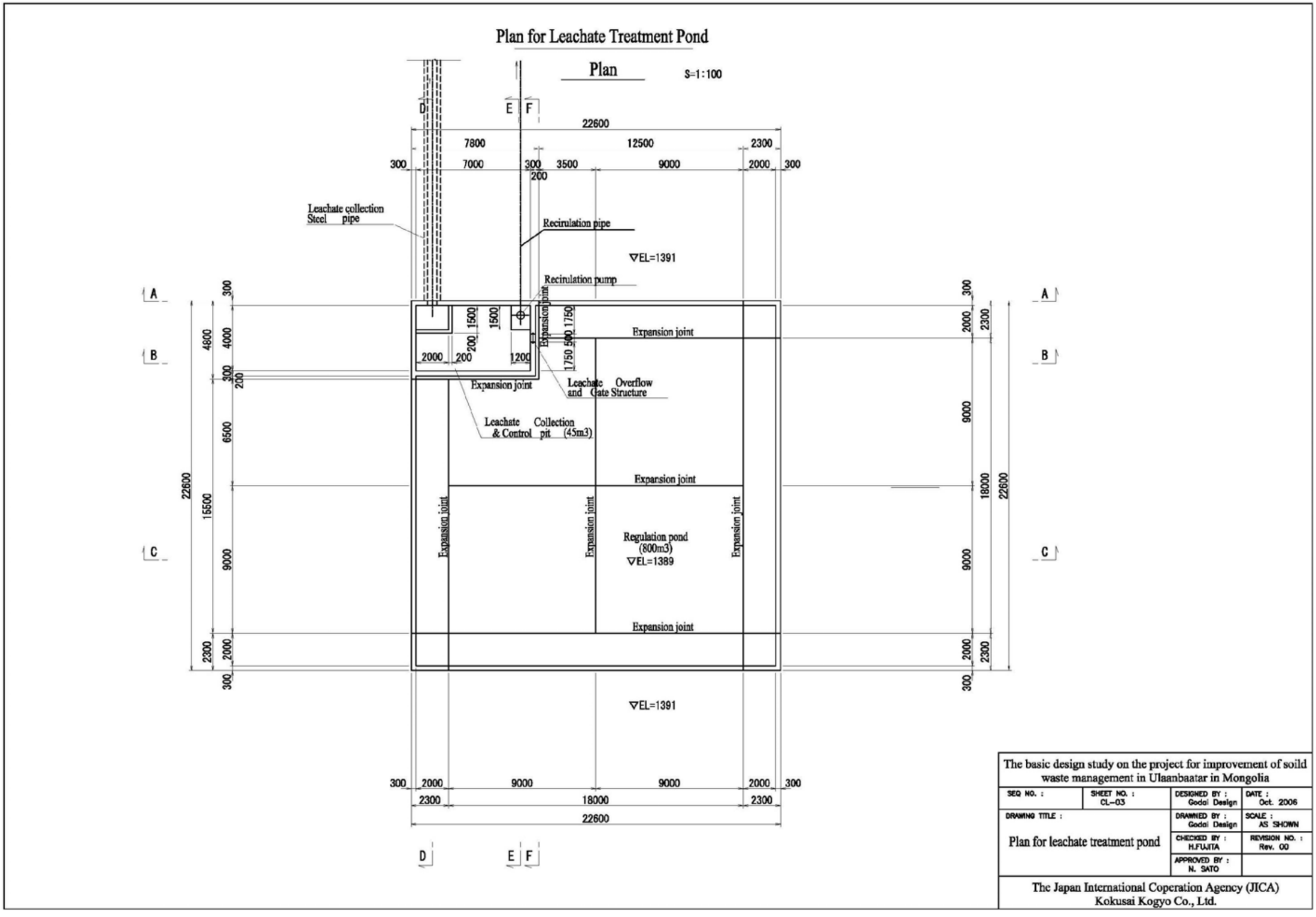


Figure 2-24: Leachate Treatment Pond

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy / Procurement Policy

(1) Implementation Policy

This project is a combination of both civil and building construction, however none of the structures present a high level of difficulty and therefore the construction will be implemented by one Japanese contractor.

(2) Procurement Policy

1) Policy on equipment and material procurement

The equipment to be procured for this project is not manufactured in Mongolia, so Japanese made equipment will be procured. Based on the basic design study and past project experience, there will be no problem to provide maintenance for Japanese equipment due to the supply of spare parts and existence of local agencies. However, in such cases where the equipment is not manufactured in Japan or the equipment is manufactured by only one manufacturer in Japan, the equipment that originates from other countries will be considered. A list of equipment based on expected country of origin is shown below.

Table 2.28: Country origin of procured equipment

Classification	Name of equipment and materials	Japan	Mongolia	Other country
Equipment for waste collection				
	Compactor truck (15m^3)	○		
	Compactor truck (8m^3)	○		
	Wheel loader with back hoe	○		○
	Dump truck with canopy	○		
	Equipment for Disposal site			
	Bulldozer	○		
	Excavator	○		
	Dump truck	○		
	Water tanker	○		
	Wheel loader with back hoe	○		○
Equipment for workshop and warm garage				
	Warm water car washer	○		
	Parts cleaner	○		
	Hydraulic jack	○		
	Portable jack	○		
	Rigid rack	○		
	High pressure grease pump	○		
	Oil bucket pump	○		
	Tools for changing oil	○		
	Air compressor	○		
	Air Impact wrench	○		

Classification	Name of equipment and materials	Japan	Mongolia	Other country
	Tire changer	○		
	Tools for tire maintenance	○		
	Basic tools	○		
	Tool storage box	○		
	Torque wrench set	○		
	Battery fast charger	○		
	Battery repair kit	○		
	Digital circuit tester	○		
	Arc welder	○		
	Gas welder set	○		
	Disk sander	○		
	Electric drill	○		
	High-speed abrasive cutter	○		
	Work bench	○		
Equipment for environment monitoring				
	Gas detector	○		

2-2-4-2 Points of concern for construction and procurement

(1) Points of concern for Construction

1) Construction in mid-winter

In mid-winter, the temperature in Ulaanbaatar city can fall to between -20 and -30 degrees Celsius from December to March. Since the ground freezes during this period, earth works, concrete work and other field construction work cannot carry out. Therefore, external construction work will schedule from April to November.

(2) Points Concerned for Procurement

1) Proper selection of equipment in accordance with local climate

The mid-winter temperature in Ulaanbaatar city drops to -20 to -30 degrees Celsius, requiring equipment that complies with extreme cold weather specifications. However, maintenance for such equipment requires advanced maintenance techniques. Based on the existing equipment survey, the equipment that is currently used follows specifications for cold weather without any major complications. Therefore the equipment specifications were adopted with cold conditions.

2) Proper specification of equipment in accordance with local conditions

The basic design study and feasibility study included in the development study showed that local operators possess the proper skills to operate, and maintain the working order of the equipment. However, most of the equipments currently in use are old models which were manufactured in China or Russia. The equipment specifications for this project shall be kept as simple as possible to keep

operations and maintenance protocols easily understood for in-service operators.

2-2-4-3 Scope of Works

(1) Facility Construction

The scope of works for facility construction to be implemented by Japanese and Mongolia sides in this project is shown below.

Table 2.29: Scope of works by Japanese and Mongolia sides

Facility	Details	Japan		Mongolia	Remark
		Building	Civil		
Disposal Site	Embankment		○		
	Rainwater drainage		○		
	Road for common vehicles		○		
	Road for heavy equipment	○	○		
Environment Protection	Leachate collection facility		○		
	Leachate treatment facility		○		
	Gas removal facility		○		
	Fence for prevention of waste scattering		○		
	Tree planting in Buffer zone			○	
Operation & Maintenance	Disposal Site Administration Office	○			
	Parking of Administration office	○			
	Curb stone at Administration office	○		○	Planting shall be done by Mongolian side
	Waste water tank	○			
	Water tank for fire fighting	○			
	Street lamp	○			
	Weight bridge	○			
	Weight bridge control house	○			
	Public toilet for waste pickers	○			
	Utility pole	○	○	○	Mongolian side: Installation from city to the transformer on the boundary of the disposal site. Transformer is installed by Mongolian side. Project side: Installation from the transformer on the boundary to each facility.
	Electric line	○	○	○	
	Telephone line	○		○	Mongolian side: Installation from city to the boundary of the disposal site. Project side: Installation from the boundary to each facility

(2) Procurement of Equipment

The scope of works for procurement of equipment to be implemented by the Japanese and Mongolian sides in this project is shown below.

Table 2.30: Scope of works by Japanese and Mongolian sides

Items	Japan	Mongolia
Procurement of equipment	・Equipment for waste collection (Compactor truck, Dump truck and Wheel loader with back hoe) ・Equipment for Disposal site (Bulldozer, Excavator, Dump truck, Water tanker and Wheel loader with back hoe) ・Equipment for Environment monitoring (Gas analyzer)	・To procure necessary equipments except Japanese side procured equipment(Consumables, Battery etc.) ・Procurement of Dump truck for waste collection ・Fuel for collection vehicle and landfill equipment
Transportation of procured equipment	・Transportation to Final destination	・Nil
Maintenance of procured equipment	・On the job training by Japanese equipment supplier at central work shop ・Training of operation of sanitary land fill by soft component	・To secure of manpower and necessary budget for Operation and maintenance ・To bear miscellaneous cost for Operation and maintenance ・To secure storage space (warm garage) for procured equipment ・To construct central work shop ・To conduct environmental monitoring which stated in EIA report
Tax exemption Commission for opening of A/P	・Nil	・To bear necessary cost
Warranty	・To warrant all of procured equipment for one year from handing over including minor repairing on normal operation	・To bear other than Japanese side

2-2-4-4 Consultant Supervision for Construction and Procurement

This project will be implemented under Japanese Grant Aid for general projects by the government of Japan, and the government of Mongolia will enter into an agreement with a consultant recommended by the Japan International Agency (jica) for construction and procurement supervision. The construction of facilities and procurement of equipment and materials will be undertaken by the construction contractor and equipment suppliers on the Japanese side that will enter into an agreement with the Mongolia side. The consultant and the contractor on the Japanese side will dispatch the supervision / management personnel as shown in below.

Table 2.31: Construction and Procurement supervision personnel on Japanese side

Criteria	Supervision / Management	No. of staff	Responsibility	Dispatch Period
Consultant for Construction	Project manager	1	General Supervision of the Project	Spot
	Facility planning	1	Supervise of Facility construction	Spot
	Supervisor	1	Supervise of construction works	Full time
Consultant for Equipment	Procurement Planning	1	Delivery Inspection, Initial Training	Spot
	Inspection	1	Inspection for Shipping	Spot

2-2-4-5 Procurement Plan

(1) Labor

There are many civil and building construction projects are on going in Ulaanbaatar City therefore common and skilled laborers are available in Ulaanbaatar city. The majority of these workers are Mongolian, with virtually no foreign laborers such as those from China, etc.

(2) Construction Materials

The common construction materials used in construction or civil engineering projects, such as cement, gravel and reinforced bar, are manufactured and available in Mongolia. Some construction materials which cannot be manufactured domestically are imported from China or Russia and are available on the Mongolian market.

The construction materials shall be selected in terms of reasonable price, quality, supply capacity, reliability or delivery time and ease of maintenance.

Table 2.32: County of Origin of Major construction materials

Martial name		Mongolia	Japan	Other
Sand		○		
Asphalt		○		
Cement		○		
Formwork material		○		
Reinforced bar		○		
Crashed stone		○		
Ready mixed concrete		○		
Brick		○		
Painting material		○		
Furniture		○		
Sanitary arrangements		○		
Air conditioning facilities		○		
plumbing equipment	Steel tank	○		

Martial name		Mongolia	Japan	Other
	Copper pipe	○		
	Manhole cover	○		
	Others	○		
Electric services	Cable	○		
	Conduit pipe	○		
Weight Bridge			○	

(3) Construction machinery

Construction machinery and vehicles are available in Mongolia.

(4) Spare parts and Consumables for equipment supplies.

Spare parts for the equipment to be procured in Japan are considering difficult to get with reasonable price in local market Mongolia. Therefore those necessary spare parts shall supply by this project. Quantities of the spare parts are sufficient for one year of operation under normal circumstances, and from one year onward Mongolian side will be purchased by themselves.

Table 2.33: Spare parts and Consumables

Name of Equipment	Spare parts	Consumables
For Collection		
Compactor（15 ㎥）	○	—
Compactor（8 ㎥）	○	—
Wheel Loader with back hoe	○	—
For Disposal Site		
Bulldozer	○	—
Excavator	○	—
Dump Truck	○	—
Water Tanker	○	—
Wheel Loader with Back hoe	○	—
For Central Workshop		
Car washer	○	—
Air Compressor	○	—
Tire Changer	○	—
Welding Machine	○	—

(5) Transport and Packing Plan

In order to save transportation cost, transportation designed based on shipment.

All the equipment procured in Japan transport by sea and land. After the equipment is packed, it transport by sea from the main harbour in Japan to Tianjin harbour. After that, the equipment loaded to the train and transport by land to reach Ulaanbaatar station in Mongolia. It expected to take around six

weeks to reach Ulaanbaatar from Japan.

2-2-4-6 Quality Control Plan

The following quality controls shall carry out in order to manage contractors and maintain the quality of the work.

(1) Soil Compaction Density Test

A soil compaction density test shall carry out to decide the optimal moisture content and optimal compaction frequency before the embankment dam filling.

(2) Compression Strength Test for Concrete

The compression strength test for concrete shall carry out in a laboratory in Ulaanbaatar City, taking one sample set for each 100 cubic meters of casting volume. Six test samples are to be taken each casting.

(3) Tensile Strength Test for Reinforcement Bar

The tensile strength test for reinforcement bar shall carry out according to the material properties, diameter and manufacturing lot.

2-2-4-7 Operational Guidance Plan

(1) Installation Work Plan

Installation work is not required for this project.

(2) Adjustment/Trial Operation Plan

Adjustment and trial operation is not required for this project.

(3) Training for Initial Operation Guidance

The supplier of the bulldozer, back hoe and compactor that are provided in this project are to be operated according to initial operation guidance implemented by the supplier. This training shall conduct at Naragiin Enger Disposal Site (NEDS) or the Central Workshop for the operator.

(4) Operation Guidance Plan

Operation guidance is not required for this project.

(5) Equipment Verification and Inspection Plan

There is a large number of equipment to be supplied, and verifying all the parts after packaged will be quite complicated, therefore factory verification and inspection will carry out prior to shipping.

2-2-4-8 Soft Component (Technical Assistance) Plan

(1) Background of soft component plan

A part of the City Maintenance and Public Utilities Division (CMPUD) was divided the personnel (5 of the 9) for establishment of the City Maintenance and Public Utilities Agency (CMPUA) on 15 September 2006 a new agency which mainly in charge of waste management.

This new organization, CMPUA employ 30 staff members at the end of 2006, and by the year prior to the completion of this project, plans to employ 45 staff at the end of 2008. Moreover, the Director of CMPUA has authority to employ the personnel required for the sustainable operation of facilities constructed and the equipment supplied by this project.

Under this new organization, the operation management of the disposal site which is currently managed by the company Nuuts, will shift to the Disposal Site Operation & Management Section under the CMPUA.

There is also a political problem concerning how to handle the public city renovation service (TUK) which is privatized; a problem that can not be solved at the present. As of March 2007, only the Bayangol city renovation service was completely privatized; the city renovation services in other districts in their present condition have only private management.

It is not depending on dealing with the city renovation service company, CMPUA established their Waste Collection Service Section, and using the collection equipment supplied by this project will implement pick-up services according to plan.

At present, the majority of the illegally dumped waste is construction waste. The city has devised a plan for the collection of construction waste in which contractors will submit an application for permission to start construction which must be approved by the City Specialized Inspection Agency (CSIA). However, prior to receiving permission, the contractor must sign a contract with the Waste Collection Unit of CMPUA to collect any construction waste.

The Vehicle and Garage Management Section and the Central Workshop, under the administration of the Chief Engineer will in charge of the maintenance of collection and landfill machinery.

The number of staffs, position is the schedule will increase according to plan. However it is new

organization, ability of the staff who is assigned and experience is not sufficient. That these organizations are active independently at present time, it is thought that it is difficult.

(2) Objective of the Soft Component

The objective of this project is for the proper collection, transfer and disposal of waste in the Ulaanbaatar City. A solid waste management system is formed to properly eliminate solid waste from the sphere of activity where it is generated through an organic combination of collection, transfer and proper disposal to create an appropriate management system. In order to achieve this objective, the soft component of this project use to provide technical guidance pertaining to the construction of facilities and initial operation of equipment supplied by this project. These activity objectives are itemized below.

1) Enable sanitary and safe landfill operations at the disposal site

The existing disposal site will reach maximum capacity within a few years so the project includes the construction of a new disposal site. Ulaanbaatar City recognizes four disposal sites at present, and although they employ a uniform technique to operate the disposal sites, this merely consists of simply using a bulldozer, compaction of the waste and maintaining the disposal stations in town. In the future CMPUA confirm the implementation of sanitary landfill operations in the disposal site for which CMPUA have insufficient experience to operate such a facility.

Also, it is predicted that the approximately 300 waste-pickers that currently retrieve valuable materials from the waste heap at the current disposal site to make their living. This activity will transfer to the new disposal site once new landfill site is completed. Nonetheless, it necessary to somehow safeguard their opportunity to work within heavy machinery to conduct sanitary landfill operations. In order to compatible both activities education and training have to be introduced.

Furthermore, it will also be necessary to implement environmental monitoring at the disposal site to be constructed in this project at Narangiin Enger, a monitoring is proposed in both the EIA and the Development Study. In order to carry out the monitoring, the Mongolian side agreed to secure both the personnel and budget necessary.

Environmental monitoring of the disposal site will conduct using dual methods; one conduct several times per year and analyzed in principle by a third-party to be commissioned as obligation in the EIA., in addition to the disposal site attendant using simple instruments frequently and repeatedly for the purpose of early detection of any poisonous gas released from the site, or seepage of leachate. Support for the soft component requested in this project applies to the latter as it will necessary to educate and train the personnel at the disposal site whom have no experience conducting monitoring activities.

2) Manage the collection equipment at the Central Workshop

When the collection equipment is provided by this project, responsibility for the management of the equipment will be taken by Ulaanbaatar City. It is necessary that Ulaanbaatar undertakes maintenance for all equipment and material (repair and management of equipment and materials) on its own, however, CMPUA does not have sufficient experience and human resources. Therefore, the management for such as vehicle dispatch, ledger, and past records fully responsible by Ulaanbaatar City, when maintenance (inspection, repair) concerning relatively easy daily service and routine inspection (short range and time routine inspection), light and general repairs will be done at the Central Workshop, and other specifications (routine inspection by distance/time and types of overhaul, etc.) which will be entrusted to a private repair shop.

The project uses specialized vehicles, such as the waste collection vehicles and especially the compactor, for which the personnel has little to no experience, and since a Russian-made dump truck with a gasoline engine is used up to now, the diesel engine vehicles also present a new experience so that initially, when the equipment is provided, training will need to give to maintain these vehicles as well as education and training for the continual operation and maintenance of equipment.

3) Properly administer the dispatch of collection vehicles provided in the project

The organization in charge of solid waste management in Ulaanbaatar City was the CMPUD until 15 September 2006 when reform broadened authority to the CMPUA. CMPUA carried out collection services in each zone however, with the implementation of this project, CMPUA was confirmed that the CMPUA will in charge direct control of operation and management for equipment and facilities procured through this project.

Accordingly, the new organization, CMPUA, will employ its own drivers and operators, and it will require dispatching the collection vehicles from the Central Warm Garage in a timely manner in order to collect waste from each zone. Furthermore, in case there is damage to the vehicle, it may necessary to procure a replacement vehicle or otherwise the number of trips by an existing vehicle to the disposal site will increase accordingly. Such plans and operations are new for CMPUA so that guidance and training will provide to encourage the efficient use of the equipment provided.

(3) Soft component output and method of verification

The table below is the outline of the soft component and outputs that are expected

Table 2.34: Activities and Outputs

Item	Activity	Outputs	Verification Method
Education and training	Monitoring for	Waste pickers will be	Advice Record

for sanitary landfilling	Organization of Waste Pickers	organized and cooperation between landfilling operator and WPs will be achieved.	
	Planning and design of landfilling methods in order to maintain WPs activities in landfilling site.	Preparation for Commencement of landfilling operation at NEDS will be made.	Sanitary landfilling operation guide. Working plan for landfill equipment and safety operation guidelines.
	Training for Supervisors and Operators for sanitary and safe operation method.	Preparation for Commencement of landfilling operation at NEDS will be made.	Training Record
	Modification and Tune up of Environmental Monitoring Plan. Training for the NEDS staff for monitoring.	The person in charge for monitoring will understand monitoring item, frequency, location and methods of analysis.	Monitoring plan and training record.
Education and training for the staff in central workshop for periodical inspection of collection trucks.	Determination of periodical inspection item, frequency and procurement planning of spare parts.	Appropriate maintenance system for collection trucks will be developed.	Operation and maintenance plan for collection trucks
	Technical training for mechanic.	Mechanic will understand the inspection items, frequency and spare parts order methods in order to conduct proper maintenance.	Training record
Education and Training for dispatch plan of collection truck	Training to the CMPUA staff in charge of dispatching collection truck	The person in charge will be able to plan how to dispatch trucks based on the amount of waste and distance to the disposal site.	Dispatch Plan

(4) Soft component activities (Input)

In order to realize the outputs summarized to the above, the guidance contained in the soft component lies within the field of proper management to operate the collection vehicles and manage operations at the disposal site. Initial operational training will carry out by equipment supplier and effective operation training of the equipment carry out by soft component activities.

Table 2.35: Division of the Soft Component and Operation Guidance

Guidance Item	Operation Guidance of Equipment	Soft Component
Initial Instruction for Equipment ・ Operation Guidance for basic equipment (how to use it) ・ Pre-Inspection before initial use ・ Troubleshooting methods	○	

Guidance to use the equipment for the effective achievement of objectives ・ Sampling method for water quality testing ・ Post-measurement data management, and maintenance reporting system ・ Managing the history, ledger book, maintenance and inspection, etc. of supplied equipment		○

Detail of the activities for each field is summarized in the table below.

Table 2.36: Activity Details of Soft Component

Field	Activity	Activity Details
Operation Management of Disposal Site	Checking the status of waste-picker organization and giving guidance	Provide guidance and check on the weekly meetings hosted by CMPUA (WP registration, check the composition of each group's members, update ID cards, create site operation rules, monitor cooperation for fire prevention, check transaction costs for valuables and give guidance to dealers, guidance for safe operations, give support that corresponds to any other problems that are perceived.)
	Design plan for the co-existence of waste-pickers and landfill methods	Establish a plan for disposal site operations that allows both activities of waste-pickers and sanitary landfill (1. unloading, 2. waste picking, 3. surface compaction, soil preparation and topsoil is carried out at regular intervals so that time is ensured for waste picking prior to laying the topsoil) Investigation for Area Division Plan Create landfill schema Establish a rotation schedule based on volume of waste disposed Create manuals for WP, SV, and operators
	Guidance for safety and methods for sanitary landfill to disposal site SV, operator	1. Based on the above-mentioned plan, provide guidance for sanitary landfill methods to the disposal site SV, and heavy equipment operators. The existing disposal site will be used because the new site is unfinished. In detail: Survey the landfill locations and define boundaries Prepare soil for landfill locations and perform leveling Maintain an entrance ramp to ensure collection vehicle access Prepare a borrow-pit for cover soil resources Implement sanitary landfill
	Reviewing the environmental monitoring plan, establishing a measurement work plan, and technical training for staff in charge of measurements	1. Carry out training for environmental monitoring as proposed in the Development Study for the new disposal site. The target for the training is the site supervisor. In detail: Define the items, frequency, location and analysis methods for monitoring Establish the implementation plan based on the plans for the project Practical skill training for measurement methods using monitoring instruments
Proper repair and	1. Establishing regular	Establish a plan for the education and training of

Field	Activity	Activity Details
management of collection equipment	inspection items, time period, spare parts procurement plan	the CMPUA supervisor for the proper maintenance of the equipment provided. In detail: Managing the equipment provisions (repair history, operation times, etc.) Establish an inspection plan and contact system Establish a system to manage spare parts and procurement methods
	2. Technical training for staff in charge of maintenance	Using the plan above, provide guidance and training to the CMPUA supervisor.
Managing collection vehicle dispatch	1. Guidance to establish a dispatch plan for the collection services division	1. This will enable the establishment of a dispatch plan giving consideration to the volume of waste from each zone and transportation distance to the disposal site. In detail: Volume of waste from each Khoroo Transportation distance Trips per day Required number of vehicles Prepare a backup system

Each of the activities listed above are arranged below to show the detailed content of activities implemented on a daily basis.

1) Activity 1.1 Checking the condition of the waste-picker (WP) organization and provide safety instructions

When Sanitary landfilling implement at the proposed Narangiin Enger disposal site (using heavy machinery to compact and then lay down topsoil) WP will be become an obstruction for sanitary landfill activities. However, WP who is socially vulnerable and WP are making a living at site. Therefore landfill activities must avoid bearing off WP activities from the standpoint of social consideration.

The Development Study laid out plans to construct a recycling complex immediately adjacent to the disposal site where separated waste will be collected, including valuable materials, creating an employment opportunity for WP by installing a hand-separating area within the complex. However, separate collection system is not established at present therefore construction of this hand-separating area was omitted from the application contents.

Accordingly, in order to construct the new disposal using sanitary landfill as stipulated in this project and plan for co-existence with WP, it will necessary to implement the transition of the WP into a manageable organization. In other words, while WP sought to recover valuable materials from within the disposal site, they will not allow picking through the waste freely as before, but will need to follow directives given by the disposal site manager (CMPUA).

Fortunately, when the pilot project of the Development Study was executed, the first stage of the organizational conversion of WP and a cooperative relationship was already progressing forward with the jica study team. In the future, this relationship will continue and improve by the site operator,

CMPUA, to be able to use the equipment provided for the new disposal site by the project effectively, which is key to carry out sanitary landfill procedures.

Here, CPMUA independently holds regular weekly meetings, and the result of such meetings will check once in the middle of the project to confirm the condition of the WP organization and provide guidance for Activity 1.1 waste-picker organization and safety guidance activities.

Table 2.37: Status check of waste-picker organization and safety instruction

Guidance Details
● Status check of waste-picker organization (mid-term) and guidance ➢ Translate past weekly meeting minutes and analyze the content ➢ Create the improvement plan ➢ CMPUA supervisor meetings with WPs ➢ Mid-term evaluation ➢ Guidance and instructions for CMPUA supervisor ➢ Guidance and instructions, accompaniment and advice for WPs
● Status check of waste-picker organization (final evaluation) and preparation for transfer to new disposal site ➢ Translate and analyze the content of past weekly meeting logs ➢ CMPUA supervisor meetings with WPs ➢ Final evaluation ➢ Rules of conduct in accordance with transfer to new disposal site ➢ Guidance and instructions for CMPUA supervisor ➢ Guidance and instructions, accompaniment and advice for WPs

2) Activity 1.2 Landfill method plan design to devise co-existence with waste-pickers

Table 2.38: Project Design Activities for Planning Waste-Picker Co-existence with Landfill Methods

Guidance Details
● Meeting on division methods for each area for 1) unloading, 2) wastepicking, 3) turning and preparing the soil and cover soil
● Establish a rotation schedule based on the amount of waste brought in and create an area division schema
● Create schema of landfill plan
● Create instruction materials for WPs, instructors, heavy machinery operators

3) Activity 1.3 Guidance for safety and sanitary landfill methods for disposal site instructors and heavy machinery operators

Table 2.39: Guidance activities for safety and sanitary landfill for disposal site instructors and heavy machinery operators

Guidance Details
● Survey landfill location based on schema of landfill plan, and define boundaries for each area
● Construction guidance for each area (practical guidance to make area

divisions for three disposal sites)
● Introduce activity methods to instructors for WP, collection vehicle and heavy machinery operators in each area
● Introduce methods to heavy machinery operators for soil preparation as well as leveling and compacting the waste at landfill location
● Instructor and heavy machinery operator activity monitoring
● Introduce maintenance method of entry ramp to heavy machinery operators to ensure access of collection vehicles into the site
● Introducing traffic guidance methods to instructors for collection vehicles
● Monitoring instructor and heavy machinery operator activities
● Introduce methods to heavy machinery operators for collecting soil from the borrow pit
● Introduce methods to heavy machinery operators for collecting soil at disposal site
● Guidance for implementation of sanitary landfill to instructors, heavy machinery operators and other related personnel

4) Activity 1.4 Reviewing the environmental monitoring plan, establishing a plan for monitoring operations, and technical guidance for staff in charge of monitoring

Table 2.40: Reviewing the environmental monitoring plan, establishing a plan for monitoring operations, and technical guidance for staff in charge of monitoring

Guidance Details
● Meeting and final decision on environmental monitoring items, frequency and locations, as well as analysis methods
● Meeting to establish implementation schedule based on environmental monitoring plan
● Prepare sampling using monitoring instruments as well as a management and reporting system for measurement data

5) Activity 2.1 Establish management plan, and plan for regular inspection items, time period, spare parts procurement

Table 2.41: Activity schedule to establish management plan, and plan for regular inspection items, time period, spare parts procurement

Guidance Details
● Introduction and instruction of administration techniques (e.g. ledger and vehicle repair history) of equipment supplies (i.e. collection vehicles) going to the Central Workshop
● Introduction and instruction on administration techniques (e.g. ledger and vehicle repair history) for equipment supplies going to Nalaikh district
● Introduction and instruction on administration techniques (e.g. ledger and vehicle repair history) of equipment supplies going to Ulaanbaatar City CMPUA/NEDS, Site Administration Division (i.e. bulldozer, excavator, wheel loader, water tank lorry, dump truck), and guidance to establish a contact system
● Guidance for the Ulaanbaatar City CMPUA/NEDS, Site Administration Division to establish a management system for spare parts for equipment supplies (e.g. bulldozer, excavator, wheel loader, water tank lorry, dump truck) and procurement methods
● Guidance to the Central Workshop and 7 districts to establish a management system for spare parts for the compactor truck and dump truck with canopy, as

well as procurement methods.

6) Activity 2.2 Technical guidance for maintenance supervisor

Actual guidance for the supervisor in charge pertaining to the implementation plan details for the equipment management plan established above in activities 2.1 shown above will give once the procured equipment arrives at the site.

Table 2.42: Activity schedule for technical guidance for maintenance supervisor

Guidance Details
● Guidance and training for the maintenance supervisor concerning the management plan for collection equipment at the Central Workshop (15m^3 compactor truck, 8m^3 compactor truck, dump truck with canopy, wheel loader)
● Guidance and Training for the maintenance supervisor at NEDS for the management plan concerning specialized vehicles (bulldozer, excavator, wheel loader, water tank lorry, dump truck)

7) Activity 3.1 Support to establish a vehicle dispatch plan for the collection services division

Table 2.43: Support to establish a vehicle dispatch plan for the collection services division

Guidance Details
● Guidance to establish a vehicle dispatch plan for the apartment area is given to the dispatcher at the Collection Services Division
● Guidance to establish a vehicle dispatch plan for the Ger area is given to the dispatcher at the Collection Services Division
● Prepare a back-up system in case of damages with the dispatcher at the Collection Services Division

(5) Procurement methods for resources to implement soft component

The soft component for this project will carry out in the form of direct support by this consultancy.

The soft component in this project is to guide the basis of solid waste management, which is to guide the equipment maintenance from first stage of the launch. The CMPUD currently executes collection services, but the equipment and materials to be provided in the project will under direct management of a the new organization, CMPUA, so the support provided by the soft component is not merely guidance for disposal methods and collection and transportation methods that will provide in the case that solid waste management will establish to some extent. The initial activities of this newly founded organization are promoted on the basis of the function and role of the newly built Narangiin Enger disposal site and the equipment provided for that purpose, such that guidance for the operation and maintenance of that equipment, establishing the basic design and monitoring the procurement of those equipment and materials is more effectively carried out by this consultancy to maintain consistency rather than appointing another organization for short-term technical guidance. However, for activities which require continuous development over a long period of time, such as

maintaining cooperation with waste-pickers, that a local resource should be primary to perform this effectively.

(6) Implementation Schedule of Soft Component

Implementation schedule of soft component is shown below.

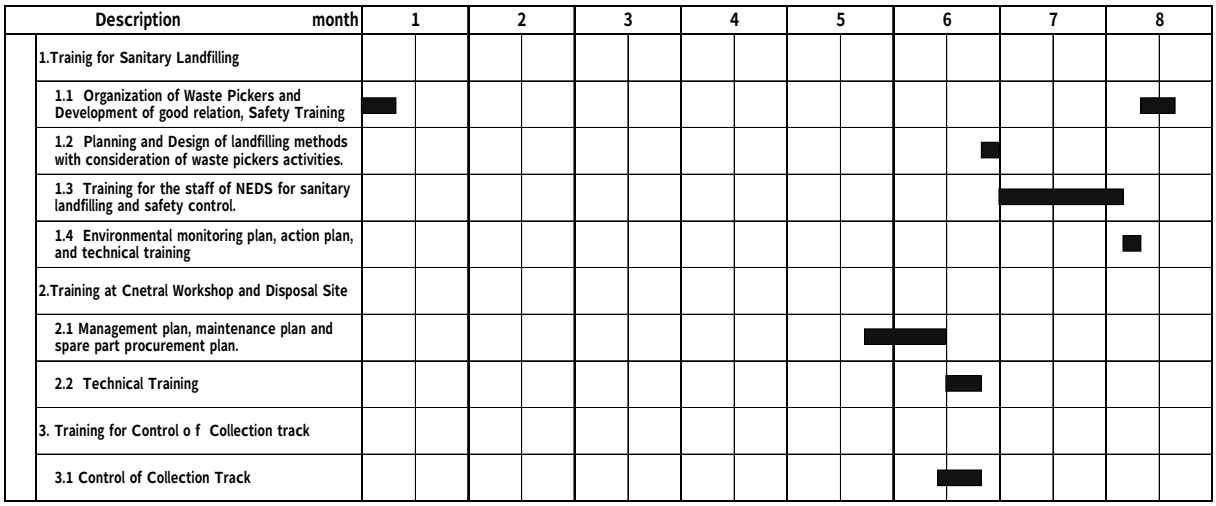


Figure 2-25: Implementation Schedule for Soft Component

(7) Output of the Soft Components

Outputs of the soft components are as follows.

- Report of completion (both for Recipient country and Japanese)
- Soft component implementation reports
- Registration records of waste pickers and Minutes of meetings
- Plan for Sanitary landfilling
- Environmental monitoring plan, Training records.
- Collection truck maintenance plan.

(8) Obligation of Recipient Country

Obligations of recipient country are as follows. (Ulaanbaatar City: CMPUA)

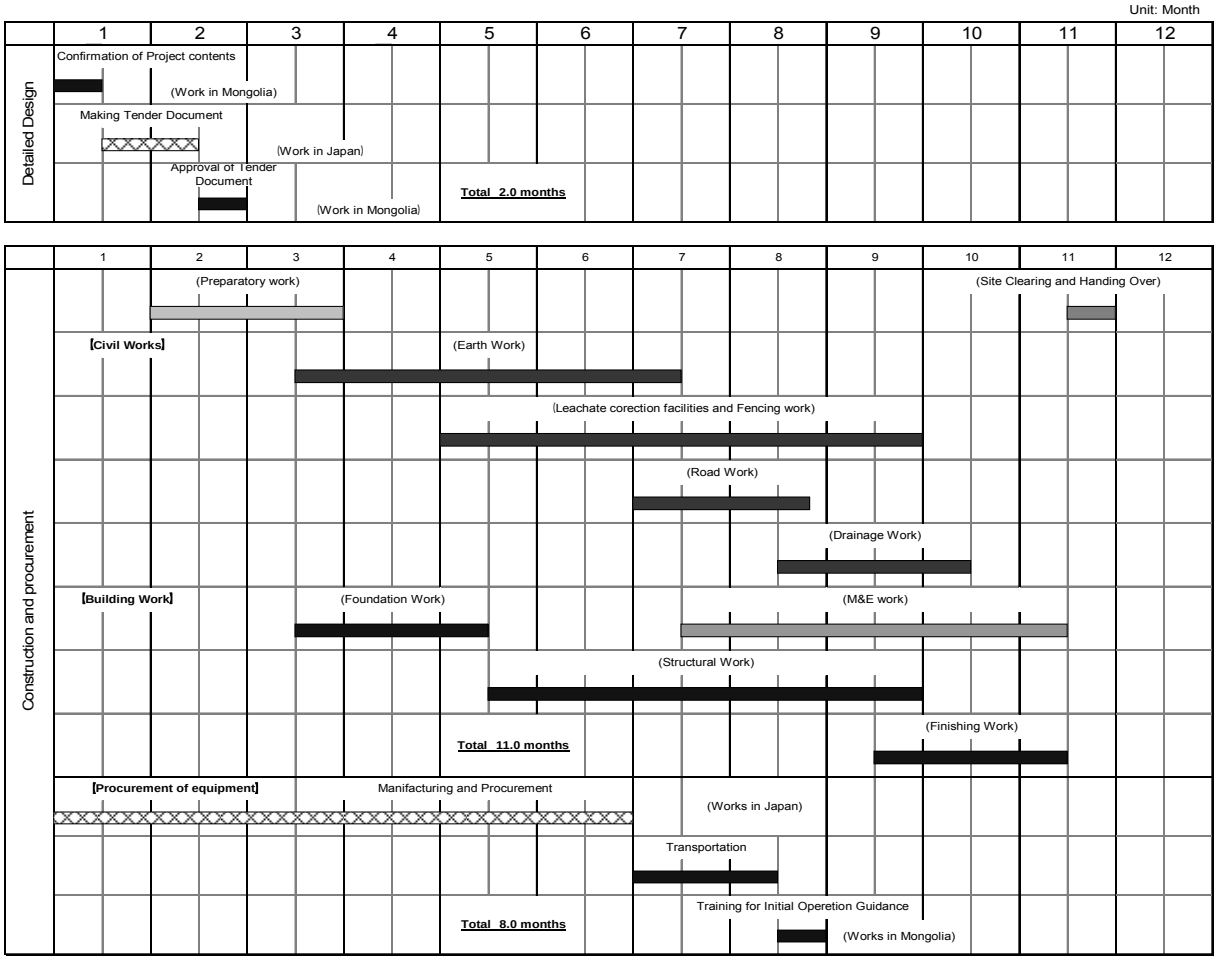
Organization	Obligations
Waste Management Division・Disposal Site Operation Section	Decision of Responsible Organization of NEDS and selection of personnel in charge of NEDS operation. Attendance to the waste pickers meetings and providing assistance. Participation to the formulation of the plan for sanitary landfilling operation Formulation of monitoring plan Coordination with relevant organizations such as Ministry of Environment. Proper operation of facilities after control is fully transferred.
Chief Engineer	Selection of responsible personnel for management of

	collection trucks. Participation to the formulation of maintenance plan. Formulation of implementation plan based on the maintenance plan. Proper maintenance after handing over equipment.

2-2-4-9 Implementation Schedule

Following is the implementation schedule for the Project.

Table 2.44: Implementation Schedule



2-3 Obligation of Recipient Country

2-3-1 Items Agreed on September 8 2006.

Following items which will be carried out or provided by the Mongolian side prior to implementing Japanese Grant Aid are agreed and signed on September 8, 2006 as a Minutes of Discussion on the Basic Design.

(1) Monitoring Plan for NEDS

The monitoring items and placement of monitoring has been verified in the Minutes, that Ulaanbaatar City shall execute the monitoring of measurement items proposed in the Development Study as well as the Mongolian EIA for NEDS which is newly established in this plan. In addition, it was verified that Ulaanbaatar will secure the necessary staff and budget for monitoring.

(2) Resettlement of Ger Houses within the site of NEDS

The area scheduled for Narangiin Enger disposal site is currently occupied by 2 families consisting of 7 nomadic people living in a Ger. However, it has been verified that Ulaanbaatar City will take the necessary measures to ensure the relocation of these families by the end of August 2007 to an alternative location that will be provided. The land planned for the disposal site is municipal land and any occupation of the land is illegal, by which Ulaanbaatar City explained to the effect that there is no objection in relocating the inhabitants.

(3) Sanitary Landfill at NEDS

The Mongolian side agreed that Ulaanbaatar city will operate sanitary landfill at NEDS after completion of construction of NEDS and procurement of machineries by the Project. In addition, Ulaanbaatar city agreed to allocate the necessary budget and staff.

(4) Construction of Central Workshop

The Mongolian side agreed that the Central Workshop will be constructed by the Mongolian side by the end of 2007 and the necessary budget will be approved by the end of December 2006.

(5) Provision of Collection Service to all the households in Ulaanbaatar City

This project was requested based on Development study and the study recommended that Ulaanbaatar city will provide collection services to all the households in Ulaanbaatar City including the Ger area, by the year 2010 (collection service is provided 60~70% to Ger area at present moment and having a problem that Ger area collection fee is higher than apartment area).

The Ulaanbaatar city explained that collection service will be provided for all of Ulaanbaatar citizens by 2010, and promised to make all possible efforts to realize this goal including reorganization of waste management and financial system for solid waste management.

(6) Greenbelts for NEDS

The EIA report recommended having a Green belt surrounding of new Disposal site to mitigate environmental impact. Both sides confirmed that trees for NEDS greenbelts shall be planted and

maintained by the Mongolian side and a fence shall be installed by the Japanese side.

2-3-2 Items Agreed on September 29, 2006

The following items were agreed and signed on September 29, 2006 as a Technical Note.

(1) Waste Water Discharge from NEDS

Sewage water should be stored inside of the Disposal Site, not discharged to the surroundings. The Mongolian Side agreed that CMPUA, under the Ulaanbaatar City, will arrange for a vacuum truck periodically in order to vacuum the waste water and transport to the designated discharge point.

(2) Telephone and Electricity Line Installation

The Mongolian side agreed that the telephone and electricity line including transformer up to the gate of NEDS shall be provided by the Mongolian side.

(3) Procurement of Collection Truck

The Mongolian side agreed that the procurement of the collection truck will be done by both Japanese side and Mongolian side in order to give collection services to all the residents in the Ger area by 2010.

(4) Hazardous Waste

The Mongolian side agreed that the hazardous wastes such as hazardous medical waste and hazardous industrial waste should not be transported into 4 registered disposal site including NEDS, in addition Mongolian side agreed and will take necessary action for hazardous waste.

2-3-3 Items Agreed on January 18, 2007.

The following items were agreed and signed on January 18, 2007 as a Minutes of Discussion on the Basic Design.

(1) Budget and Personnel Allocation for Operation and Maintenance

The Japanese side presented the necessary operation and maintenance costs for NEDS and utilising procured equipments. The Mongolian side agreed to secure all the necessary budget and personnel.

(2) Monitoring Plan of the Narangiin Enger Disposal Site (NEDS) by the Mongolian side

The Japanese side presented the necessary cost and monitoring frequency for environmental

monitoring for NEDS. The Mongolian side agreed to conduct periodical environmental monitoring in NEDS and promised to arrange necessary financial arrangement.

(3) Obligations of the Mongolian Side for implementing the Project

The Japanese side presented necessary costs and the Mongolian side shall prepare an access road to NEDS, renovation of the Central Workshop and warm garage. The Mongolian side agreed to take necessary measures and bear the necessary costs.

(4) Submersible Pump for recirculation of leachate treatment in NEDS

Based on EIA results, a leachate treatment facility shall be installed in NEDS and the leachate treatment facility will be constructed by Japan side. The Mongolian side agreed to purchase a submersible pump for recirculation of leachate in NEDS by its own budget before the completion of construction of NEDS.

2-3-4 Items Agreed on January 25, 2007.

Following items are agreed and signed on January 25, 2007 as a Technical Note.

(1) Utilities supply and construction of facilities at Central Workshop

Capacity requirements for electricity and volume of clean water were discussed and agreed to be supplied by the Ulaanbaatar City, and a car washing bed, its associated facility will be constructed by the Mongolian Side.

(2) Equipment for Environmental Monitoring

The Mongolian side agreed to procure necessary equipment for environmental monitoring at NEDS except the equipment which will be supplied under Grant Aid.

2-3-5 Items Agreed on March 23, 2007.

The following items were agreed and signed on March 23, 2007 as a Minutes of Discussion on the Basic Design.

(1) Fortnightly meetings with Waste Pickers

The Mongolian side promised to hold fortnightly meetings and submit minutes of meeting with waste pickers in order to achieve and maintain close relationships with them.

(2) Renovation of Central Workshop and Warm Garage

The Mongolian side agreed to submit a schedule of the renovation of the Central Workshop and

warm garage, and confirmed the warm garage renovation will be completed by the end of 2007.

(3) Landfill equipment for Morin Davaa Disposal Site (MDDS)

The Mongolian side agreed that the landfill equipment for MDDS will be supplied upon getting approval of EIA for MDDS by July 2007.

2-3-6 Other Agreed Items

In the implementation of the Japanese Grant Aid Scheme, the recipient country is required to undertake such necessary measures as the following:

1) To secure land necessary for the sites of the project and to clear, level and reclaim the land prior to commencement of construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.
4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.
6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts, such facilities that may be necessary for their entry into the recipient country and stay therein for the performance of the work.
7) The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those converted by the Grant Aid.
8) The products purchased under the Grant Aid should not be re-exported from the recipient country.
9) 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 "Bank"). The Government of Japan will execute the Grant by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under verified contracts. 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 the recipient country or its designated authority.

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

2-4 Project Operation Plan

2-4-1 Basic Policy for Project Operation Plan

The proposed facility (NEDS) and all of the to be procured equipment (landfill equipment, collection vehicles, monitoring equipment and maintenance tools for central workshop) under the project will operate and maintain by the CMPUA of Ulaanbaatar City, and its organization chart is shown in the figure below.

CMPUA was established in September 15, 2006 as the successor to CMPUD. Five out of nine staffs were transferred from CMPUD to CMPUA and are in charge of solid waste management in Ulaanbaatar City. 28 staffs are to be under CMPUA in the end of 2006 and it will be increased to 45 staff at the end of 2008. Furthermore, operational staff such as the operator of the equipment and mechanics can be employed under the power of the director of CMPUA.

It is important for CMPUA to strengthen its operational capability through the soft component of the Grant Aid in order to operate and maintain these facilities and equipment appropriately, aiming to achieve the target of year 2010.

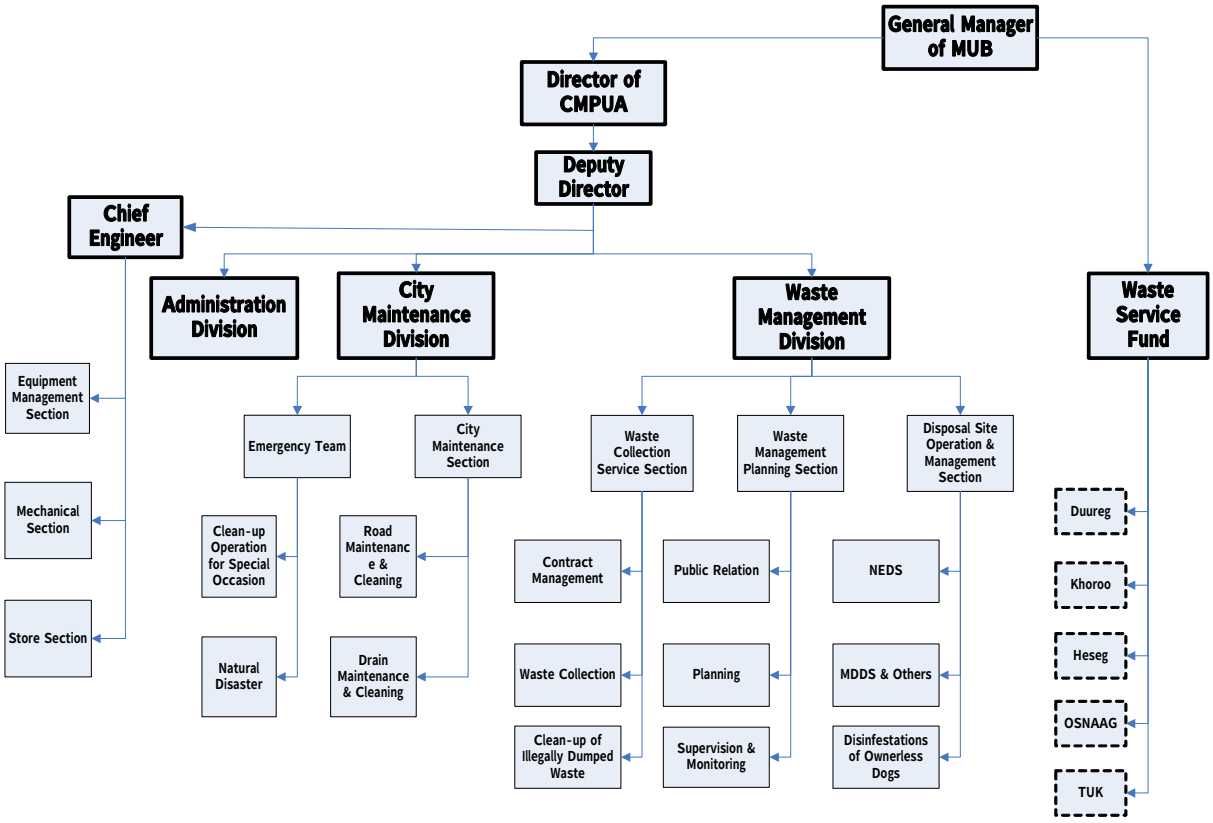


Figure 2-26: Organization of CMPUA

2-4-2 Operation and Maintenance Plan for the Equipment

The equipment to be procured and landfill equipment will be operated and maintained by the Chief of the engineer section in the above CMPUA. At present, the organisation is trying to familiarise itself with operation and maintenance work using existing equipment which were procured by Japanese Grassroots Grant Aid Scheme.

(1) Organization

The management of maintenance section under the chief engineer of CMPUA will be formed according to the following figures.

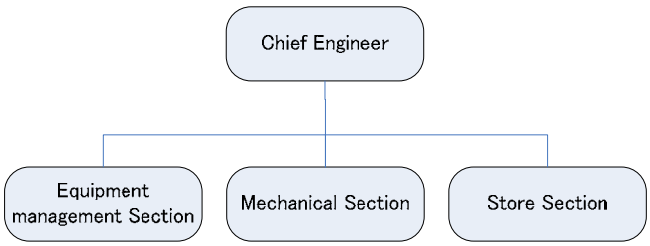


Figure 2-27: Organization of Central Workshop

(2) Duties of each section

Following are the duties of each section.

Equipment Management Section

Item	Duties
Equipment	Periodical service management Equipment ledger management Repair record management
Others	Subcontractor management Equipment arrangement

Mechanical Section

Equipment	Duties
Collection Trucks	1 and 3 month periodical maintenance Minor repairs
Heavy Equipment	50,100,250 hr periodical maintenance Minor repairs
Record	Periodical maintenance records General repair records Daily work sheet

Store Section

Frequency	Duties
Daily	-Spare parts and materials in-out management -Material ledger (issue voucher) -Order and purchase of spare parts and materials
Monthly	-Inventory
Yearly	-Inventory

(3) Personnel

The Ulaanbaatar City intent arrange for experienced and skilled personnel for the maintenance section. The minimum requirement calls for an engineer, technician (or senior mechanic), mechanics and store keeper and equipment management officer. The number of personnel and their qualifications are as follows.

Table 2.45: Required Personnel

Position	Number	Qualifications
Engineer/Workshop Manager	1	More than 10 years experience of workshop management, both heavy and light duty equipment. Applied mechanical engineer by recognized authorities.
Technician (or senior mechanic)	1	More than 15 years experience of site duties of equipment maintenance or 7 years experience of applied technician.
Mechanic	3	More than 5 years experience of site duties for light and heavy equipment
Mechanic helper	3	More than 3 years experience of site duties for light and heavy equipment
Store keeper	1	More than 7 years experience store management. PC skills will be required.
Equipment management officer	1	More than 10 years experience of head driver or transport officer.
Office Clerk	1	More than 3 years experience as a clerk. PC skills will be required.
Accountant	1	More than 15 years experience as an accountant. Qualification by authorities will be required.

(4) Layout of Central Workshop

The Central workshop will include a body repair yard, tire repair yard, battery repair yard, welding yard, spare part store, administrative office and car washing bay, and be constructed by the Mongolian side. Maintenance of heavy equipment (Bulldozer, Excavator, Wheel loader etc.) will be carried out at the warm garage located in NEDS. In addition, the sewerage pipe for discharging waste water from car washing will be prepared by the Mongolian side.

Following is the layout plan for the Central Workshop.

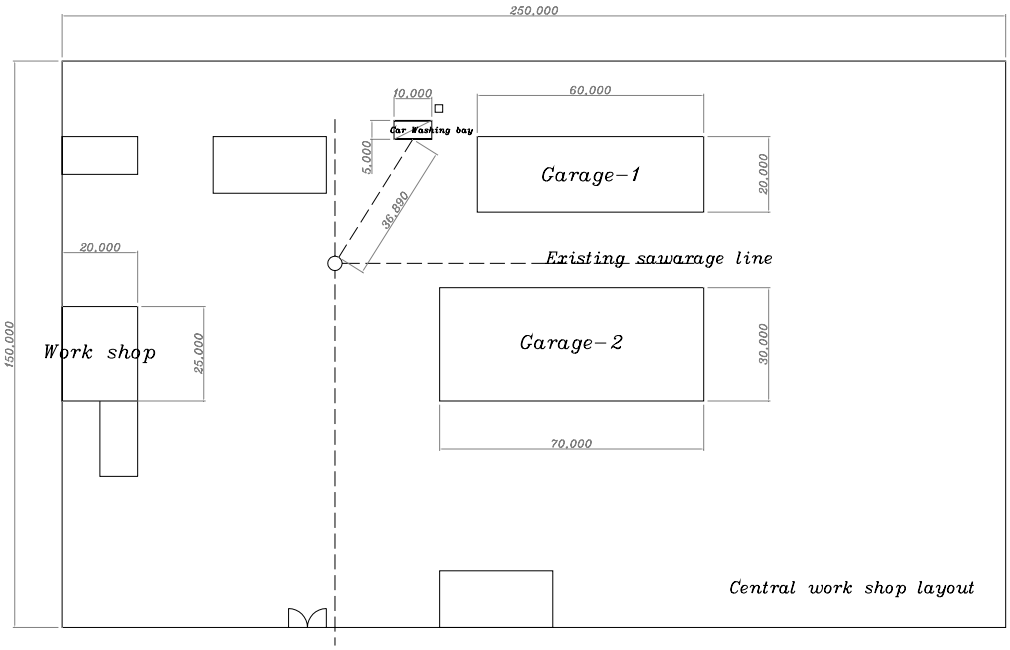


Figure 2-28: Layout of Central Workshop and Warm Garage

(5) Contents of the Maintenance Work

Actual economic life and operation efficiency of waste collection and land fill equipment depends on the degree of maintenance. However, it is difficult for CMPUA to carry out all of the maintenance work. In light of this situation, all the management duties (such as equipment ledger, equipment arrangement, record, etc.) is done directly (the Municipality of Ulaanbaatar: MUB) and maintenance duties will be divided into 3 stages: the first stage, such as daily checks and minor repairs should be done by the person responsible for the equipment (i.e. the user, company/institution) and the next stage such as 1, 3 month periodical maintenance for vehicles 50, 100, and 250 hrs periodical maintenance for heavy equipment and medium repairs are done directly (MUB workshop) and other periodical and heavy repairs are done by an authorized dealer or professional workshop (private). According to the investigation, some authorized dealers and professional garages have the required technical support capability and system. Intensive periodical maintenance (6, 12 month or 500, 1000, 2000 hrs) and heavy (overhaul) work shall be done in those workshops or professional garages (or suitable institutions). Following is the maintenance plan.

Table 2.46: Maintenance Plan

	Vehicle Compactor, Skip loader, Dump truck Truck, Pick-up	Heavy equipment Bulldozer, Wheel loader, Excavator
Operators and its organization	-Daily Oil, grease, cooling water refilling. working condition of engine, battery, brake, suspension, clutch etc. -Checking before after working Condition of brake, clutch, engine starting, suspension condition check by driver.	-Daily checking oil, grease, cooling water refilling, working devises, track, etc. -Before & after working checking Brake, clutch, engine ,suspensions condition check by operator
MUB workshop	-1 month periodical maintenance. Engine oil/filter change, brake clutch check & adjustment, T/M, D/F oil check etc. -3month periodical maintenance Engine oil/filter, fuel filter change, brake, clutch check & adjustment etc. -Medium repair works Clutch plate, brake lining change, battery charge, welding works, tire service etc.	-50,100hrs periodical maintenance. Lubricant check & refill, brake check & adjustment, transmission check, track check & adjustment etc. -250hrs periodical maintenance Engine oil & filter change, lubricants check & refill, track check & adjustment (including bucket) etc. -Medium repair works Track shoe, end bit, tooth change, minor electrical & welding service etc.
Sub contract garage.	-6month periodical maintenance. Engine oil/filter, fuel filter change, gear oil change, lubricant check & refill, brake lining check, replace & adjustment, clutch check replace & adjustment, suspension lubrication check & refill etc. -12 month (1 year) periodical maintenance. Engine oil/filter, fuel filter change, gear oil change, air element change, coolant change and all 6 month periodical services. -Normal repair works All repair works other than UMC duties(all over haul works)	-500hrs periodical maintenance. Engine oil/filter, fuel filter change, T/M oil /filter change. Air element change including all 250hrs period maintenance. -1000hrs period. maintenance. 500hrs+antifreeze, hydraulic oil change including all 500hrs period maintenance (-250hrs periodical maintenance Depend on contents of works.) -Normal repair works All repair works other than UMC duties(all over haul works)

2-5 Project Cost

2-5-1 Initial Cost Estimation

The total project cost necessary to implement this project is 10.57 hundred million Yen. The project cost breakdown, based on the division of responsibility for both Japan and Mongolia shown above, is estimated according to the conditions of the quotation shown below in (3), as follows. However, this initial cost estimation does not show the provision limit amount of the exchange of notes.

(1) Obligation of Japanese side

The following costs shall be born by the Japanese side.

The project for improvement of waste management in Ulaanbaatar

Estimated project cost 1,005 million Japanese yen

Description		Project Cost (Million Yen)	
Facilities	Control Building, Weigh bridge, Toilet, Fire fighting tank, Sewage tank, Embankment dam, Collection Pipe, Drainage, On-site road, Leachate Treatment facility, etc.	294	941
Equipment	Compactors, Dump trucks, Wheel shovel with excavator, Bulldozer, Excavator, Water Trucks, Tools for Central workshop, Monitoring equipment.	647	
Detailed Design/Supervision・Soft component			64

(2) Obligation of Mongolian Side

The following costs shall be born by the Mongolian side.

512.3 million MNT (approx. 52.10 million Japanese yen)

①.	Preparation of access road	120 million MNT	(approx. 12.20 million JY)
②.	Renovation cost of central workshop	200 million MNT	(approx. 20.34 million JY)
③.	Installation of electricity and telephone line	24 million MNT	(approx. 2.44 million JY)
④.	Planting in Green belt	150 million MNT	(approx. 1.86 million JY)
⑤.	Others	18.3 million MNT	(approx. 15.26 million JY)

(3) Condition of Quotation

1) Time of Estimation

Project cost was estimated in October 2006 when the field survey of the Basic Design Study was completed.

2) Exchange rate

Project cost was calculated based on the average exchange rate in six months from September 30,

2006 to March 31, 2007.

1 US$ = 118.58 Yen

1 MNT = 0.1017 Yen

3) Schedule for Facility Construction and Equipment Procurement

Schedule for facility construction and equipment procurement is shown in the implementation schedule.

4) Others

Project cost was estimated according to the Guideline of Japanese Grant Aid.

2-5-2 Operation and Maintenance Costs

There are operation costs required for the yearly operation and maintenance including collection and transportation of wastes, and environmental monitoring for the NEDS facility, as well as for the Central Workshop.

(1) Collection and Transportation of Wastes

Following table shows the necessary annual operation and maintenance cost for collection and transportation of wastes in 2010.

Table 2.47: Annual O & M cost for collection and transportation of Wastes in 2010

Unit: million MNT

	Compactor 15m^3	Compactor 8m^3	Dump Truck	Total
Salary	165	51	595	811
Fuel	390	64	755	1,209
Spare Parts and Maintenance	217	57	535	809
Depreciation			860	860
Total	772	172	2,745	3,689

(2) Final Disposal

The necessary operation and maintenance cost and environmental cost for NEDS in 2010 are shown below. In fact 70% of cost occupied by procurement of spare parts which landfill equipments such as bulldozer and excavator.

Table 2.48: O & M Costs for NEDS in 2010

Description	Amount (1,000MNT/year)
Salary	27,504
Fuel for Landfill Equipment	289,354
Spare parts	79,416
Electricity and Heating	50,400
Maintenance of facilities (extension of gas extraction pipe)	37,200
Others	17,126
Total	501,000

Table 2.49: Cost for Environmental monitoring

Unit: thousand MNT

Monitoring Item	Amount
Air pollution	400
Soil	450
Ground water	2,300
Noise	10
Settlement	20
Total	3,180

(3) Central Workshop

Operation and maintenance costs for the Central workshop are shown below.

Table 2.50: O & M Costs for Central Workshop

Description	Amount (1,000MNT/year)
Salary	15,000
Fuel	17,000
Tools	34,000
Electricity and Heating	20,000
Total	86,000

(4) Summary of Annual O & M cost

Following tables shows the summary of annual Operation and Maintenance cost for the project.

Table 2.51: Summary of O & M Cost in 2010

Unit: million MNT

Item	Amount
Collection and Transportation	3,689
Central Workshop	86
Disposal Site	502
Environmental Monitoring	3,180
Total	7,457

(5) Financial Analysis

Cost for collection and transportation of wastes in the Ulaanbaatar City is solely born by the waste fee collected from residents and business entities. Hence, cost for operation of the disposal site is partially born by the disposal fee charges to the business entities and the balance was covered by the general revenue of the Ulaanbaatar City.

A new collection and disposal fee was proposed, based on the recommendation of the Development study, and approved by the City Cabinet in August 24, 2006 and came into force from September 1, 2006. The following table indicates the previous and revised collection fee.

Table 2.52: Collection and Disposal Fee

Description	Previous Fee	Revised Fee
Business waste	19,000 MNT/truck or 4 ton	35,000 MNT/truck or 4 ton
Household waste (Apartment area)	200 MNT/person/month、 600 - 1,000 MNT/HH/month	1,200 - 2,000 MNT/HH/month (depend on district)
Household waste (Ger area)	1,000 - 1,500 MNT/HH/month (depend on district)	1,500 - 2,500 MNT/HH/month (depend on district)
Household waste (Summer House)	2,000 MNT/HH/month	2,500 MNT/HH/month
Public Area Cleansing	18 MNT/1m^2	50 MNT/1m^2
Final Disposal	100 MNT/1m^3	2,080 MNT/ton

HH: House Hold

At this moment (as of May 2007), revised collection and disposal fee was applied to the resident and business entities. If the fee collection rate of the apartment area is assumed to be 90% (fee collection rate in 2004 is 86 %) and that of the Ger area is maintained as it is (42% in 2006), the annual income from the collection fee is calculated as 4,072 million MNT in 2010. Hence, the annual income from the disposal fee is calculated as 153 million MNT in 2010.

Therefore, total income from waste collection and disposal fee will be 4,225 million MNT in 2010. As a result, there will be a deficit of 57 million MNT and CMPUA needs to compensate from the general revenue of the Ulaanbaatar City.

This 57 million MNT is merely 25 % of the annual budget of CMPUA in 2006 (200million MNT) and it is concluded that necessary operations and maintenance will be carried out by CMPUA satisfactorily.

Financial analysis of waste management in 2010 is shown as below.

Table 2.53: Financial analysis of waste management in 2010

Cash flow analysis			unit	Bayabgol	Bayazulkh	Songino	Sukhbaatar	Khan Uul	Chingeltei	Nalaikh	Total
Basic Data	Population	Apartment	nos	179,361	151,131	97,549	62,400	45,743	61,297	14,881	612,362
		Ger	nos	26,160	60,989	102,725	56,448	44,325	71,761	12,910	375,318
		Total									987,680
	Household	Apartment	hh	39,858	33,592	21,682	13,869	10,167	13,624	3,307	136,100
		Ger	hh	7,541	24,780	27,046	11,741	10,887	19,230	3,889	105,115
		Total									241,215
	Waste Collection Amount	Apartment	t/year	17,622	14,832	9,594	6,138	4,500	6,030	1,458	
		Ger	t/year	5,472	12,780	21,474	11,826	9,288	14,994	2,718	
		Business	t/year	4,554	4,932	2,160	3,528	1,944	3,312	180	
		Road and Park	t/year	1,116	882	594	1,296	684	882	108	
		Construction	t/year	7,452	8,370	8,856	5,166	3,924	5,940	1,188	
		NH-Industrial	t/year	6,156	4,608	3,420	4,032	8,712	2,844	468	
		NH-Medical	t/year	1,116	1,260	1,368	792	612	900	180	
		Total	t/year	43,488	47,664	47,466	32,778	29,664	34,902	6,300	242,262
	Waste Collection Fee	Apartment	MNT/mth	2,000	2,000	1,500	2,000	2,000	2,000	1,200	
		Ger	MNT/mth	2,500	2,500	1,500	2,500	2,500	2,500	1,500	
		Business	MNT/ton	8,750	8,750	5,000	8,750	8,750	8,750	5,000	
		Road and Park	MNT/ton	8,750	8,750	5,000	8,750	8,750	8,750	5,000	
		Construction	MNT/ton	8,750	8,750	5,000	8,750	8,750	8,750	5,000	
		NH-Industrial	MNT/ton	8,750	8,750	5,000	8,750	8,750	8,750	5,000	
		NH-Medical	MNT/ton	8,750	8,750	5,000	8,750	8,750	8,750	5,000	
Income	Income fron Waste Collection Fee (Fee collection rate is assumed to be 100%)	Apartment	1000MNT/y	956,592	806,197	390,277	332,867	244,016	326,988	47,622	3,104,557
		Ger	1000MNT/y	226,241	743,402	486,830	352,243	326,615	576,915	69,999	2,782,245
		Business	1000MNT/y	39,848	43,155	10,800	30,870	17,010	28,980	900	171,563
		Road and Park	1000MNT/y	9,765	7,718	2,970	11,340	5,985	7,718	540	46,035
		Construction	1000MNT/y	65,205	73,238	44,280	45,203	34,335	51,975	5,940	320,175
		NH-Industrial	1000MNT/y	53,865	40,320	17,100	35,280	76,230	24,885	2,340	250,020
		NH-Medical	1000MNT/y	9,765	11,025	6,840	6,930	5,355	7,875	900	48,690
		Total	1000MNT/y	1,361,281	1,725,054	959,096	814,732	709,546	1,025,335	128,241	6,723,285
	Fee Collection Rate ①	Apartment:		90%	90%	90%	90%	90%	90%	90%	
		Ger:		42%	42%	42%	42%	42%	42%	42%	
		Business		97%	97%	97%	97%	97%	97%	97%	
		Road and Park		0%	0%	0%	0%	0%	0%	0%	
		Construction		20%	20%	20%	20%	20%	20%	20%	
		NH-Industrial		97%	97%	97%	97%	97%	97%	97%	
		NH-Medical		97%	97%	97%	97%	97%	97%	97%	
	Income fron Waste Collection Fee based on the fee collection rate①	Apartment	1000MNT/y	860,933	725,577	351,249	299,580	219,614	294,289	42,859	2,794,102
		Ger	1000MNT/y	95,021	312,229	204,468	147,942	137,178	242,304	29,400	1,168,543
		Business	1000MNT/y	38,652	41,860	10,476	29,944	16,500	28,111	873	166,416
		Road and Park	1000MNT/y	0	0	0	0	0	0	0	0
		Construction	1000MNT/y	13,041	14,648	8,856	9,041	6,867	10,395	1,188	64,035
		NH-Industrial	1000MNT/y	52,249	39,110	16,587	34,222	73,943	24,138	2,270	242,519
		NH-Medical	1000MNT/y	9,472	10,694	6,635	6,722	5,194	7,639	873	47,229
		Total		1,069,368	1,144,119	598,271	527,450	459,297	606,876	77,463	4,482,844
	Expence for Feee Collection										
	Apart	OSNAG	%	6%	6%	6%	6%	6%	6%	6%	
	Ger	Khoroo	%	10%	10%	10%	10%	10%	10%	10%	
	Annual Expence		1000MNT/y	61,158	74,758	41,522	32,769	26,895	41,888	5,512	284,502
	City Waste Fund	CMPUA	%	3%	3%	3%	3%	3%	3%	3%	
	Annual CWF		1000MNT/y	30,246	32,081	16,702	14,840	12,972	16,950	2,159	125,950
	Net Income from Fee		1000MNT/y	977,964	1,037,280	540,047	479,841	419,430	548,038	69,792	4,072,392
Other Income	From MUB budget	Disposal Operation									50,608
	Income form Private Co.	Business waste									153,000
Total Income											4,276,000
Expence	Waste Collection	Waste Collection	1000MNT/y								3,689,000
		Central Workshop	1000MNT/y								86,000
		Total									3,775,000
	Final Disposal	NEDS	1000MNT/y								501,000
	Total Expence										4,276,000
Balance											0

2-6 Other Relevant Issues

(1) Strengthening of CMPUA

CMPUA is the new organization which started operations in September, 2006 and is solely in charge of solid waste management in the Ulaanbaatar City. CMPUA has been set up and institutional reform for solid waste management in the Ulaanbaatar City is in progress in order to improve collection services to all the residents. Strengthening of this new organization will be done gradually using the collection trucks which were donated through recycling Grant Aid before equipment will be supplied under this Grant Aid project. Furthermore, it is important to utilize technical assistance (soft component) in order to achieve the project outcome.

(2) Waste Service Fund and Waste Fee Collection System

The Ulaanbaatar City has introduced and enforced Waste Service Funds and a new waste collection system from January 1, 2007. The progress of the fund depends on the districts, and three districts (Bayangol, Songinokhairkhan, Bayanzurkh) have started to collect waste fees and pooled them into a fund. The other three districts have been progressing more slowly. This fund and fee collection system is essential for CMPUA to start operation of waste collection directly; therefore, careful attention will be paid to their progress.

(3) Renovation of Central Workshop and Warm Garage

Renovation of the Central workshop and warm garage will be done by the Mongolian side. Budget allocation was done and renovation work will start soon and be complete by the end of 2007. Progress of this work should be carefully monitored.

The project index and baseline survey results are presented as follows.

Table 3.2: Project Index and Baseline Survey Results

Project Index	Baseline Survey Results
Collection Rate per population Present: Apartment Area: 100% Ger area: 42% Target（2010） Apartment area: 100% Ger area: 80%	• Collection rate is that which gives the percentage of people who receive collection services, not taking quality of service into account. At this time, collection services are provided for **100%** of the apartment area, but in the Ger area, only people who pay a collection charge are receiving collection service. Thus only **42%**[4] of the people in the Ger area are receiving collection services. • These figures are considered as the baseline survey result. But in the future, the collection fee system will be changed, such that a cross-subsidy system will be adopted; an interview survey needs to be carried out in order to understand the collection rate in Ger area.
90% of the wastes generated in UB city will be landfilled in a sanitary manner. Present: Open Dumping Target（2010） NEDS: Level 4 of SL MDDS: Level 2 of SL SL: Sanitary Landfill	• Around 90% of the wastes generated in UB city are disposed in UCDS. NEDS will be constructed next to UCDS and will receive the same amount of the waste as previously received at UCDS. Level 4 of sanitary landfilling will be executed in NEDS instead of open dumping in UCDS. • 5% of the wastes generated in UB city will be disposed at MDDS. And level 2 of sanitary landfilling will be executed in MDDS with supplied landfill equipment.

[4] Basic study team has conducted interview survey to each khoroo government in Sep. 2006.

3. Project Evaluation and Recommendations

3 Project Evaluation and Recommendation

3-1 Project Effects

3-1-1 Project Effects

The following are the effects for the target "Solid Waste shall be properly collected, transported, and disposed in Ulaanbaatar City" which are expected following the implementation of the project.

Table 3.1: Project Effect

Current Problem	Measures	Direct Effect	Indirect Effect
There is not enough equipment for collection and transportation, and what there is is very old. Furthermore, the majority are dump trucks for which collection efficiency is low.	30 compactor trucks and 13 dump trucks with canopies will be supplied	Collection service will be provided for all the residents in apartment area and 80% of the residents in Ger area.	Living environment will be improved in Ger area by providing more collection services.
The existing Ulaan Chuluut disposal site (UCDS) where 90% of the wastes are transported, will be full in year 2008.	Narangiin Enger disposal site (NEDS) will be constructed next to UCDS.	NEDS will be ready for operation to dispose 90% of the wastes in Ulaanbaatar instead of UCDS, which will be full in around two years.	Surrounding environment in NEDS will be improved.
No protection measures against the surrounding environment, such as soil cover, were taken in the existing landfill site.	Sanitary landfill equipment such as bulldozer, excavator, dump truck and wheel shovel will be supplied.	90% of the wastes will go to sanitary landfill at NEDS and 5% of the wastes will go to semi sanitary landfill at MDDS.	Surrounding environment in NEDS and MDDS will be improved.
There are around 300 waste pickers working at UCDS in order to earn their livelihoods.	Waste picking and sanitary landfilling shall be incorporated.	Landfill operation which takes care of environment and social aspects.	Sanitary landfill operation methods will be developed, which takes care of both environment and social aspects.

3-1-2 Benefit from the Project and Project Index

Around 894 thousands people staying in Ulaanbaatar City will receive benefit from this project. People staying in the Ger area, especially, will receive more benefit since the collection rate of waste in the Ger area will improve significantly from its current rate of less than 50%. Furthermore, illegal dumping will decrease and the living environment will be improved.

3-2 Recommendations

3-2-1 Recommendation to the Recipient Country

The following will be recommended to the recipient country in order to implement the project effectively and efficiently and to achieve designated results.

(1) To fulfil the obligation of the Recipient Country

The recipient country should carry out the following obligations: 1) Improvement of the access road to NEDS from nearest paved road, 2) Renovation of the Central workshop and warm garage, 3) Electricity and telephone line to the boundary of the NEDS site, 4) Procurement of submersible pump for recirculation of leachate at NEDS, during implementation of the project. Furthermore, the tree planting inside fencing at NEDS should be carried out after installation work has been completed. To fulfil these obligations is essential to implement environmentally friend waste management operations.

(2) Capacity Development of New Organization

The City Maintenance and Public Utility Agency (CMPUA) was established on Sep. 15th, 2006 and put in charge of solid waste management in Ulaanbaatar City by taking over duties of City Maintenance and Public Utility Department of the Ulaanbaatar City. Collection services and the disposal site will be operated directly by the CMPUA. Since CMPUA is a newly formulated organization, several problems are anticipated during the initial stage, such as employment of new staff and training them accordingly. CMPUA should focus on capacity development for their staff via technical assistance of Japanese Grant Aid and on-the-job training, which utilizes collection trucks donated by Japanese Recycling Grant Aid. CMPUA should possess sufficient capacity to operate and maintain the supplied equipment and facilities at the time of completion of the Grant Aid project.

(3) Establishment of New Financial System and its Development

A new financial system was developed according to the recommendation of the Development study, and the waste collection and disposal fee were revised on September 1, 2006. Furthermore, the Waste Management Fund was introduced to each district and city on January 1, 2007. This new financial system makes it possible to improve the collection rate and operate sanitary landfilling. Thus, establishment and development of this system is the key to conduct sustainable solid waste management in Ulaanbaatar City.