ANNEX 3
Landfill Operation Manual

3 Guidelines on how to conduct proper landfill operations at NEDS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ULAANBAATAR CITY
MONGOLIA

PRACTICAL GUIDELINES ON HOW TO CONDUCT PROPER LANDFILL OPERATION AT NEDS IN ULAANBAATAR CITY IN MONGOLIA

July 2010

KOKUSAI KOGYO CO., LTD.

3.1 Planning and Design

Any landfill work requires proper planning and design in order not to disrupt the daily operation of the landfill. A plan needs to be drawn to show the detail of how and where waste will be managed across the site. It should include the following issues:

- the type and quantities of existing waste deposit,
- management and supervision of the site,
- general site layout and access,
- areas to landscape, the proposed final landform and the extent of filling,
- layout of enclosing and divider bunds/embankments
- layout of leachate collection and gas venting facilities
- layout of drainage facilities
- sequencing of upgrading work,
- method of construction,
- sources and quantities of cover material,
- operating hours,
- management of special waste,

Once a concrete plan is made, the next step is to estimate the following items and to secure the funding:

- quantity survey (volume of various work)
- required resources (manpower, materials and construction equipment)
- construction schedule (for example, the construction of the next embankment dam)
- construction cost

Depending on the magnitude of the upgrading work, planning/design work may be better undertaken by an experienced consultant or a construction contractor.

You do not have to improve everything at once. In order to sustain the proper operation, incremental improvement or sectional-phased improvement is strongly recommended.

Planning and design work at the site

3.2 Access Road

Access to the disposal area is one of the important aspects of the landfill operations. The access road needs to be suitable to allow all-weather tipping. This means that the road leading up to the dumping area can be driven on, even in times of heavy rain, fire, and etc. The illegal dumping at the access road during the night time must be avoided in order to ensure the next day access.

There are three parts to the access road. The first one is from the public road to the front gate of the landfill. The second access road is from the front gate to the disposal area. The last access is inside the disposal area to the tipping face.

The first two parts of the access road, one from the public road to the front gate and another

that leads to the disposal area, should be considered as permanent. These roads need to be properly graded and compacted and are better paved if funding allows. To keep the access gradients as well as side ditches have to be provided. The access road must have enough width to allow vehicles to pass each other safely.

The third stage of the access road, inside the disposal area, is considered as temporary. Temporary roads inside the disposal area sometimes are required to be established on the buried waste and need to be shifted from one location to another as the tipping face moves.

The construction of a new access road is illustrated in the following photo:

		
Temporary road at NEDS	Permanent road at NEDS	Permanent road at NEDS

The temporary access road is constructed by employing heavy construction equipment such as bulldozers and backhoes. Rough and preliminary grading of the ground is also done during construction. If the ground is very soft at some locations, the areas need to be strengthened by putting more soil and compaction to provide firmer base for the traffic of collection vehicles and heavy equipment.

The function of access roads is often underestimated, but they are extremely important for proper operation and maintenance, not only of the landfill but for other facilities as well.
Access roads should provide secure access to the operational parts of the site at all times.

Since the upgrading work should not hamper the daily landfilling operation, additional access or diversion roads to and from the tipping face may be required during the upgrading work.

Material for constructing access road can be soil, construction waste such as brick and concrete debris, steel plate which can be shifted the location for reuse, whatever available materials near the landfill site.

		
Access by soil	Access by steel plate	Access by Steel Plate

3.3 Landfill method

Staff needs to be employed to supervise dumping in the disposal area. The staff at the tipping face should ensure that users are not dumping in other areas across the site and only in the designated disposal area. The disposal area should be kept as small as possible and clearly

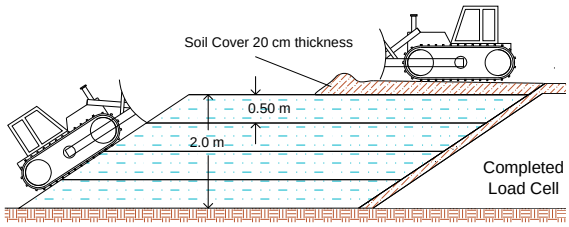
defined. The area can be defined with the use of soil bunds or excavated trenches.

Cell Method

A cell is a unit of landfilled space or area including cover material that is developed during one operating period. Ideally one operating period is one day, but in reality it varies from several days, a week, or even a month, depending on the availability of landfill equipment and cover materials. An amount of solid waste is covered with soil in cells. This method is the most popular method of filling. The amount of solid waste deposited during one operating period (usually one day) determines the size of each cell. As each cell is an independent filling area covered with soil, each cell acts as a firewall.

Dumping Method

This method involves rubbish trucks to simply dump solid waste into the landfill site. As the solid waste is not compacted, the landfill base is weak and negative impacts such as bad odor and harmful vectors may develop. Due to these problems it is not recommended for a method of landfilling.

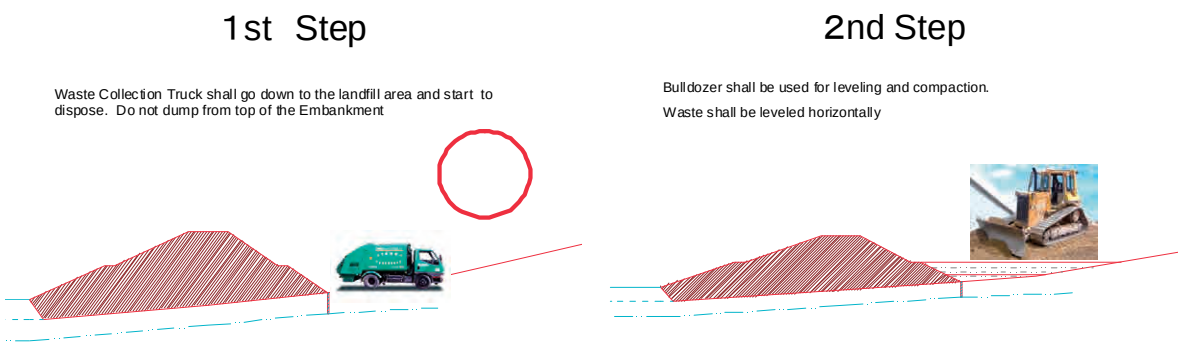


3.3.1 Order of Landfillg

Landfilling on a waste site can be either of two ways: landfill from uphill down, or, landfill from downhill up. Landfilling from uphill downwards allows easy access to the tipping face via the already landfilled area. However, slipping of the landfilled layer may occur if the landfilled slope is steep, and especially during periods of heavy rain. In contrast, landfilling from downhill upwards gives reduced access to the tipping face but reduced risks of slippage. Furthermore, landfilling from downhill upwards can achieve better compaction to the landfilled waste, therefore, the life of disposal site can be longer. Landfilling from downhill upwards will be recommended in NEDS.

Landfill from uphill down

Landfill from downhill up

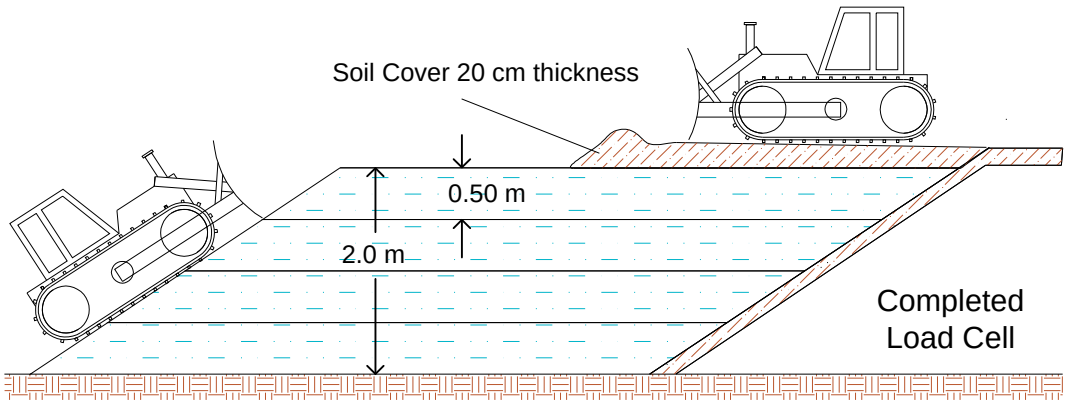


Order of Landfilling from downhill upwards

3.3.2 Spreading and Compaction

Spreading and compaction can be performed two ways, pushing down or pushing up the slope by the compaction equipment (bulldozer, loader, and landfill compactor). It is easier to push solid waste into a uniform thickness if spreading uphill and better compaction is achieved. If pushing solid waste down the slope, the waste at the base of the slope tends to be thicker. The spreading and compaction of the waste has a direct influence over the capacity and stabilization of the landfill. If low compaction is achieved the landfill site will last a shorter period of time than that if high compaction is attained. When pushing solid waste, waste should be spread thinly out in layers of about 30 to 50cm. The layer should be made as uniform as possible. Between each layer, the compacting equipment needs to make regular passes over the waste layer. The layers should make a lift of about 2 meters with a maximum of 3 meters. A slope gradient of 3:1 (about 20 degrees) is recommended for pushing up (compacting) the slope.

Waste shall be push up and compacted by bulldozer and, as a result, the thickness of waste became around 0.5m as shown below.



3.3.3 Landfill Equipment

Typical problems with landfill equipment include breakdown from wear and tear, entanglement of wires or metal pieces caught in moving parts, loss of hydraulic pressure, or clogging of the radiator mesh due to dust and dirt. Therefore it is important that a regular service schedule for preventive maintenance for the equipment be followed.

The activities that require the use of heavy earthmoving equipment include:

1. grading and maintaining site access roads,
2. excavation of disposal areas,
3. excavation of soil for cover, and,
4. spreading, compacting and covering the deposited waste.

It is necessary when considering equipment to ensure:

1) that maintenance parts and servicing are available,
2) operators can effectively use the equipment,
3) compaction rates are considered (which will affect the landfill life).

A storage shed should also be included so that maintenance for the equipment can be located on site.

Landfill Equipment

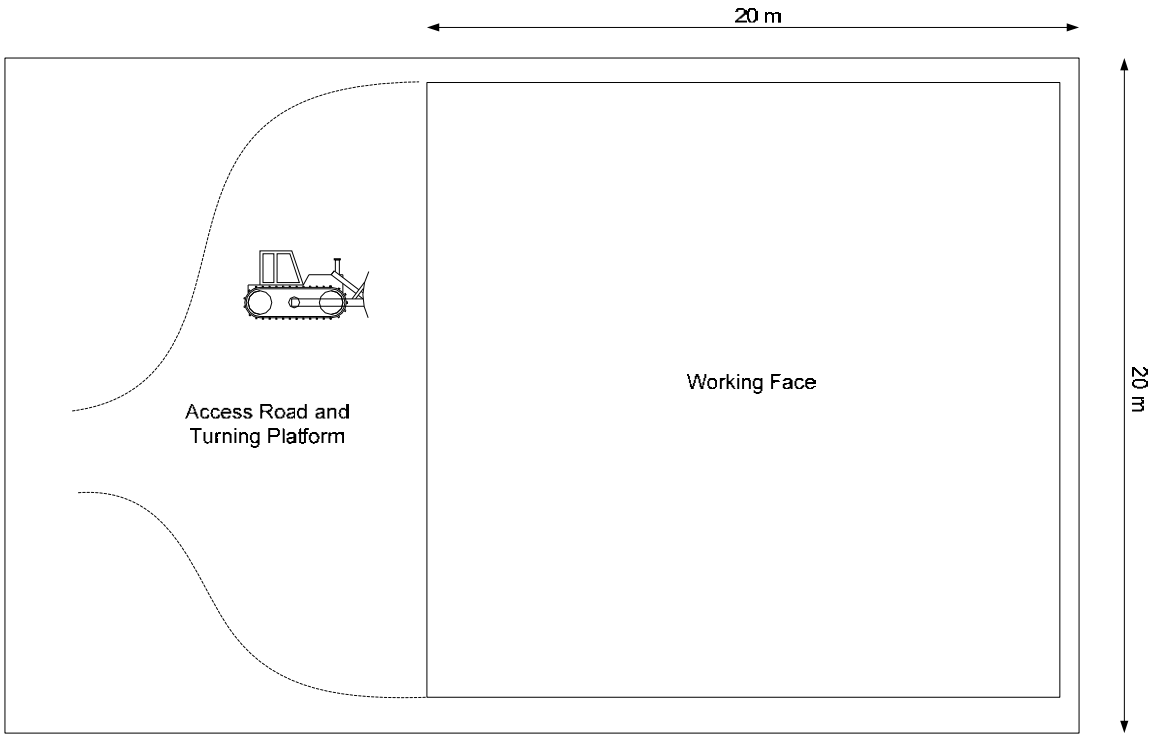
Maintenance for the equipment on site

3.3.4 Working (Tipping) Face

The working face of a landfill should be kept as small as possible. The advantages of maintaining a small face include less litter as there is less waste exposed to the wind, better control of scavengers, less leachate generation, fires and, covering and compacting waste can be undertaken more efficiently. A large landfill should not extend its tipping face any greater than 30m by 50m, whilst smaller operations should aim for a 20m by 20m area.

As for the NEDS, daily required area of working face can be calculated below.

Daily Landfill Amount based on weighbridge record
Say 1,000 ton/day
Assume density after compaction
1.0 ton/m^3
Daily landfill volume
1,000 ton/m^3 ÷ 1.0 ton/m^3= 1,000 m^3/day
In case daily filling height is 2.5 m, required area per daily operation is;
1,000 m^3/day ÷ 2.5 m = 400 m^2/day
20m x 20m = 400 m^2
So, only 20 m x 20m as shown below is enough as a daily working face if landfill operation is properly planned and managed.



3.3.5 Cover Material

Necessity of Cover Material - To maintain sanitary conditions the waste needs to be covered on a regular basis. The frequency of covering will be dependant on a number of factors, such as weather conditions, type of waste being landfilled, or availability of landfill equipment and cover materials. Cover material needs to be identified and sourced, preferably on-site, or else from a borrow pit nearby. Cover material ideally should consist of inert, non-combustible, dry and dense material. Once the material has been spread and compacted over the waste, then it should prevent pests and vermin from accessing the waste, minimize rainwater infiltration, prevent litter migration and provide a stable platform for tipping vehicles. The placement of soil over solid waste also reduces the fire risk and the covered waste becomes an effective firewall.

Suitable cover material could include soil, sand, crushed rock, crushed coral rock, ash, decomposed waste from another part of the site, demolition waste, sawdust and garden waste.

3.3.6 Type of Cover Soil

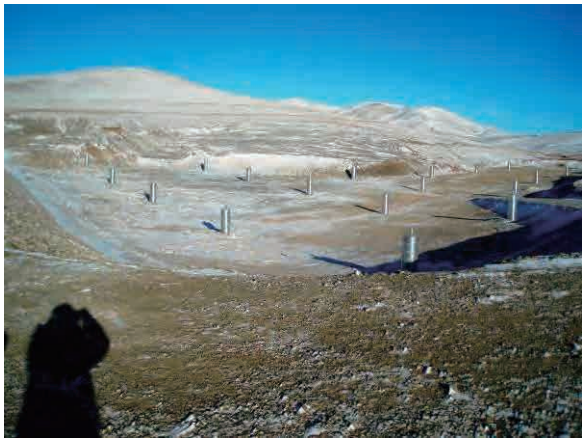
There are three purposes of cover soil: daily, intermediate or final cover soil. Daily cover soil as the name suggests is laid after each days waste has been dumped and compacted. The best quality soil should be reserved for intermediate and final cover soil requirements. Intermediate cover soil is laid for the base for roads or over daily cover areas where landfilling will not be occurring for an extended period of time and it is important that rainfall infiltration is prevented. Final cover soil is the soil placed on the top of the landfill when the final wastes are placed in the landfill unit. Final cover soil should be of good quality and preferably clay to form an effective barrier against rainfall and resist erosion, be low permeability and suitable for sustaining plant growth. The final cover is usually clay topped for these reasons.

3.3.7 Gas Removal Pipe

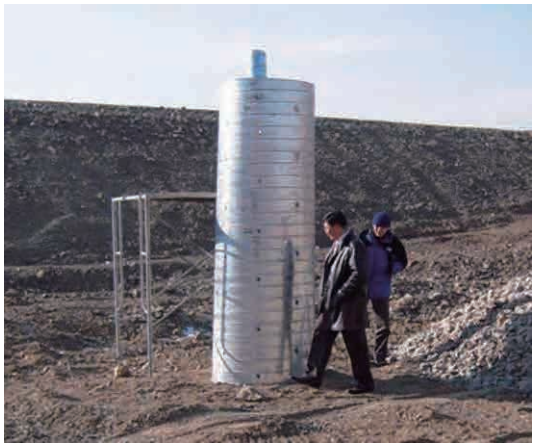
Landfill gas is by-product of natural decomposition process occurring at a landfill, including methane (CH_4), carbon dioxide (CO_2), nitrogen (N_2), hydrogen sulfide (H_2S), ammonia (NH_3) etc. some of these gases may cause fires and explosions at landfill site.

In order to extract these gases from landfill under controlled manner, gas removal pipes are installed.

In NEDS, following gas removal pipes were pre-installed.



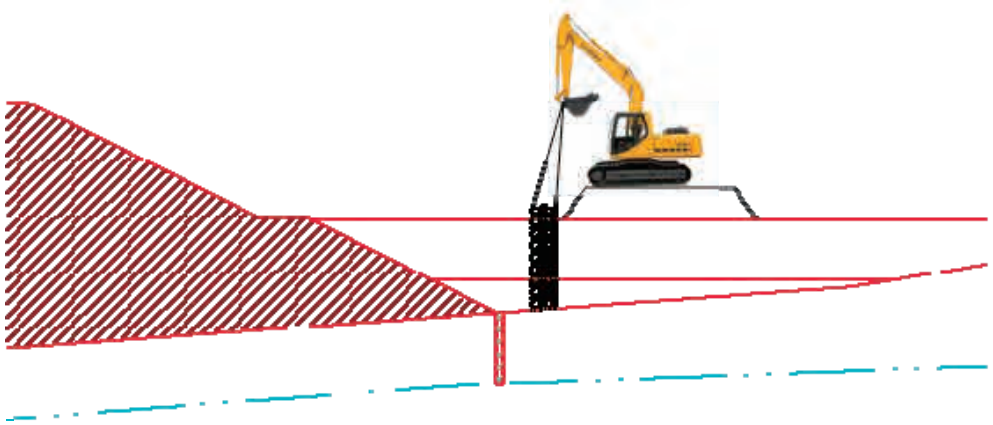
Overview of Landfill Area



Pre installed Gas Removal Pipe

Before height of landfill reached up to top of the removal pipes, the pipe shall be extended for next phase of landfilling

In case, it is not possible to purchase steel pipes for extension, following lifting operation might be practical.



3.3.8 Landfill Procedure

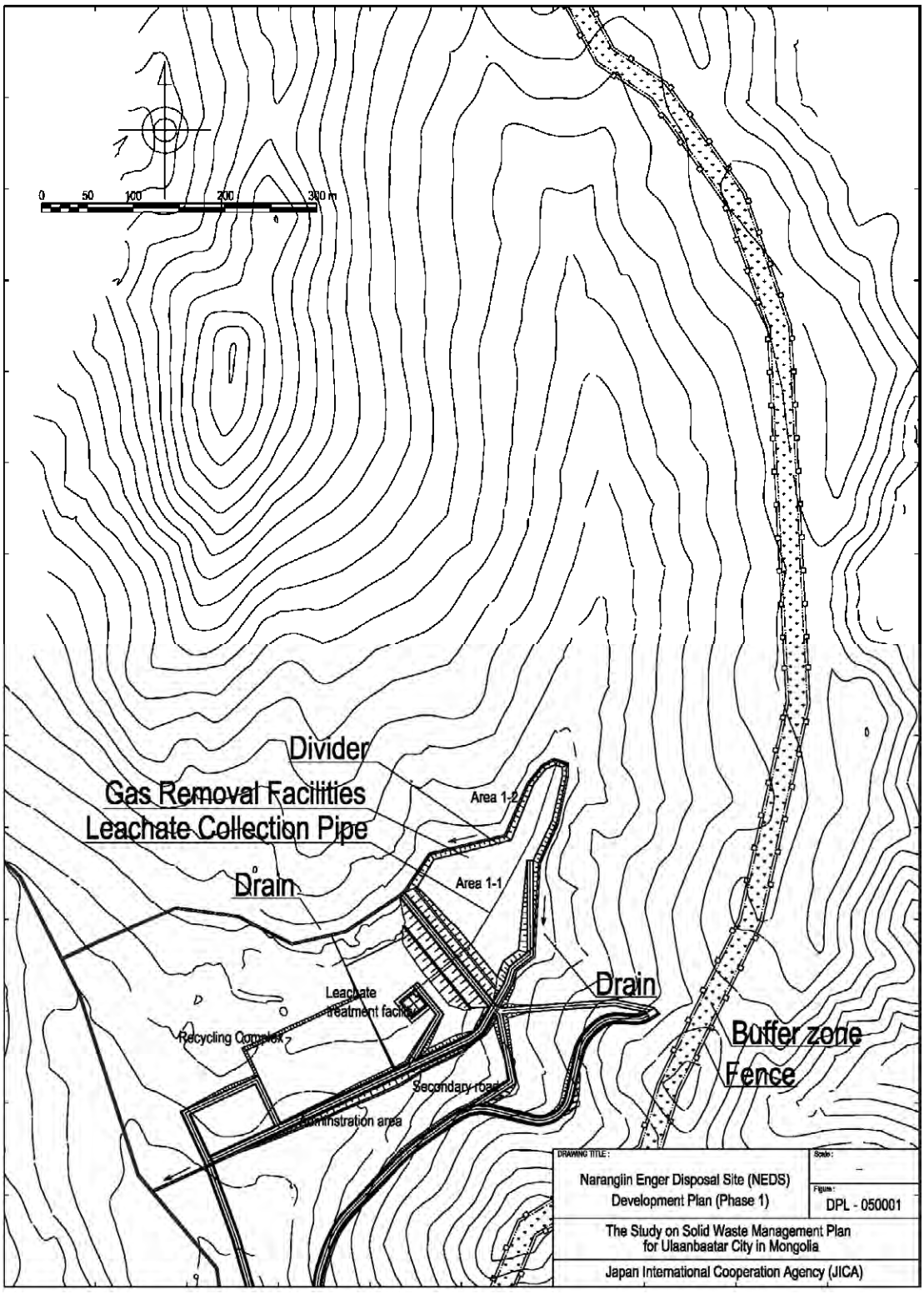
Landfill area will be expanding according to the height of landfilling because the filling area is a valley shape. At phase 1, height of embankment dam is around 10 m, so once landfill waste reached this height, next embankment dam for phase 2 should be constructed.

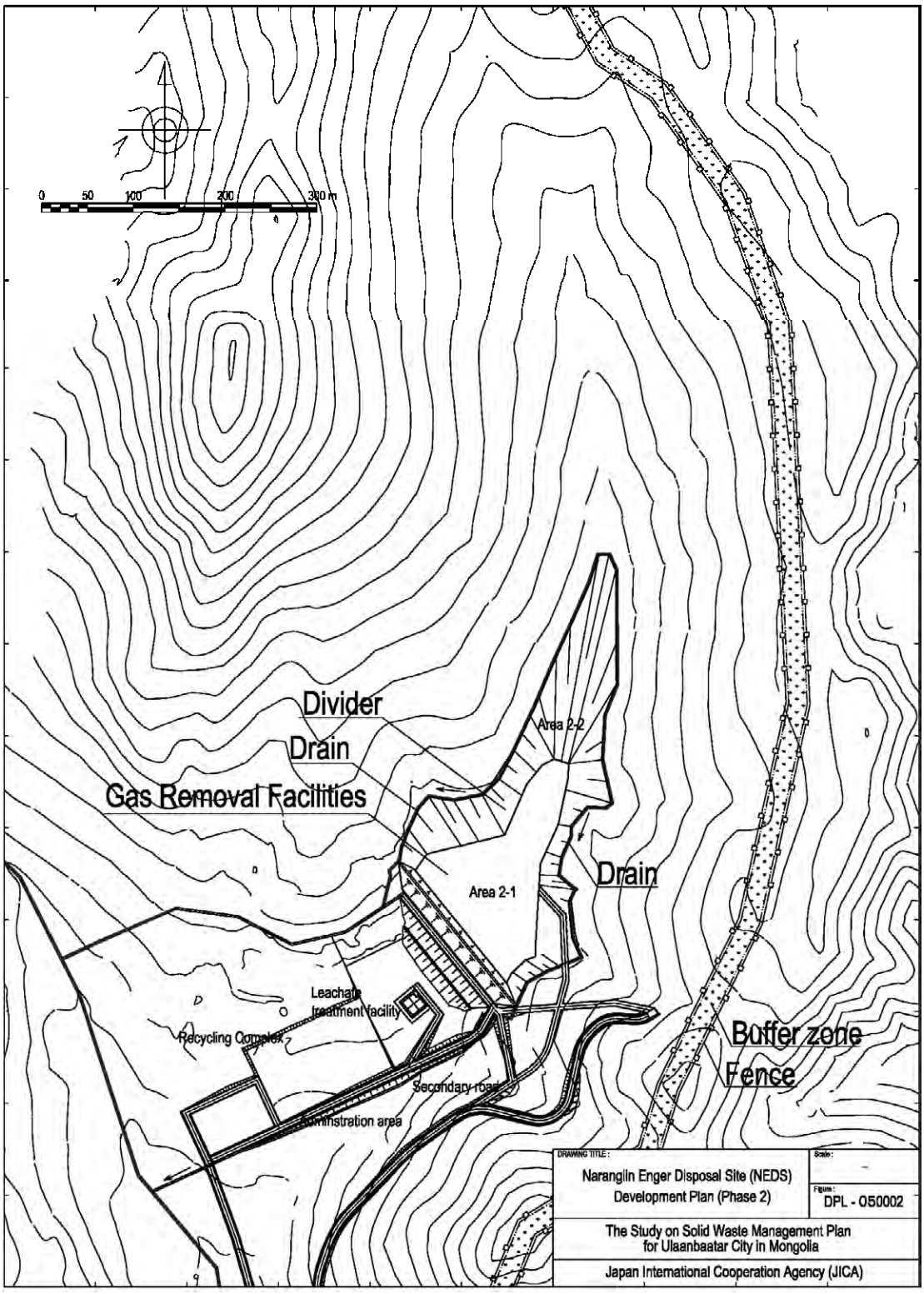
Following table indicates filling volume in each phase and will be utilized for deciding when next embankment dam shall be constructed with monitoring the weighbridge record.

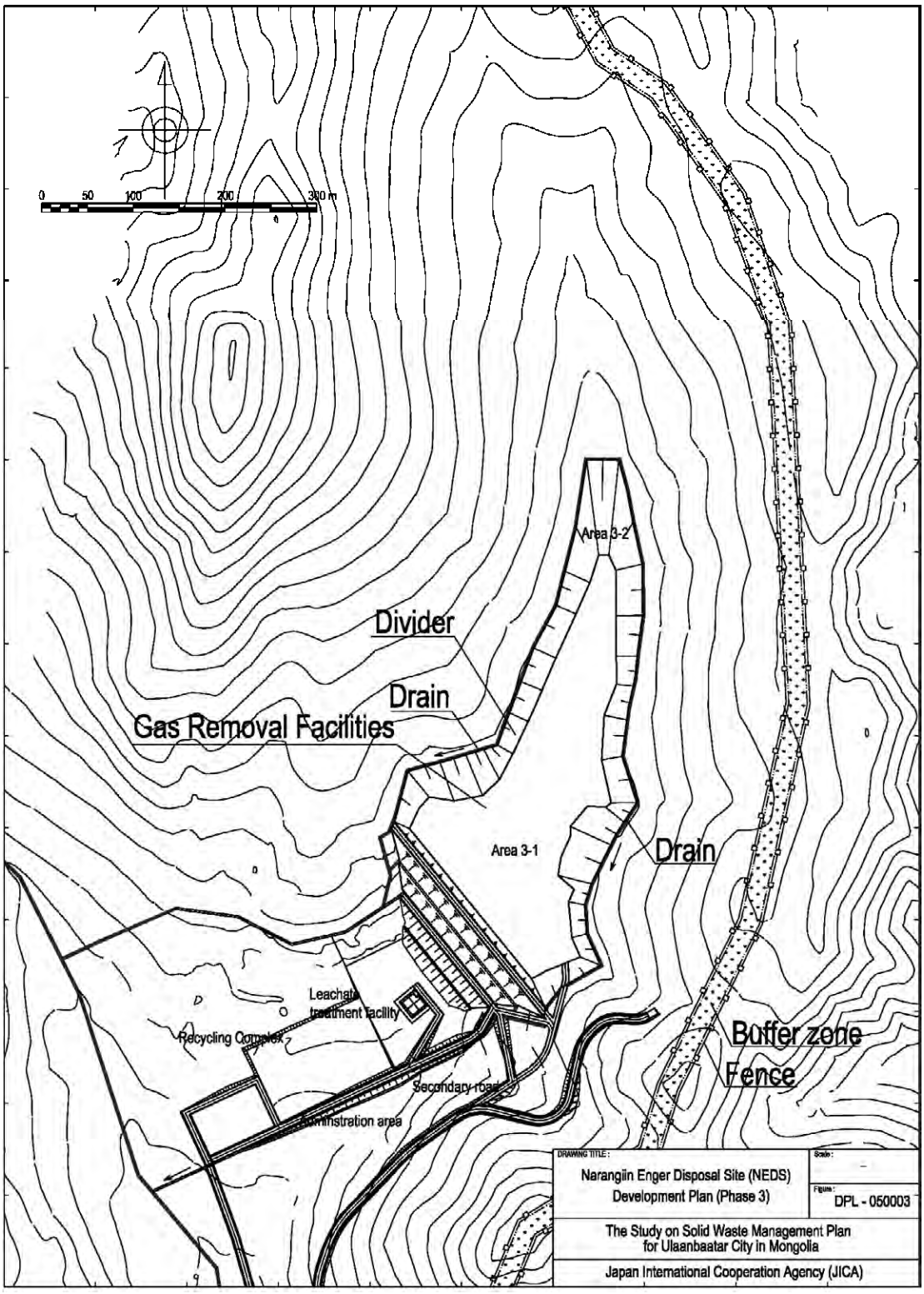
For conversion of weighbridge record which indicate in weight into volume, unit weight of 1 ton/m^3 can be used for easy and safety side calculation.

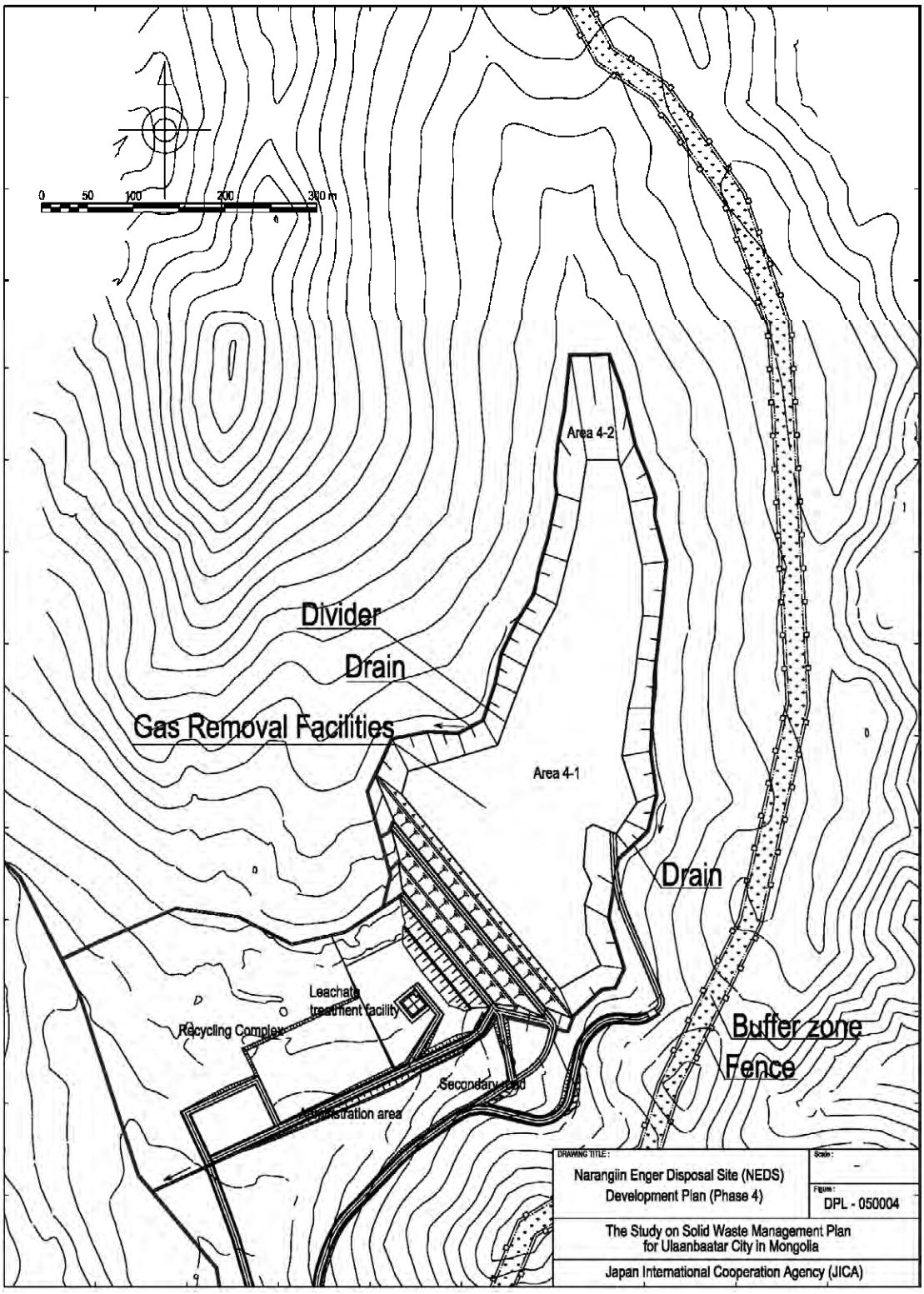
Phase	Bottom EL (m)	Top EL (m)	Filling Height (m)	Bottom Area (m2)	Top Area (m2)	Ave. Area (m2)	Filling Volume (m3)	Accum. Filling Volume (m3)
Phase 1-2	1392.0～1399.8	1401.0	5.1	13,428	19,898	16,663	84,981	
Phase 3	1401.0	1406.0	5.0	17,435	48,284	32,860	164,298	249,279
Phase 4	1406.0	1411.0	5.0	41,805	76,141	58,973	294,865	544,144
Phase 5	1411.0	1416.0	5.0	66,460	106,776	86,618	433,090	977,234
Phase 6	1416.0	1421.0	5.0	96,290	145,246	120,768	603,840	1,581,074
Phase 7	1421.0	1426.0	5.0	131,419	190,841	161,130	805,650	2,386,724
Phase 8	1426.0	1431.0	5.0	133,449	182,415	157,932	789,660	3,176,384

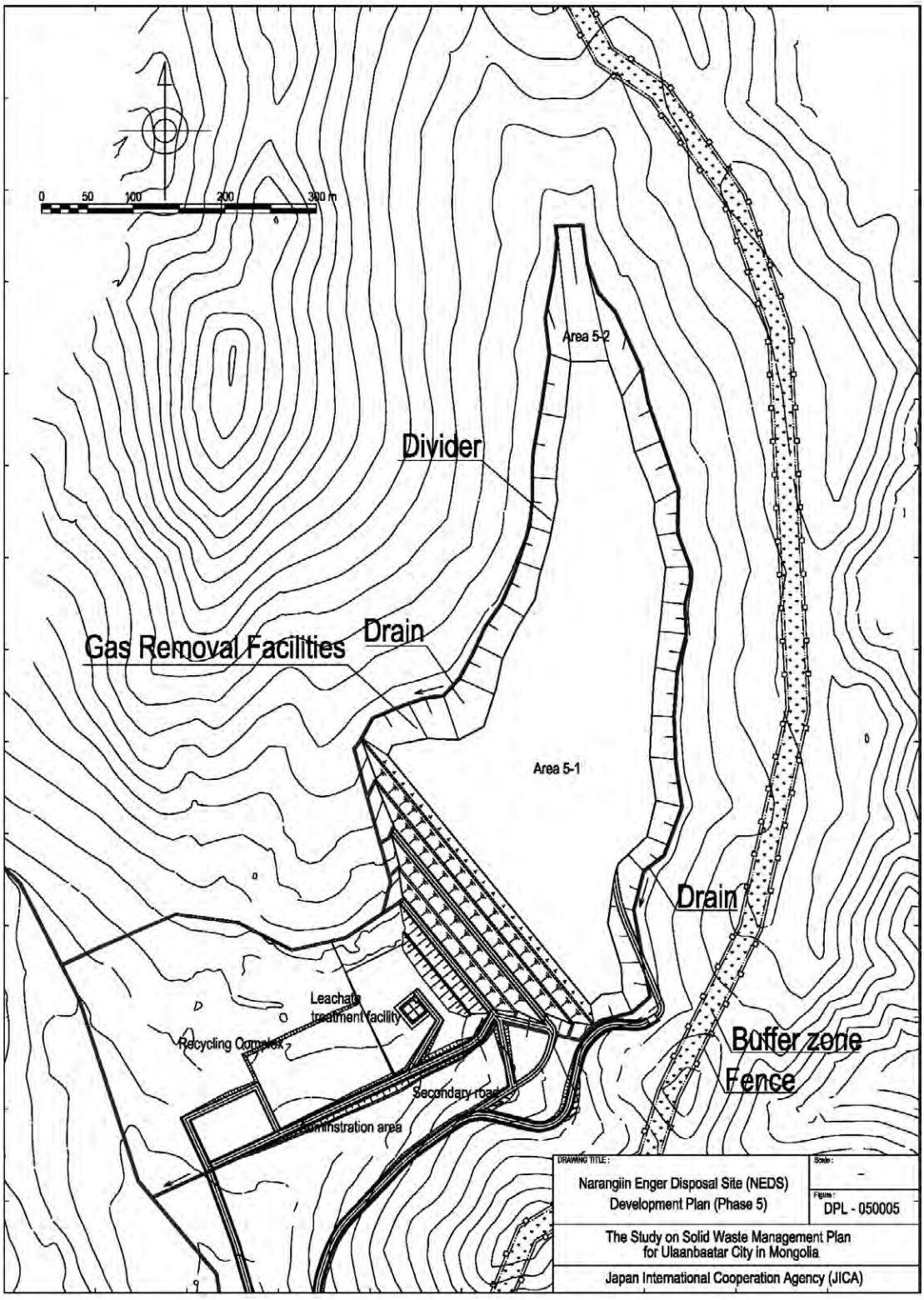
Landfill area of each phase is show in following page.

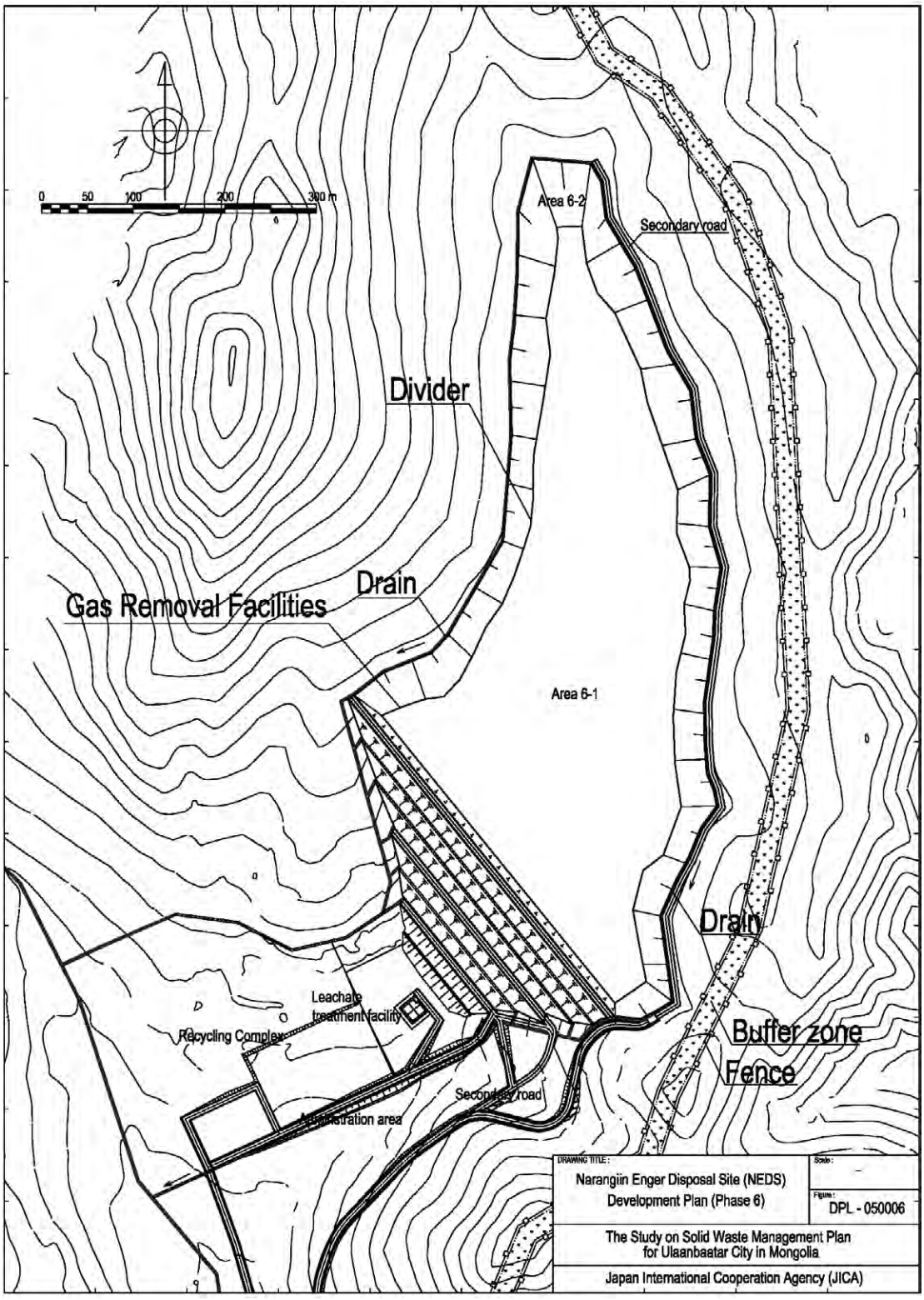

0 50 100 200 300 m
Divider
Gas Removal Facilities
Leachate Collection Pipe
Drain
Area 1-2
Area 1-1
Drain
Leachate treatment facility
Recycling Complex
Secondary road
Administration area
Buffer zone
Fence
DRAWING TITLE :
Naranglin Enger Disposal Site (NEDS) Development Plan (Phase 1)
Scale: -
Figure: DPL - 050001
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)

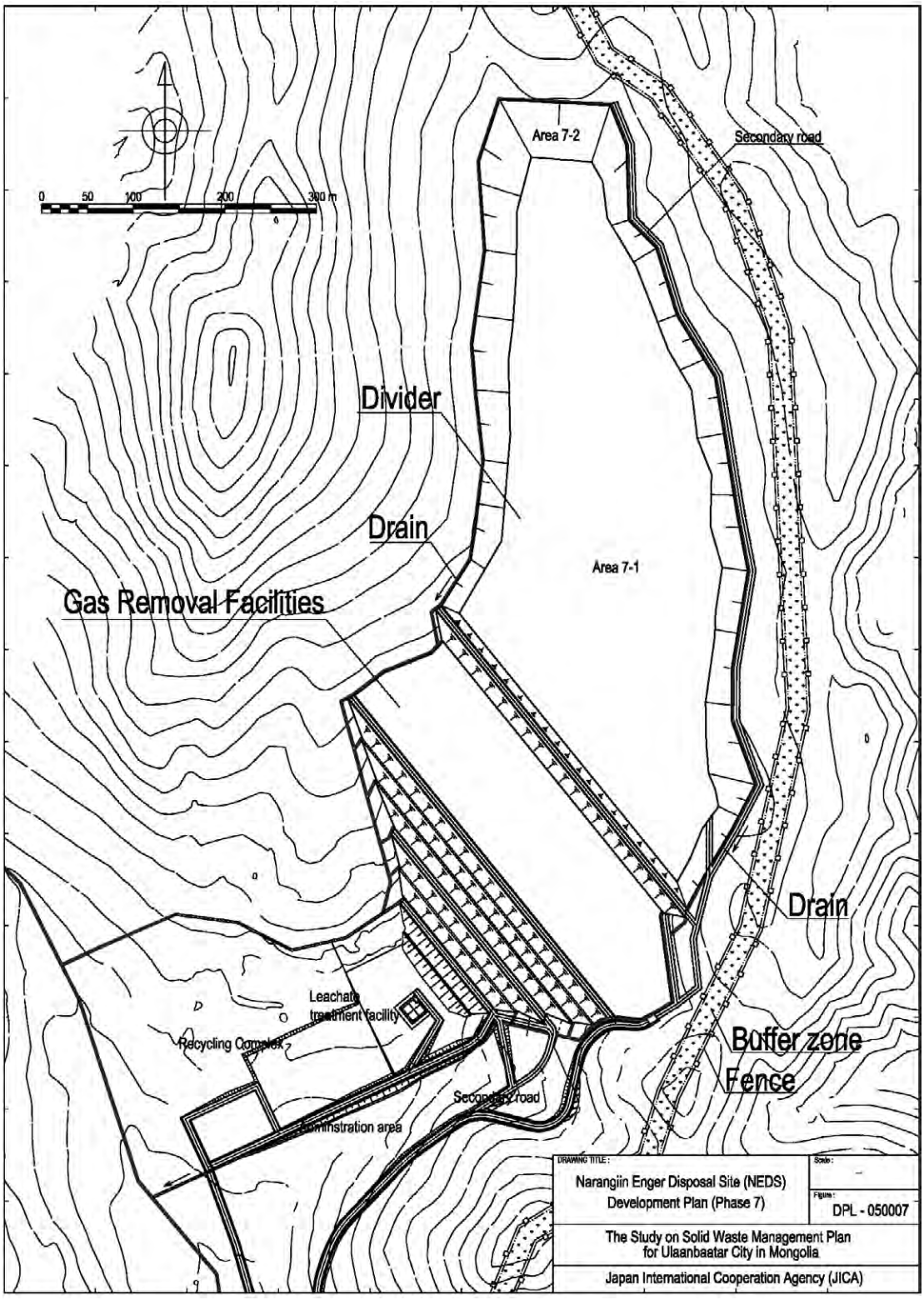

0 50 100 200 300 m
Divider
Drain
Gas Removal Facilities
Area 2-2
Drain
Area 2-1
Leachate treatment facility
Recycling Complex
Secondary road
Administration area
Buffer zone
Fence
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS)
Development Plan (Phase 2)
Scale: -
Figure: DPL - 050002
The Study on Solid Waste Management Plan
for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)

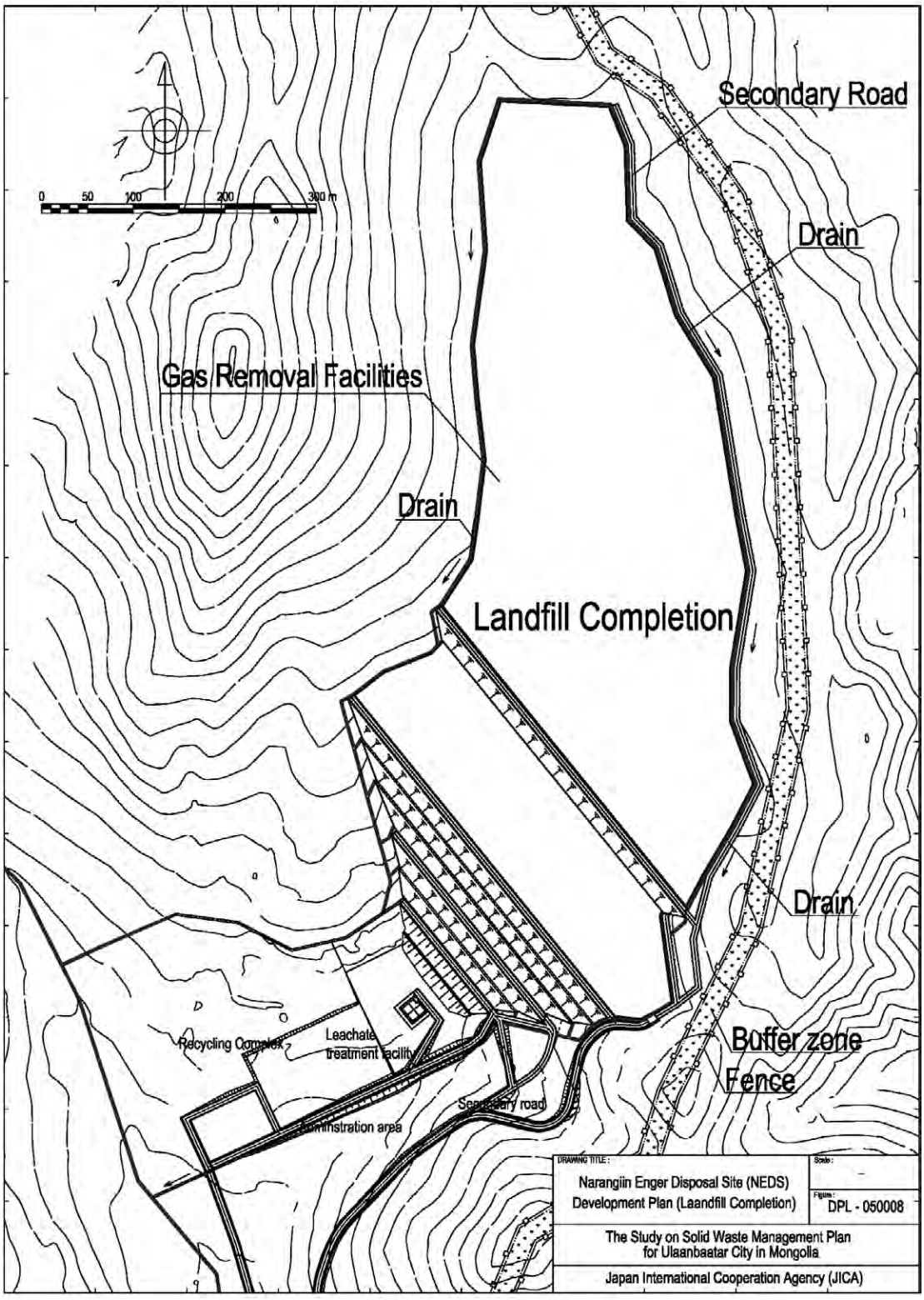

0 50 100 200 300 m
Area 3-2
Divider
Drain
Gas Removal Facilities
Area 3-1
Drain
Leachate treatment facility
Recycling Complex
Secondary road
Administration area
Buffer zone
Fence
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS)
Development Plan (Phase 3)
Scale:
Figure:
DPL - 050003
The Study on Solid Waste Management Plan
for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)


0 50 100 200 300 m
Area 4-2
Divider
Drain
Gas Removal Facilities
Area 4-1
Drain
Leachate treatment facility
Recycling Complex
Buffer zone
Fence
Narangiin Enger Disposal Site (NEDS)
Development Plan (Phase 4)
DPL - 050004
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)


0 50 100 200 300 m
Area 5-2
Divider
Gas Removal Facilities
Drain
Area 5-1
Drain
Leachate treatment facility
Recycling Complex
Secondary road
Administration area
Buffer zone
Fence
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS) Development Plan (Phase 5)
Scale: -
Figure: DPL - 050005
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)


0 50 100 200 300 m
Area 6-2
Secondary road
Divider
Drain
Gas Removal Facilities
Area 6-1
Drain
Buffer zone
Fence
Leachate treatment facility
Recycling Complex
Secondary road
Administration area
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS) Development Plan (Phase 6)
Scale :
Figure :
DPL - 050006
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)


0 50 100 200 300 m
Area 7-2
Secondary road
Divider
Drain
Area 7-1
Gas Removal Facilities
Drain
Leachate treatment facility
Recycling Complex
Buffer zone
Fence
Secondary road
Administration area
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS) Development Plan (Phase 7)
Scale: -
Figure: DPL - 050007
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)


Secondary Road
Drain
Gas Removal Facilities
Drain
Landfill Completion
Drain
Buffer zone
Fence
Recycling Complex
Leachate treatment facility
Administration area
0 50 100 200 300 m
DRAWING TITLE :
Narangiin Enger Disposal Site (NEDS)
Development Plan (Laandfill Completion)
Scale: -
Figure: DPL - 050008
The Study on Solid Waste Management Plan for Ulaanbaatar City in Mongolia
Japan International Cooperation Agency (JICA)

3.4 Environmental Management

Landfills are sometimes referred to as a typical NIMBY (Not In My Back Yard) facility. The reason for that is people suffer many nuisances caused by the landfills. Appropriate measures can minimize the nuisances as illustrated below:

3.4.1 Odor

Odor is sometimes very difficult to manage at a landfill site. All sites will generate odor to some extent and it will generally be worse in wet, hot weather. Some measures which can be taken include:

- immediate covering of highly odorous waste,
- regular covering of waste,
- ensure the tipping face does not pond water
- encourage residents to store waste in a dry condition (so that when waste reaches the landfill it is not as odorous),
- maintain buffer zones around the landfill site (to minimize impacts on neighboring sites).

3.4.2 Dust

Dust control measures at a landfill site typically include wetting down of dirt roads with a water truck. Regular rounds of the roads will need to be made by the water truck, particularly in periods of very dry weather.

3.4.3 Fire and Smoke

Fires should be minimized at landfill sites as burning rubbish can generate poisonous gases and be an environmental and health risk. The type of control measures typically considered includes:

- spreading out and dosing with water as soon as possible after any fires break out,
- regular covering of waste to minimize risk of fires,
- developing a fire management plan including maintenance of an effective fire break around the perimeter of the site, and,
- developing emergency procedures for minor and major fires.

3.4.4 Noise

Noise control can include the restriction of opening hours to certain times. Noise barriers can be constructed, either soil beams or maintaining a buffer zone with trees.

3.4.5 Visual Impact

The visual improvement of a landfill site can contribute to reducing the NIMBY syndrome against rubbish dumps. Effort should be made to try to keep waste from view of the public employing such measures as building a buffer zone with trees, constructing bunds, installing wooden or galvanized walls or fences, etc. This can reduce some of the potential impacts of landfill operations such as noise, dust and odor. Even simple regular covering of soil over rubbish can significantly reduce the eyesore potential.

3.4.6 Gas

Gas monitoring will need to be conducted where there is the potential of gas to accumulate in high concentrations, such as the outlets of gas venting pipes.

In NEDS, following monitoring is recommended.

Table 3.1: Environmental Monitoring Plan

Item	Environmental Monitoring prescribed in EIA report			Environmental Monitoring recommended by the JICA Development Study		
	Monitoring Item	Frequency	Annual cost[1] 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

[1] Costs were presented in the EIA report

Item	Environmental Monitoring prescribed in EIA report			Environmental Monitoring recommended by the JICA Development Study		
	Monitoring Item	Frequency	Annual cost[1] 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

ANNEX 4
Guideline on Estimation of appropriate waste collection fees

4 Guideline on Estimation of appropriate waste collection fees

Guideline on Estimation of appropriate waste collection fees

July 2011

JET

4.1 Definition of terms

The definitions for the terms used in the guideline are the following:

Waste collection fee of households: Waste collection fee to be paid by residents (households) for discharging waste.

Waste collection fee for transporters: Waste collection fee to be paid to waste transporting organizations

4.2 Appropriate amount of waste collection fee for transporters

4.2.1 Objective

Waste collection fee of households in apartment areas is collected together with the utility payments (those for electricity, water and heating). However, it is collected in cash on the spot at the same time with waste collection in GER area.

The amount of waste collection fee of households is the same in all districts while the amount of waste collection fee for transporters differs district by district. Fundamentally, the amount of waste collection fee of households should be set at a level that can finance waste collection services. As fee collection rates in apartment and GER areas differ, the amount of the fee should be used as a key indicator for selection of private contractors for waste collection. Therefore, the objectives of the guideline are (1) to identify the appropriate base amount of waste collection fee for transporters when calling tenders and (2) to estimate an appropriate amount of waste collection fee of households based on those for transporters.

4.2.2 Assumptions

The following assumptions are used in preparation of the guideline.

Table 4.1: Assumptions

	Items	Assumptions
1	Transportation distance	The transportation distance for a district in the guideline is the average distances from the central points of khoroos in the district to NEDS. The data of border as of Oct 2005 are used in the estimation. Khoroo #12, 13 and 14 were excluded as the waste from these khoroos is transported to MDDS.
2	Type of vehicles	Various types of vehicles are being used by TUKs and private companies. As their maintenance cost and basic prices are not clear, relevant estimations in the guideline are based on those of the grant aid trucks (CT-15m3; CT-8m3 and DP-10m3).
3	Population	2009 statistics by MUB were used.
4	Types of target waste	The target waste in the guideline is non-hazardous household waste. Business waste and waste from public area cleaning are excluded.
5	Waste generation rate	The rates are 280 g/person/day for apartment and 788 g/person/day for GER area based on the results of WACS conducted by the JET in 2010.
6	Wage	The amounts of driver's and collection worker's wages are taken from the results of the interview survey conducted in 2010.
7	Depreciation cost	As fleet must be renewed after a certain period of time, depreciation cost was considered in the guideline.
8	Fuel cost	The fuel cost is estimated based on the market price in UBC as of Jul 2011 (1,800 MNT/liter for diesel and 1,700 MNT/liter for gasoline).

Items		Assumptions
9	Average trips	The number of average daily trips to be conducted form each district to NEDS is 2 trips/day for all types of vehicles (CT-15m3; CT-8m3 and DT-10m3).
10	Average waste to be transported	Average amounts of waste to be transported to NEDS are those estimated during the Development Study for each type of trucks: CT(15m3)-6.08 ton/truck, CT(8m3)-3.24 ton/truck and DT(10m3)-2.70 ton/truck.
11	Maintenance cost	Although the maintenance cost differs depending on years of utilization, the annual amount was considered as 6% of basic prices of the vehicles.
12	Indirect costs	Total amount of the indirect costs is considered as 30% of the direct cost (direct labor, fuel cost and maintenance cost).
13	Waste collection rate and Fee collection rate	Fee collection rates in districts were taken from the results of the questionnaire survey conducted in 2009. Waste collection rate for apartment area is 100% while that for GER area is assumed as same as fee collection rate since waste is collected only from households that pay the fees.
14	Combination of collection trucks	In apartment areas, CT provided under the Grant Aid will operate. Likely, DT of Grant Aid is considered to operate in GER areas. The number of trucks is the same with the amount provided by the Grant Aid.
15	Waste collection fee of households	The results of JET survey taken from DWSFs in 2010 were used.

4.2.3 Appropriate amount of waste collection fee for transporters

a. Current fee system

The waste collection fees for transporters that are being used in each district as of Jul 2011 are shown in the table below:

Table 4.2: Waste collection fees for transporters as of Jul 2011

SBD	ChD	SKhD	BZD	BGD	KhUD
65,000 MNT/trip (for 3 to 4 tons of waste) ±5 MNT/kg **Tuzuku yume Compactor Track**	1350 MNT/ton*km (for 10 km)	1350 MNT/ton*km (for 10 km)	65,000 MNT/trip **CMPUA Compactor Track**	**No definition** WSF transport waste by themselves	**No definition** Tuk is collected both waste and fee
70,000 MNT/trip (for 5 to 6 tons of waste) ±5 MNT/kg **Tuzuku yume Dump Track**	1300 MNT/ton*km (for 20 km)	1300 MNT/ton*km (for 20 km)	75,000 MNT/trip **CMPUA Dump Track**		
1350 MNT/ton*km (for 10 km) **EU**	1240 MNT/ton*km (for 30 km)	1240 MNT/ton*km (for 30 km)	77,800 MNT/trip **TUK Dump Track**		
1300 MNT/ton*km (for 20 km) **EU**	1200 MNT/ton*km (for 40 km)	1200 MNT/ton*km (for 40 km)	100,800 MNT/trip **10m3 Dump Track & 15m3 Compactor Track**		
1240 MNT/ton*km (for 30 km) **EU**	1180 MNT/ton*km (for 41 km or above)	1180 MNT/ton*km (for 41 km or above)			
1200 MNT/ton*km (for 40 km) **EU**					
1180 MNT/ton*km (for 41 km or above) **EU**					

b. Appropriate waste collection fee for transporters

The waste collection fee for transporters consists of the following parts:

1. Direct cost
   - (1) Wage (driver's and collection worker's)
   - (2) Fuel cost (for truck operation)
   - (3) Depreciation cost (for renewal of trucks)
   - (4) Maintenance cost
2. Indirect cost
   - (1) Office-related costs
   - (2) Wages of officers and other employees
   - (3) Profit

In the following section, appropriate amount of each cost is estimated.

b.1 Wages

The amounts of wages provided by the WSFs of each district are compiled in the following table. It is considered that a driver and 2 collection workers work on a collection truck.

Table 4.3: Wages

Description	Q'ty	Unit	Unit rate	Total	
			MNT/man/day	MNT/month	MNT/day
Driver	1	man	200,000	200,000	6,667
Assistant	2	man	150,000	300,000	10,000
Total					16,667

b.2 Fuel costs

The fuel cost depends on the distance between each district and NEDS. The distances from the districts to NEDS are considered as same as the average distances from central points of khoroos in respective districts to NEDS. The estimated distances from the districts to NEDS and the routes are shown below:

Table 4.4: Average distance from each district to NEDS

	Average distance to NEDS (km)
SBD	16.1
ChD	15.1
SKhD	8.0
BZD	20.3
BGD	11.3
KhUD	17.3

b.2.1 Average transportation distance

SBD

SBD												
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,980m	2,980	2,980	2,980	2,980	2,980	2,980	2,980	2,980		
D	–	F	4,800m									4,800	4,800
Sub-distance				2,500	2,000	1,000	900	600	2,700	3,700	2,600	970	3,300
Total				14,220	13,720	12,720	12,620	12,320	14,420	15,420	14,320	14,510	16,840

Khoroo number				11	12	13	14	15	16
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,980m						
D	–	F	4,800m	4,800	4,800	4,800	4,800	4,800	4,800
Sub-distance				2,300	4,000	4,700	6,500	8,500	8,600
Total				15,840	17,540	18,240	20,040	22,040	22,140
Average distance				16,059 m					

ChD

ChD												
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,980m	2,980	2,980	2,980	2,980	2,980	2,980				
D	–	F	4,800m									4,800	
F	–	G	1,500m										
Sub-distance				1,330	280	770	1,500	1,100	310	5,300	4,900	520	5,910
Total				13,050	12,000	12,490	13,220	12,820	12,030	14,040	13,640	14,060	14,650

Khoroo number				11	12	13	14	15	16	17	18
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,980m								
D	–	F	4,800m	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800
F	–	G	1,500m			1,500	1,500	1,500	1,500	1,500	1,500
Sub-distance				2,000	2,430	1,630	2,060	2,550	3,500	4,650	3,500
Total				15,540	15,970	16,670	17,100	17,590	18,540	19,690	18,540
Average distance				15,091 m							

SkhD

SKhD											
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700		3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m					1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m										
C	–	D	2,500m										
Sub-distance				3,300	1,600	1,000	5,900	1,500	1,250	3,300	4,600	5,240	6,270
Total				7,000	5,300	4,700	5,900	6,450	6,200	8,250	9,550	10,190	11,220
Khoroo number				11	12	13	14	15	16	17	18		
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700		
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250		
B	–	C	1,290m		1,290	1,290	1,290	1,290	1,290	1,290	1,290		
C	–	D	2,500m		2,500								
Sub-distance				6,700	660	2,300	2,500	2,500	1,750	1,200	510		
Total				11,650	9,400	8,540	8,740	8,740	7,990	7,440	6,750		
Average distance				8,001 m									

BZD

BZD													
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,900m	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900
E	–	F	3,650m				3,650	3,650	3,650	3,650		3,650	
E	–	G	5,150m								5,150		5,150
F	–	H	2,200m									2,200	
Sub-distance				4,500	4,800	3,500	590	1,750	600	750	4,250	4,300	6,700
Total				16,140	16,440	15,140	15,880	17,040	15,890	16,040	21,040	21,790	23,490
Khoroo number				11	12	13	14	15	16	17	18	19	20
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,900m	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900
E	–	F	3,650m			3,650	3,650		3,650	3,650		3,650	
E	–	G	5,150m	5,150	5,150						5,150		5,150
F	–	H	2,200m						2,200	2,200		2,200	
Sub-distance				21,470	6,300	2,300	1,300	3,300		3,600	930	2,100	23,710
Total				38,260	23,090	17,590	16,590	14,940	17,490	21,090	17,720	19,590	40,500
Average distance				20,288 m									

BGD

BGD													
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	2,900m										
Sub-distance				2,570	2,000	4,120	2,000	2,300	920	1,350	2,240	1,860	3,160
Total				11,310	10,740	12,860	10,740	11,040	9,660	10,090	10,980	10,600	11,900
Khoroo number				11	12	13	14	15	16	17	18	19	20
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	
D	–	E	2,900m						2,900				
Sub-distance				4,460	3,270	1,960	2,690	3,290	700	3,100	2,900	2,290	2,700
Total				13,200	12,010	10,700	11,430	12,030	12,340	11,840	11,640	11,030	8,940
Average distance				11,254 m									

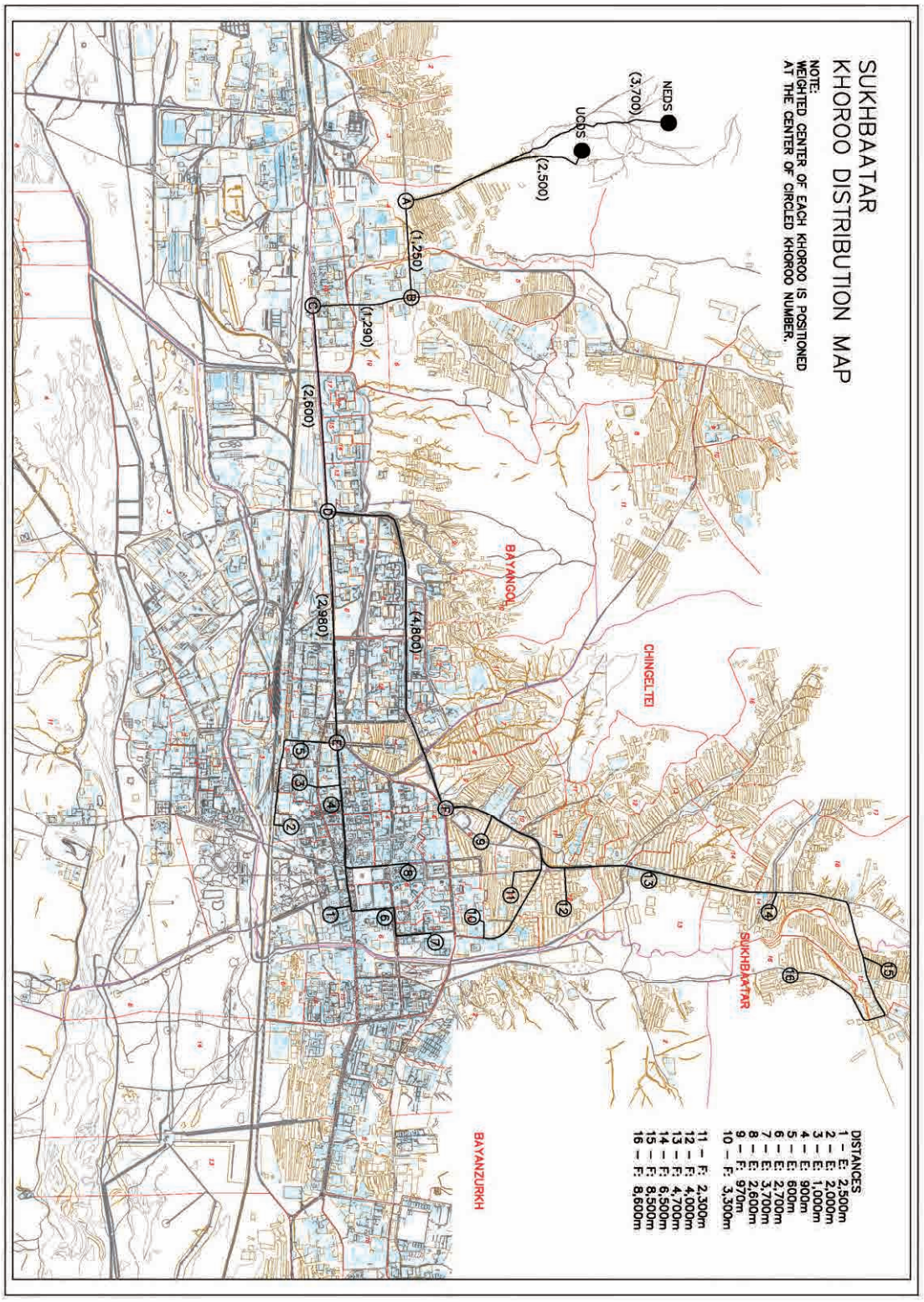
KhUD

KhUD											
Khoroo number				1	2	3	4	5	6	7	8	9	10
NEDS	–	A	3,700m	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700
A	–	B	1,250m	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
B	–	C	1,290m	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
C	–	D	2,500m	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
D	–	E	4,500m				4,500						
C	–	F	7,500m					7,500	7,500	7,500	7,500	7,500	7,500
Sub-distance				5,500	5,400	3,300	4,700	4,400	3,500	3,000	940	3,500	3,000
Total				14,240	14,140	12,040	17,940	20,640	19,740	19,240	17,180	19,740	19,240

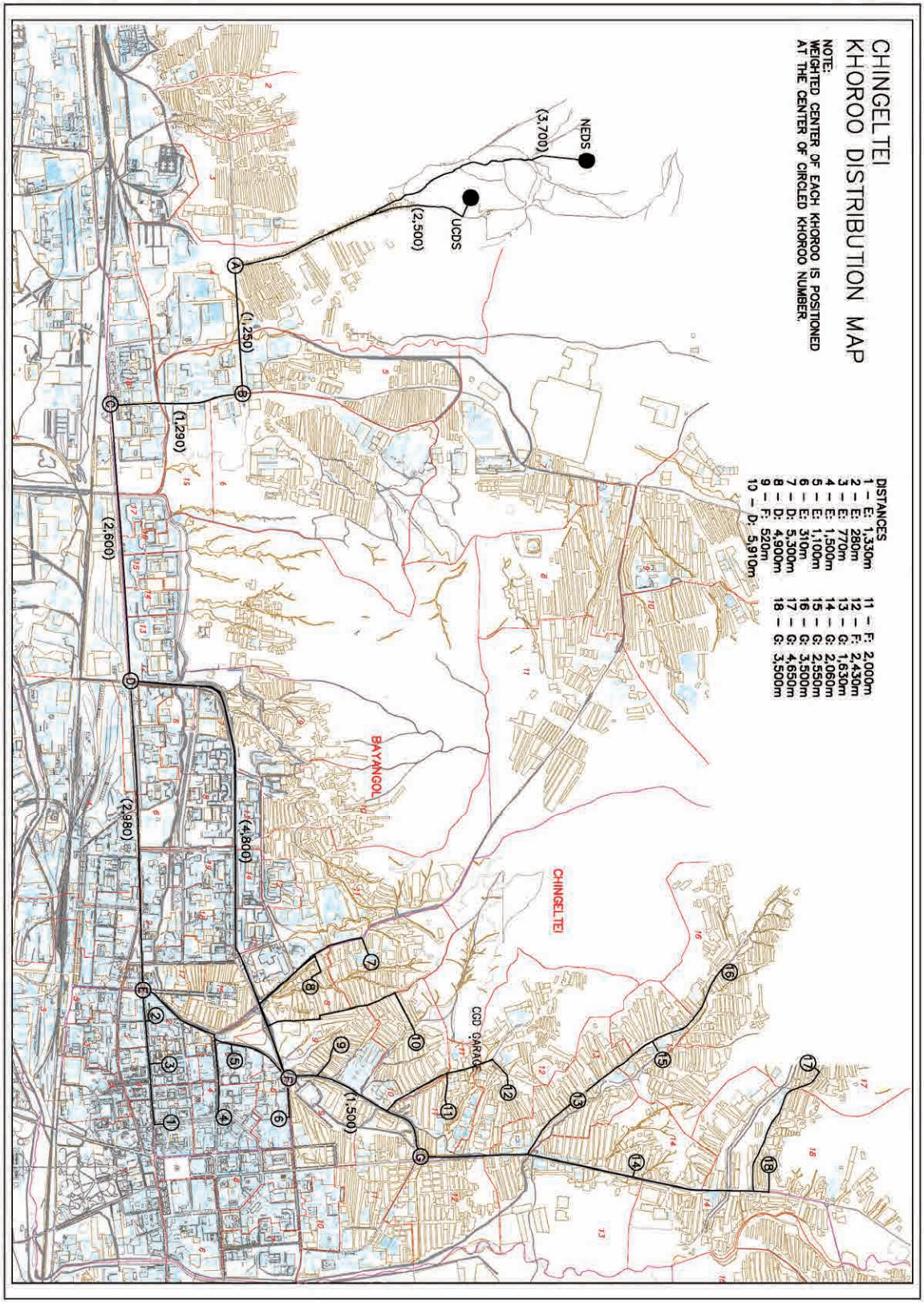
Khoroo number				11
NEDS	–	A	3,700m	3,700
A	–	B	1,250m	1,250
B	–	C	1,290m	1,290
C	–	D	2,500m	2,500
D	–	E	2,900m	
C	–	F	7,500m	
Sub-distance				7,300
Total				16,040
Average distance				17,289 m

b.2.2 Waste Transportation Routes

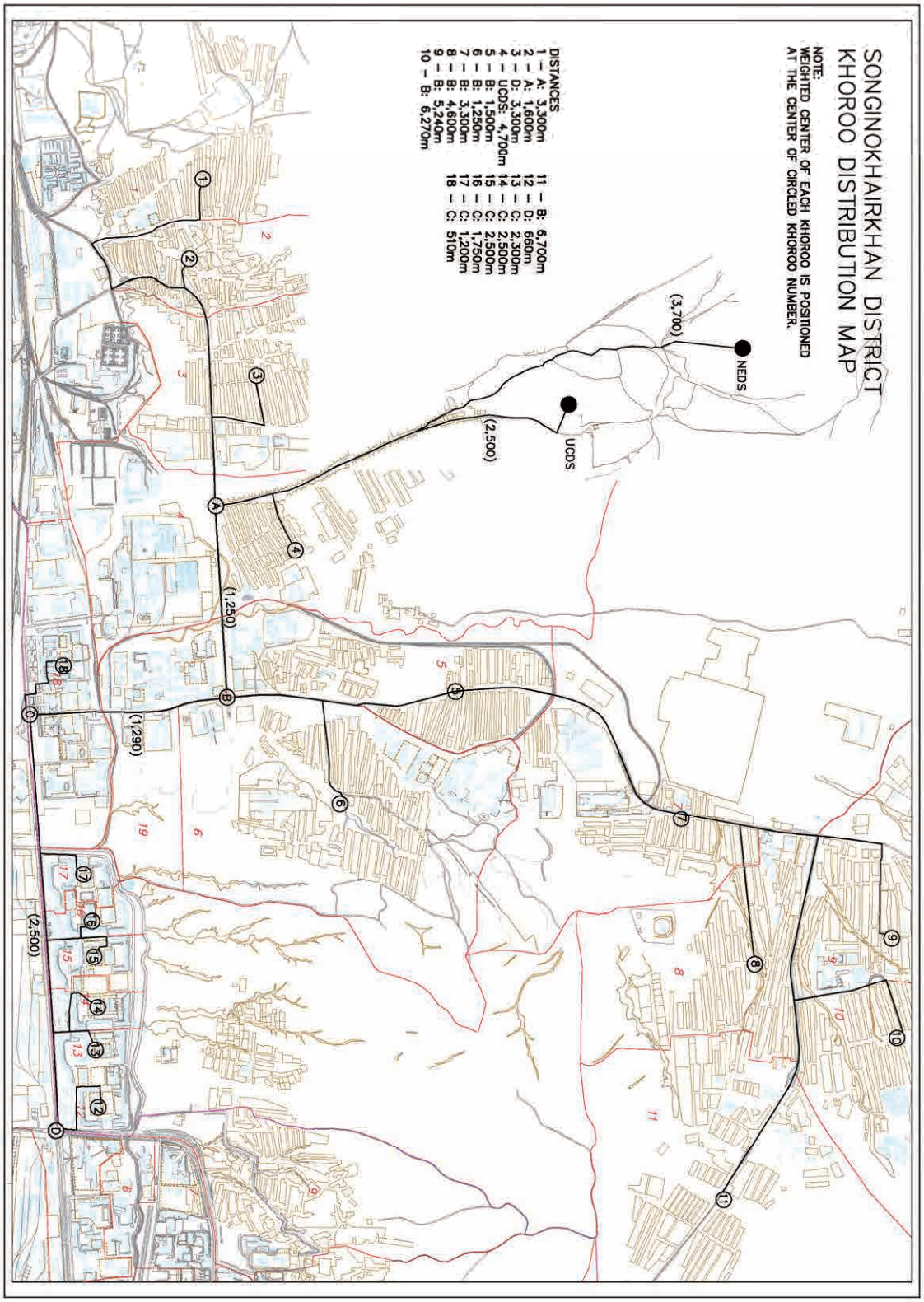
SBD



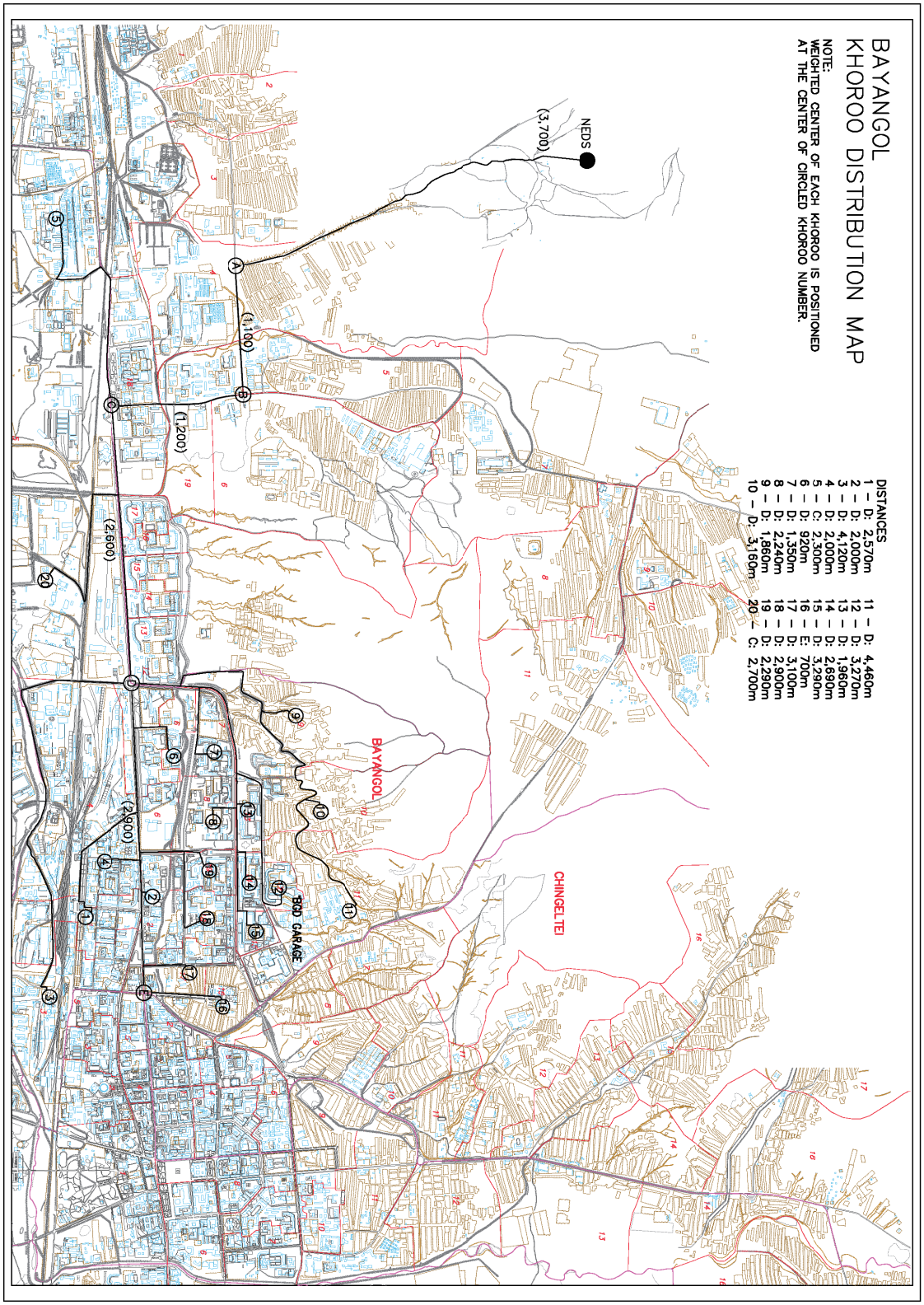
ChD


CHINGELTEI
KHOROO DISTRIBUTION MAP
NOTE:
WEIGHTED CENTER OF EACH KHOROO IS POSITIONED AT THE CENTER OF CIRCLED KHOROO NUMBER.
DISTANCES
1 – E: 1,330m
2 – E: 280m
3 – E: 770m
4 – E: 1,500m
5 – E: 1,100m
6 – E: 310m
7 – D: 5,300m
8 – D: 4,900m
9 – F: 520m
10 – D: 5,910m
11 – F: 2,000m
12 – F: 2,430m
13 – G: 1,630m
14 – G: 2,060m
15 – G: 2,550m
16 – G: 3,500m
17 – G: 4,650m
18 – G: 3,500m
NEDS
(3,700)
UCDS
(2,500)
(1,250)
(1,290)
(2,600)
(2,980)
(4,800)
(1,500)
BAYANGOL
CHINGELTEI
CGD GARAGE

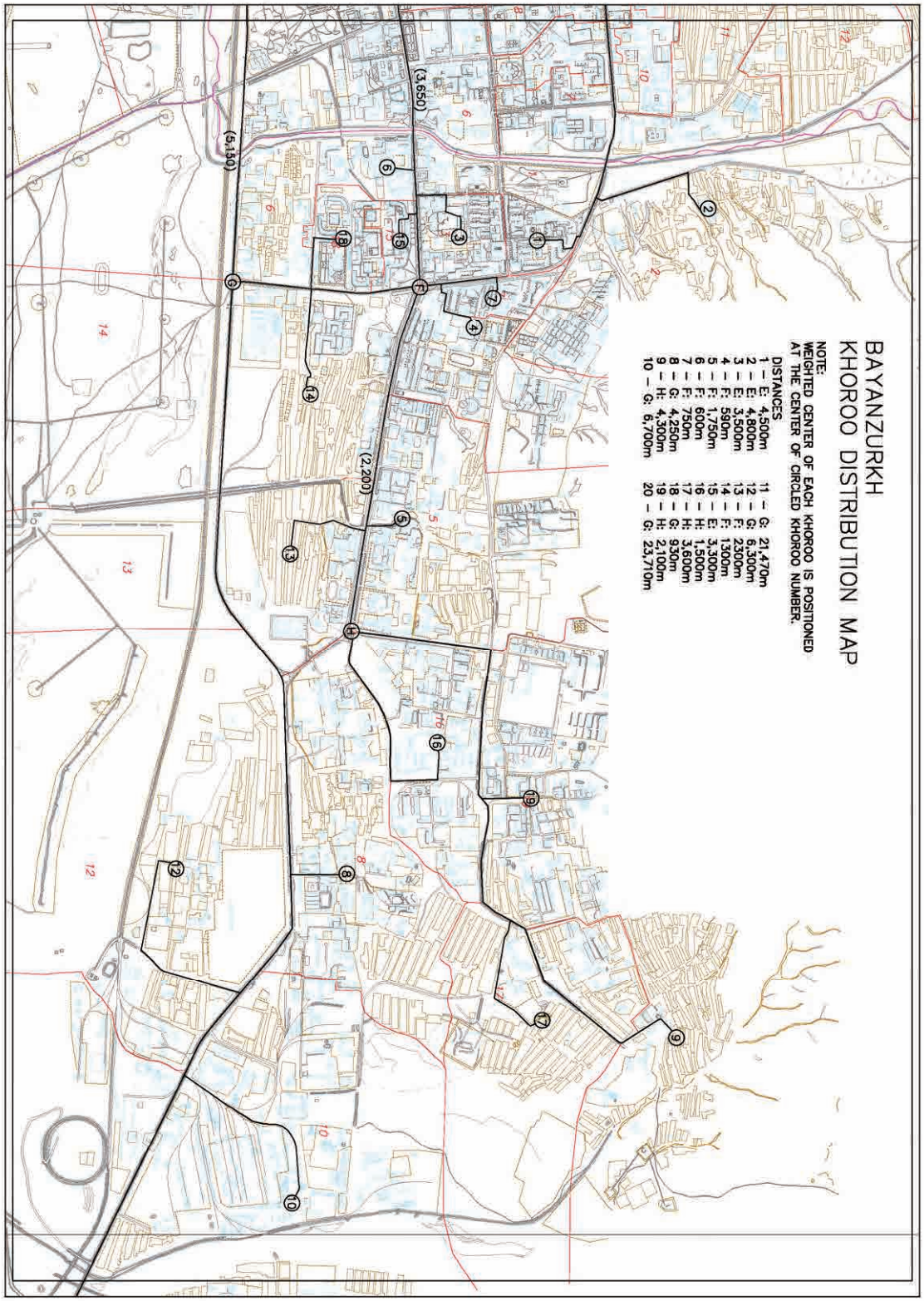
SkhD


SONGINOKHAIRKHAN DISTRICT
KHOROO DISTRIBUTION MAP
NOTE:
WEIGHTED CENTER OF EACH KHOROO IS POSITIONED AT THE CENTER OF CIRCLED KHOROO NUMBER.
DISTANCES
1 – A: 3,300m
2 – A: 1,600m
3 – D: 3,300m
4 – UCDS: 4,700m
5 – B: 1,500m
6 – B: 1,250m
7 – B: 3,300m
8 – B: 4,600m
9 – B: 5,240m
10 – B: 6,270m
11 – B: 6,700m
12 – D: 660m
13 – C: 2,300m
14 – C: 2,500m
15 – C: 2,500m
16 – C: 1,750m
17 – C: 1,200m
18 – C: 510m
NEDS
(3,700)
UCDS
(2,500)
(1,250)
(1,290)
(2,500)

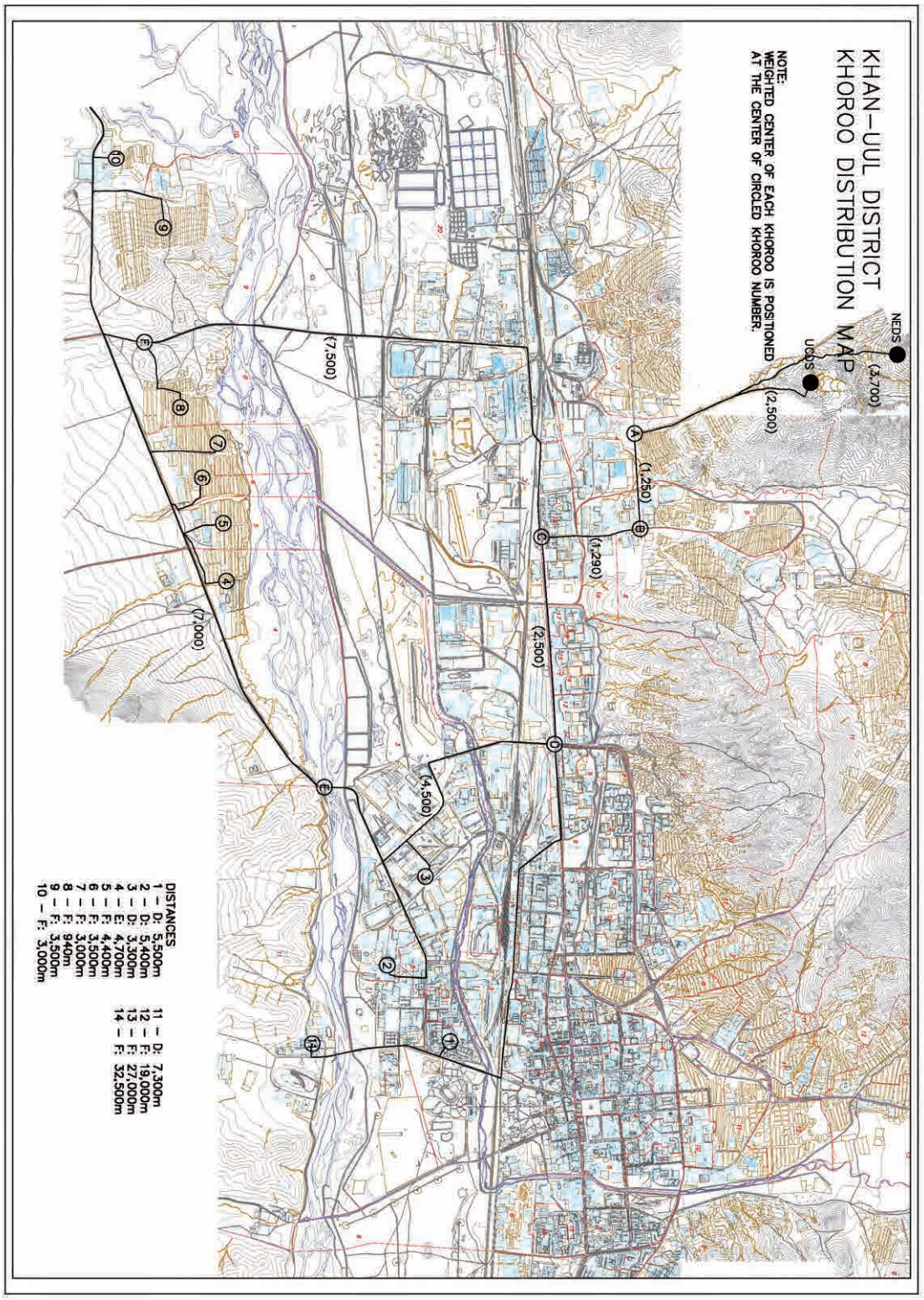
BZD


BAYANGOL
KHOROO DISTRIBUTION MAP
NOTE:
WEIGHTED CENTER OF EACH KHOROO IS POSITIONED AT THE CENTER OF CIRCLED KHOROO NUMBER.
DISTANCES
1 – D: 2,570m
2 – D: 2,000m
3 – D: 4,120m
4 – D: 2,000m
5 – C: 2,300m
6 – D: 920m
7 – D: 1,350m
8 – D: 2,240m
9 – D: 1,860m
10 – D: 3,160m
11 – D: 4,460m
12 – D: 3,270m
13 – D: 1,960m
14 – D: 2,690m
15 – D: 3,290m
16 – E: 700m
17 – D: 3,100m
18 – D: 2,900m
19 – D: 2,290m
20 – C: 2,700m
NEDS
(3,700)
(1,100)
(1,200)
(2,600)
(2,900)
BAYANGOL
BGD GARAGE
CHINGELTEI

BZD


BAYANZURKH
KHOROO DISTRIBUTION MAP
NOTE:
WEIGHTED CENTER OF EACH KHOROO IS POSITIONED AT THE CENTER OF CIRCLED KHOROO NUMBER.
DISTANCES
1 – E: 4,500m
2 – E: 4,800m
3 – E: 3,500m
4 – F: 590m
5 – F: 1,750m
6 – F: 600m
7 – F: 750m
8 – G: 4,250m
9 – H: 4,300m
10 – G: 6,700m
11 – G: 21,470m
12 – G: 6,300m
13 – F: 2300m
14 – F: 1300m
15 – E: 3,300m
16 – H: 1,500m
17 – H: 3,600m
18 – G: 930m
19 – H: 2,100m
20 – G: 23,710m
(5,150)
(3,650)
(2,200)

KhUD


KHAN-UUL DISTRICT
KHOROO DISTRIBUTION MAP
NOTE:
WEIGHTED CENTER OF EACH KHOROO IS POSITIONED AT THE CENTER OF CIRCLED KHOROO NUMBER.
NEDS
UCDS
(3,700)
(2,500)
(1,250)
(1,290)
(2,500)
(4,500)
(7,000)
(7,500)
DISTANCES
1 – D: 5,500m
2 – D: 5,400m
3 – D: 3,300m
4 – E: 4,700m
5 – F: 4,400m
6 – F: 3,500m
7 – F: 3,000m
8 – F: 940m
9 – F: 3,500m
10 – F: 3,000m
11 – D: 7,300m
12 – F: 19,000m
13 – F: 27,000m
14 – F: 32,500m

c. Depreciation and maintenance costs

It is considered that a vehicle is depreciated for 8 years and the remaining value equals to 10% of the basic price of the vehicle. As for the maintenance cost, it equals to 6% of the basic price of the vehicle. The following table shows the estimated depreciation and maintenance costs for CT-15m3, CT-8m3 and DT-10m3.

Table 4.5: Depreciation and maintenance costs

	Basic price		Years of depreciation	Remaining value	*Depreciation cost		Maintenance rate per year	Maintenance cost	
	USD	MNT	Year	MNT	MNT/year	MNT/day	%	MNT/year	MNT/day
Compactor truck 15m3, 10ton	95,000	123,500,000	8	12,350,000	13,893,750	38,065	6%	7,410,000	23,685
Compactor truck 8m3, 6ton	80,000	104,000,000	8	10,400,000	11,700,000	32,055	6%	6,240,000	19,945
Dump truck 10m3, 6ton	65,000	84,500,000	8	8,450,000	9,506,250	26,045	6%	5,070,000	16,205

d. Direct operation costs

The direct operation cost for each type of trucks is calculated based on the estimations and shown in the table below.

Table 4.6: Direct operation cost

	Items	Unit	Compactor 8m3						Remarks
			SBD	ChD	SKhD	BZD	BGD	KhUD	
A	Distance to Disposal Site	km	16.1	15.1	8.0	20.3	11.3	17.3	T&M Survey
B	Diesel consumption per km for travelling	km/l	5	5	5	5	5	5	Catalogue
C	Collection and discharge time	minutes	69	69	69	69	69	69	T&M Survey
D	Efficiency for working hours		0.9	0.9	0.9	0.9	0.9	0.9	T&M Survey
E	Diesel consumption per minutes for collection	min/l	30	30	30	30	30	30	Catalogue
F	Diesel consumption for traveling	liter/trip	6.44	6.04	3.20	8.12	4.52	6.92	A*2/B
G	Diesel consumption for collection	liter/trip	2.07	2.07	2.07	2.07	2.07	2.07	C*D/E
H	Total consumption of diesel	liter/trip	8.51	8.11	5.27	10.19	6.59	8.99	F+G
I	Unit rate of diesel	MNT/liter	1,800	1,800	1,800	1,800	1,800	1,800	Fuel & Salary
J	Fuel cost per trip	MNT/trip	15,318	14,598	9,486	18,342	11,862	16,182	H*I
K	Trip nos per day	Trip/day	2	2	2	2	2	2	Conditions
L	Fuel cost per day	MNT/day	30,636	29,196	18,972	36,684	23,724	32,364	J*K
M	Depreciation cost	MNT/day	32,055	32,055	32,055	32,055	32,055	32,055	Dep & Mainte cost
N	Maintenance cost	MNT/day	19,945	19,945	19,945	19,945	19,945	19,945	Dep & Mainte cost
O	Salary	MNT/day	16,667	16,667	16,667	16,667	16,667	16,667	Fuel & Salary
	O&M cost per day	**MNT/day**	**99,303**	**97,863**	**87,639**	**105,351**	**92,391**	**101,031**	
P	Waste carried amount per trip	ton/trip	3.24	3.24	3.24	3.24	3.24	3.24	Conditions
Q	Waste amount carried per day	ton/day	6.48	6.48	6.48	6.48	6.48	6.48	Q=PxK
	Unit cost per ton of waste	**MNT/ton**	**15,324**	**15,102**	**13,524**	**16,258**	**14,258**	**15,591**	

	Items	Unit	Compactor 15m3						Remarks
			SBD	ChD	SKhD	BZD	BGD	KhUD	
A	Distance to Disposal Site	km	16.1	15.1	8.0	20.3	11.3	17.3	T&M Survey
B	Diesel consumption per km for travelling	km/l	2	2	2	2	2	2	Catalogue
C	Collection and discharge time	minutes	125	125	125	125	125	125	T&M Survey
D	Efficiency for working hours		0.9	0.9	0.9	0.9	0.9	0.9	T&M Survey
E	Diesel consumption per minutes for collection	min/l	15	15	15	15	15	15	Catalogue
F	Diesel consumption for traveling	liter/trip	16.10	15.10	8.00	20.30	11.30	17.30	A*2/B
G	Diesel consumption for collection	liter/trip	7.50	7.50	7.50	7.50	7.50	7.50	C*D/E
H	Total consumption of diesel	liter/trip	23.60	22.60	15.50	27.80	18.80	24.80	F+G
I	Unit rate of diesel	MNT/liter	1,800	1,800	1,800	1,800	1,800	1,800	Fuel Tab
J	Fuel cost per trip	MNT/trip	42,480	40,680	27,900	50,040	33,840	44,640	H*I
K	Trip nos per day	Trip/day	2	2	2	2	2	2	Conditions
L	Fuel cost per day	MNT/day	84,960	81,360	55,800	100,080	67,680	89,280	J*K
M	Depreciation cost	MNT/day	38,065	38,065	38,065	38,065	38,065	38,065	Dep & Mainte cost
N	Maintenance cost	MNT/day	23,685	23,685	23,685	23,685	23,685	23,685	Dep & Mainte cost
O	Salary	MNT/day	16,667	16,667	16,667	16,667	16,667	16,667	Fuel & Salary
	O&M cost per day	**MNT/day**	**163,377**	**159,777**	**134,217**	**178,497**	**146,097**	**167,697**	
P	Waste carried amount per trip	ton/trip	6.08	6.08	6.08	6.08	6.08	6.08	Conditions
Q	Waste amount carried per day	ton/day	12.16	12.16	12.16	12.16	12.16	12.16	Q=PxK
	Unit cost per ton of waste	**MNT/ton**	**13,436**	**13,140**	**11,038**	**14,679**	**12,015**	**13,791**	

	Items	Unit	Dump Track						Remarks
			SBD	ChD	SKhD	BZD	BGD	KhUD	
A	Distance to Disposal Site	km	16.1	15.1	8.0	20.3	11.3	17.3	T&M Survey
B	Diesel consumption per km for travelling	km/l	3	3	3	3	3	3	Catalogue
C	Collection and discharge time	minutes	125	125	125	125	125	125	T&M Survey
D	Efficiency for working hours		0.9	0.9	0.9	0.9	0.9	0.9	T&M Survey
E	Diesel consumption per minutes for collection	min/l	30	30	30	30	30	30	Catalogue
F	Diesel consumption for traveling	liter/trip	10.73	10.07	5.33	13.53	7.53	11.53	A*2/B
G	Diesel consumption for collection	liter/trip	3.75	3.75	3.75	3.75	3.75	3.75	C*D/E
H	Total consumption of diesel	liter/trip	14.48	13.82	9.08	17.28	11.28	15.28	F+G
I	Unit rate of diesel	MNT/liter	1,800	1,800	1,800	1,800	1,800	1,800	Fuel & Salary
J	Fuel cost per trip	MNT/trip	26,070	24,870	16,350	31,110	20,310	27,510	H*I
K	Trip nos per day	Trip/day	2	2	2	2	2	2	Conditions
L	Fuel cost per day	MNT/day	52,140	49,740	32,700	62,220	40,620	55,020	J*K
M	Depreciation cost	MNT/day	26,045	26,045	26,045	26,045	26,045	26,045	Dep & Mainte cost
N	Maintenance cost	MNT/day	16,205	16,205	16,205	16,205	16,205	16,205	Dep & Mainte cost
O	Salary	MNT/day	16,667	16,667	16,667	16,667	16,667	16,667	Fuel & Salary
	O&M cost per day	**MNT/day**	**111,057**	**108,657**	**91,617**	**121,137**	**99,537**	**113,937**	
P	Waste carried amount per trip	ton/trip	2.70	2.70	2.70	2.70	2.70	2.70	Conditions
Q	Waste amount carried per day	ton/day	5.40	5.40	5.40	5.40	5.40	5.40	Q=PxK
	Unit cost per ton of waste	**MNT/ton**	**20,566**	**20,122**	**16,966**	**22,433**	**18,433**	**21,099**	

e. Waste collection fee for transporters

The amount of waste collection fee for transporters equals to addition of the direct and indirect operation costs. The indirect operation cost is assumed to be same as 30% of the direct operation costs estimated above.

The following tables show the amounts of cost for transporting unit waste and the fee for a trip from each district.

Table 4.7: Cost per unit waste, by districts and by types of vehicles

1 Compactor track

Description			Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Direct operational cost	Compactor track (15m3)	A	MNT/ton	13,436	13,140	11,038	14,679	12,015	13,791
	Compactor track (8m3)	B	MNT/ton	15,324	15,102	13,524	16,258	14,258	15,591
Indirect cost (30% of Direct operational cost)	Compactor track (15m3)	C	MNT/ton	4,031	3,942	3,312	4,404	3,605	4,138
	Compactor track (8m3)	D	MNT/ton	4,597	4,531	4,057	4,877	4,277	4,677
Total operational cost	Compactor track (15m3)	E=A+C	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Compactor track (8m3)	F=B+D	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300

2 Dump track

Description			Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Direct operational cost	Dump track (10m3)	G	MNT/ton	20,566	20,122	16,966	22,433	18,433	21,099
Indirect cost (30% of Direct operational cost)	Dump track (10m3)	H	MNT/ton	6,170	6,036	5,090	6,730	5,530	6,330
Total operational cost	Dump track (10m3)	I=G+H	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500

Table 4.8: Amount of fee per trip, by districts and by types of vehicles

Unit: MNT/trip

Type of collection track	SBD	ChD	SKhD	BZD	BGD	KhUD
Compactor (15m3)	106,400	104,000	87,600	116,100	95,500	109,400
Compactor (8m3)	64,800	63,800	57,000	68,700	60,300	65,800
Dump Track (10m3)	72,400	70,700	59,700	78,800	64,800	74,300
Average distance (km)	16.1	15.1	8.0	20.3	11.3	17.3

4.3 Waste collection fee of households and fee collection rate

4.3.1 Current waste collection fee of households and fee collection rate

The waste collection fee of households as of 2009 was 2,000 MNT/month for an apartment household (in SKhD, 2,500 MNT/month) and 2,500 MNT/month for a GER household. Fee collection rate in apartment areas is high as fees are collected together with the utility fees. As for GER area, the rate is 21 to 79% since fees are collected in cash on the spot at the same time with waste collection. Waste collection rate in apartment areas is almost 100% while that in GER area is relatively low since waste is collected as long as the fees are paid.

In the following table waste collection fee of households and fee collection rate as of 2009 are shown.

Table 4.9: Waste collection fee of households and fee collection rate as of 2009

Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Apartment area	Population	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	HH	14,508	6,898	14,755	18,677	27,867	8,575
	Waste collection fee for discharger	MNT/month	2,000	2,000	2,500	2,000	2,000	2,000
	The above collection rate	%	92%	99%	88%	99%	90%	100%
GER area	Population	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	HH	16,960	23,309	37,900	37,550	10,652	17,112
	Waste collection fee for discharger	MNT/month	2,500	2,500	2,500	2,500	2,500	2,500
	The above collection rate	%	21%	30%	59%	58%	79%	14%

4.3.2 Waste collection fee of households per unit waste

The amount of waste collection fee of households per unit waste estimated from the data in Table 4.9 is shown in the following table.

Table 4.10: Waste collection fee of households per unit waste

Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Apartment area	Population	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	HH	14,508	6,898	14,755	18,677	27,867	8,575
	Waste collection fee for discharger	MNT/month	2,000	2,000	2,500	2,000	2,000	2,000
	The above collection rate	%	92%	99%	88%	99%	90%	100%
	Collected amount	MNT/month	26,694,720	13,658,040	32,461,000	36,980,460	50,160,600	17,150,000
	Waste generation rate	g/capita/day	280	280	280	280	280	280
	Waste amount	ton/month	503	243	505	639	1,052	279
	Waste collection rate	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	ton/month	503	243	505	639	1,052	279
	Waste collection fee of discharger per waste	MNT/ton	53,054	56,098	64,325	57,886	47,673	61,378
GER area	Population	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	HH	16,960	23,309	37,900	37,550	10,652	17,112
	Waste collection fee for discharger	MNT/month	2,500	2,500	2,500	2,500	2,500	2,500
	The above collection rate	%	21%	30%	59%	58%	79%	14%

Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
	Collected amount	MNT/month	8,904,000	17,481,750	55,902,500	54,447,500	21,037,700	5,989,200
	Waste generation rate	g/capita/day	788	788	788	788	788	788
	Waste amount	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	%	21%	30%	59%	58%	79%	14%
	Waste collected amount	ton/month	363	783	2,396	2,161	812	214
	Waste collection fee of discharger per waste	MNT/ton	24,548	22,313	23,328	25,190	25,914	27,934

a. Waste collection fee of households and waste collection fee for transporters

The following table shows the waste collection fee for transporters estimated in 4.2 and waste collection fee of households per unit waste as of 2011.

Table 4.11: Waste collection fee of households per unit waste and waste collection fee for transporters in 2011 (apartment area)

Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Fee collection	Population	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	HH	14,508	6,898	14,755	18,677	27,867	8,575
	Waste collection fee for discharger	MNT/month	2,000	2,000	2,500	2,000	2,000	2,000
	The above collection rate	%	92%	99%	88%	99%	90%	100%
	Collected amount	MNT/month	26,694,720	13,658,040	32,461,000	36,980,460	50,160,600	17,150,000
	Waste generation rate	g /capita/day	280	280	280	280	280	280
	Waste amount	ton/month	503	243	505	639	1,052	279
	Waste collection rate	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	ton/month	503	243	505	639	1,052	279
	Collected waste collection fee of discharger per waste	MNT/ton	53,054	56,098	64,325	57,886	47,673	61,378
Collection cost	Total operational cost CT (15m3)	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Total operational cost CT (8m3)	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300
	Owned CT (15m3)	Units	3	3	3	4	6	2
	Owned CT (8m3)	Units	2	2	1	1	1	
	Percentage of owned CT (15m3)	%	60%	60%	75%	80%	86%	100%
	Percentage of owned CT (8m3)	%	40%	40%	25%	20%	14%	0%
	Average waste collection fee for collector per waste	MNT/ton	18,500	18,140	15,200	19,520	16,114	18,000

Table 4.12: Waste collection fee of households per unit waste and waste collection fee for transporters in 2011 (GER area)

Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Fee collection	Population	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	HH	16,960	23,309	37,900	37,550	10,652	17,112
	Waste collection fee for discharger	MNT/month	2,500	2,500	2,500	2,500	2,500	2,500
	The above collection rate	%	21%	30%	59%	58%	79%	14%
	Collected amount	MNT/month	8,904,000	17,481,750	55,902,500	54,447,500	21,037,700	5,989,200
	Waste generation rate	g /capita/day	788	788	788	788	788	788
	Waste amount	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	%	21%	30%	59%	58%	79%	14%
	Waste collected amount	ton/month	363	783	2,396	2,161	812	214
	Collected waste collection fee of discharger per waste	MNT/ton	24,548	22,313	23,328	25,190	25,914	27,934
Collection	Average waste collection fee for collector per waste	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500

Comparing the fees of households (revenue) and the fees for transporters (expenditure) of apartment area, the revenue exceeds the expenditure; and thus, it can be concluded that proper management is being implemented. As for the GER area, the expenditure exceeds the revenue resulting in the losses in all districts.

4.4 Appropriate amount of waste collection fee of households

4.4.1 Estimation cases

In order to improve the inappropriate management (inequalibrium of renveues and expenditures) mentioned in the above section, it is necessary to combine revenues and expenditures in apartment and GER areas so that the result reaches to the break-even point or will be positive (profit). In this section estimations for the improvement are made for the following cases:

Case 1: Each district manages revenues and expenditures in its apartment and GER areas independently. The estimation is made for appropriate amounts of the fee of households for apartment and GER areas (the waste collection rates in the residential areas are the same as those of current condition).

Case 2: The fee of apartment households are fixed at 2000 MNT/month. Estimation is made for an appropriate amount of the fee of GER households (the fee will be same in all districts) that makes the difference between the total revenues and total expenditures "zero" in the entire 6 districts (the waste collection rates in the residential areas are the same as those of current condition).

Case 3: The fee of apartment households are fixed at 2000 MNT/month. The waste collection rate in GER area changes from 40 to 100%. Estimation is made for an appropriate amount of the fee of GER households that makes the difference between the total

revenues and total expenditures "zero" in each district (the waste collection rates in apartment area is the same as that of current condition).

Case 4: The fee of apartment households are fixed at 2000 MNT/month. The waste collection rate in GER area changes from 40 to 100%. Estimation is made for an appropriate amount of the fee of GER households (the fee will be same in all districts) that makes the difference between the total revenues and total expenditures "zero" in the entire 6 districts (the waste collection rates in apartment area is the same as that of current condition).

The cases are compiled in the table below:

Table 4.13: Conditions of estimation

Area	Individual district discharge fee	Deference in fee by district	Waste collection rate	Balance of income and expenditure by Area	Balance of income and expenditure by District	Balance of income and expenditure by city
Case 1						
Apartment	Variable	Yes	As it is	Yes	Yes	No
GER	Variable	Yes	As it is	Yes	Yes	No
Case 2						
Apartment	Fix (2000)	No	As it is	All	No	Yes
GER	Variable	No	As it is	All	No	Yes
Case 3						
Apartment	Fix (2000)	Yes	As it is	Yes	Yes	No
GER	Variable	Yes	Fix by 40%	Yes	Yes	No
	Variable	Yes	Fix by 60%	Yes	Yes	No
	Variable	Yes	Fix by 80%	Yes	Yes	No
	Variable	Yes	Fix by 100%	Yes	Yes	No
Case 4						
Apartment	Fix (2000)	No	As it is	All	No	Yes
GER	Variable	Yes	Fix by 40%	All	No	Yes
	Variable	Yes	Fix by 60%	All	No	Yes
	Variable	Yes	Fix by 80%	All	No	Yes
	Variable	Yes	Fix by 100%	All	No	Yes

4.4.2 Results of the estimation

a. Case 1

A Apartment area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection cost	Total operational cost CT (15m3)	A	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Total operational cost CT (8m3)	B	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300
	Owned CT (15m3)	C	Units	3	3	3	4	6	2
	Owned CT (8m3)	D	Units	2	2	1	1	1	
	Percentage of owned CT (15m3)	E	%	60%	60%	75%	80%	86%	100%
	Percentage of owned CT (8m3)	F	%	40%	40%	25%	20%	14%	0%
Fee collection	Average collection cost per waste	G=AxE+BxF	MNT/ton	18,500	18,140	15,200	19,520	16,114	18,000
	Population	H	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	I	HH	14,508	6,898	14,755	18,677	27,867	8,575
	The above collection rate	J	%	92%	99%	88%	99%	90%	100%
	Collected house hold	K=IxJ	HH	13,347	6,829	12,984	18,490	25,080	8,575
	Waste generation rate	L	g/capita/day	280	280	280	280	280	280
	Waste amount	M=HxLx30/10^6	ton/month	503	243	505	639	1,052	279
	Waste collection rate	O	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	P=NxO	ton/month	503	243	505	639	1,052	279
	Required waste collection fee of discharger	**Q=GxP/K**	**MNT/month**	**700**	**650**	**600**	**680**	**680**	**590**

B Ger Area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	AD	%	21%	30%	59%	58%	79%	14%
	Collected house hold	AE=ACxAD	HH	3,562	6,993	22,361	21,779	8,415	2,396
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	21%	30%	59%	58%	79%	14%
	Waste collected amount	AI=AGxAH	ton/month	363	783	2,396	2,161	812	214
	Required waste collection fee of discharger	**AJ=AAxAI/AE**	**MNT/month**	**2,730**	**2,940**	**2,370**	**2,900**	**2,320**	**2,470**

b. Case 2

A Apartment area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection cost	Total operational cost CT (15m3)	A	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Total operational cost CT (8m3)	B	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300
	Owned CT (15m3)	C	Units	3	3	3	4	6	2
	Owned CT (8m3)	D	Units	2	2	1	1	1	
	Percentage of owned CT (15m3)	E	%	60%	60%	75%	80%	86%	100%
	Percentage of owned CT (8m3)	F	%	40%	40%	25%	20%	14%	0%
	Average collection cost per waste	G=AxE+BxF	MNT/ton	18,500	18,140	15,200	19,520	16,114	18,000
Fee collection	Population	H	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	I	HH	14,508	6,898	14,755	18,677	27,867	8,575
	The above collection rate	J	%	92%	99%	88%	99%	90%	100%
	Collected house hold	K=IxJ	HH	13,347	6,829	12,984	18,490	25,080	8,575
	Waste generation rate	L	g/capita/day	280	280	280	280	280	280
	Waste amount	$M=HxLx30/10^6$	ton/month	503	243	505	639	1,052	279
	Waste collection rate	O	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	P=NxO	ton/month	503	243	505	639	1,052	279
	Waste collection fee of discharger	Q=GxP/K	MNT/month			**2,000**			
	Waste collection fee of discharger per waste	R=QxK/P	MNT/ton	53,054	56,098	51,460	57,886	47,673	61,378
	Balance	S=(R−G)xP	MNT/month	17,386,260	9,241,574	18,298,296	24,510,038	33,205,707	12,120,483

B Ger Area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	AD	%	21%	30%	59%	58%	79%	14%
	Collected house hold	AE=ACxAD	HH	3,562	6,993	22,361	21,779	8,415	2,396
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	$AG=ABxAFx30/10^6$	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	21%	30%	59%	58%	79%	14%
	Waste collected amount	AI=AGxAH	ton/month	363	783	2,396	2,161	812	214
	Required waste collection fee of discharger	**$AJ=\Sigma$ (AIxAA−S)/ Σ AE**	**MNT/month**	**870**					

c. Case-3

A Apartment area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection cost	Total operational cost CT (15m3)	A	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Total operational cost CT (8m3)	B	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300
	Owned CT (15m3)	C	Units	3	3	3	4	6	2
	Owned CT (8m3)	D	Units	2	2	1	1	1	
Fee collection	Percentage of owned CT (15m3)	E	%	60%	60%	75%	80%	86%	100%
	Percentage of owned CT (8m3)	F	%	40%	40%	25%	20%	14%	0%
	Average collection cost per waste	G=AxE+BxF	MNT/ton	18,500	18,140	15,200	19,520	16,114	18,000
	Population	H	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	I	HH	14,508	6,898	14,755	18,677	27,867	8,575
	The above collection rate	J	%	92%	99%	88%	99%	90%	100%
	Collected house hold	K=IxJ	HH	13,347	6,829	12,984	18,490	25,080	8,575
	Waste generation rate	L	g/capita/day	280	280	280	280	280	280
	Waste amount	M=HxLx30/10^6	ton/month	503	243	505	639	1,052	279
	Waste collection rate	O	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	P=NxO	ton/month	503	243	505	639	1,052	279
	Waste collection fee for discharger	**Q=GxP/K**	**MNT/month**	**2,000**					
	Waste collection fee per waste	R=QxK/P	MNT/ton	53,054	56,098	51,460	57,886	47,673	61,378
	Balance	S=(R-G)xP	MNT/month	17,386,260	9,241,574	18,298,296	24,510,038	33,205,707	12,120,483

B Ger Area (40%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**40%**	**40%**	**40%**	**40%**	**40%**	**40%**
	Collected house hold	AE=ACxAD	HH	6,784	9,324	15,160	15,020	4,261	6,845
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	40%	40%	40%	40%	40%	40%
	Waste collected amount	AI=AGxAH	ton/month	691	1,045	1,625	1,491	411	613
	Required waste collection fee of discharger	**AJ=AAxAI/AE**	**MNT/month**	**170**	**1,950**	**1,170**	**1,270**	**-5,480**	**700**

B Ger Area (60%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**60%**	**60%**	**60%**	**60%**	**60%**	**60%**
	Collected house hold	AE=ACxAD	HH	10,176	13,985	22,740	22,530	6,391	10,267
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	60%	60%	60%	60%	60%	60%
	Waste collected amount	AI=AGxAH	ton/month	1,036	1,567	2,437	2,236	617	919
	Required waste collection fee of discharger	**AJ=AAxAI/AE**	**MNT/month**	**1,030**	**2,280**	**1,570**	**1,820**	**−2,890**	**1,290**

B Ger Area (80%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**80%**	**80%**	**80%**	**80%**	**80%**	**80%**
	Collected house hold	AE=ACxAD	HH	13,568	18,647	30,320	30,040	8,522	13,690
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	80%	80%	80%	80%	80%	80%
	Waste collected amount	AI=AGxAH	ton/month	1,382	2,089	3,249	2,981	822	1,225
	Required waste collection fee of discharger	**AJ=AAxAI/AE**	**MNT/month**	**1,450**	**2,440**	**1,770**	**2,090**	**−1,590**	**1,580**

B Ger Area (100%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
	Collected house hold	AE=ACxAD	HH	16,960	23,309	37,900	37,550	10,652	17,112
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	AI=AGxAH	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Required waste collection fee of discharger	**AJ=AAxAI/AE**	**MNT/month**	**1,710**	**2,540**	**1,890**	**2,250**	**−810**	**1,760**

d. Case 4

A Apartment area

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection cost	Total operational cost CT (15m3)	A	MNT/ton	17,500	17,100	14,400	19,100	15,700	18,000
	Total operational cost CT (8m3)	B	MNT/ton	20,000	19,700	17,600	21,200	18,600	20,300
	Owned CT (15m3)	C	Units	3	3	3	4	6	2
	Owned CT (8m3)	D	Units	2	2	1	1	1	
Fee collection	Percentage of owned CT (15m3)	E	%	60%	60%	75%	80%	86%	100%
	Percentage of owned CT (8m3)	F	%	40%	40%	25%	20%	14%	0%
	Average collection cost per waste	G=AxE+BxF	MNT/ton	18,500	18,140	15,200	19,520	16,114	18,000
	Population	H	capita	59,900	28,984	60,076	76,054	125,260	33,264
	House hold	I	HH	14,508	6,898	14,755	18,677	27,867	8,575
	The above collection rate	J	%	92%	99%	88%	99%	90%	100%
	Collected house hold	K=IxJ	HH	13,347	6,829	12,984	18,490	25,080	8,575
	Waste generation rate	L	g/capita/day	280	280	280	280	280	280
	Waste amount	M=HxLx30/10^6	ton/month	503	243	505	639	1,052	279
	Waste collection rate	O	%	100%	100%	100%	100%	100%	100%
	Waste collected amount	P=NxO	ton/month	503	243	505	639	1,052	279
	Waste collection fee for discharger	Q=GxP/K	MNT/month	**2,000**					
	Waste collection fee per waste	R=QxK/P	MNT/ton	53,054	56,098	51,460	57,886	47,673	61,378
	Balance	S=(R-G)xP	MNT/month	17,386,260	9,241,574	18,298,296	24,510,038	33,205,707	12,120,483

B Ger Area (40%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**40%**	**40%**	**40%**	**40%**	**40%**	**40%**
	Collected house hold	AE=ACxAD	HH	6,784	9,324	15,160	15,020	4,261	6,845
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	40%	40%	40%	40%	40%	40%
	Waste collected amount	AI=AGxAH	ton/month	691	1,045	1,625	1,491	411	613
	Required waste collection fee of discharger		**MNT/month**	**650**					

B Ger Area (60%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	**AD**	**%**	**60%**	**60%**	**60%**	**60%**	**60%**	**60%**
	Collected house hold	AE=ACxAD	HH	10,176	13,985	22,740	22,530	6,391	10,267
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	60%	60%	60%	60%	60%	60%
	Waste collected amount	AI=AGxAH	ton/month	1,036	1,567	2,437	2,236	617	919
	Required waste collection fee of discharger		**MNT/month**	**1,320**					

B Ger Area (80%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	AD	%	80%	80%	80%	80%	80%	80%
	Collected house hold	AE=ACxAD	HH	13,568	18,647	30,320	30,040	8,522	13,690
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	80%	80%	80%	80%	80%	80%
	Waste collected amount	AI=AGxAH	ton/month	1,382	2,089	3,249	2,981	822	1,225
	Required waste collection fee of discharger		**MNT/month**	**1,650**					

B Ger Area (100%)

	Description		Unit	SBD	ChD	SKhD	BZD	BGD	KhUD
Collection	Collection cost per waste (Dump track 10m3)	AA	MNT/ton	26,800	26,200	22,100	29,200	24,000	27,500
Fee collection	Population	AB	capita	73,063	110,475	171,812	157,643	43,470	64,783
	House hold	AC	HH	16,960	23,309	37,900	37,550	10,652	17,112
	The above collection rate	AD	%	100%	100%	100%	100%	100%	100%
	Collected house hold	AE=ACxAD	HH	16,960	23,309	37,900	37,550	10,652	17,112
	Waste generation rate	AF	g/capita/day	788	788	788	788	788	788
	Waste amount	AG=ABxAFx30/10^6	ton/month	1,727	2,612	4,062	3,727	1,028	1,531
	Waste collection rate	AH	%	90%	100%	100%	100%	100%	100%
	Waste collected amount	AI=AGxAH	ton/month	1,554	2,612	4,062	3,727	1,028	1,531
	Required waste collection fee of discharger		**MNT/month**	**1,820**					

4.4.3 Summarized results

The summarized results of the estimations are as follows.

Table 4.14: Results of the estimations

Unit: MNT/month

Area	Waste collection fee of discharger					
	SBD	ChD	SKhD	BZD	BGD	KhUD
Case 1						
Apartment area	700	650	600	680	680	590
GER Area	2,730	2,940	2,370	2,900	2,320	2,470
Case 2						
Apartment area	2,000					
GER Area	870					
Case 3						
Apartment area	2,000					
GER Area (40%)	170	1,950	1,170	1,270	−5,480	700
GER Area (60%)	1,030	2,280	1,570	1,820	−2,890	1,290
GER Area (80%)	1,450	2,440	1,770	2,090	−1,590	1,580
GER Area (100%)	2,540	2,540	1,890	2,250	−810	1,760
Case 4						
Apartment area	2,000					
GER Area (40%)	650					
GER Area (60%)	1,320					
GER Area (80%)	1,650					
GER Area (100%)	1,820					

The final digits in the results for the waste collection fee of households have been rounded-up.

ANNEX 5

Strategy for Public Awareness Raising in SWM of the Ulaanbaatar City

1 Strategy for Public Awareness Raising in SWM of the Ulaanbaatar City

As a part of the activities in relation to the outcome 5), many types of public awareness raising activities have been conducted in the pilot project (PP) on improvement of waste discharging manner and waste separation since April 2010. Based on the experiences and lessons learned in these activities, the strategy for public awareness raising in SWM of the Ulaanbaatar City is to be formulated.

1.1 Principles of the Public Awareness Raising

The following basic principles of the public awareness raising shall to be applied to the improvement of waste discharging manner and waste separation.

a. Approach based on the characteristics of each district

In the UBC, each district and khoroo varies in its characteristics and problems. In order to conduct public awareness raising activities, the problems that each district faces as well as the conditions such as the scale of the target area, the number of populations and households, types of residents (with or without DC, with of without Jijur), the number of business entities, the location of waste discharging point, frequency of waste collection service, and existence of recycle shop in each target area should be considered at first. Then, a flexible approach should be applied based on its characteristics and problems.

b. Lead by good practices

People are influenced by the behaviors of others. In the UBC, there are many good practices such as the case of SBD#7 where the waste separation and community recycling had been already implemented by khoroo's initiative, and the SBD#7 and BZD#7 where there were the recycle shops in the khoroo. Therefore, the good practices that could influence other people's behaviors should be found and shared among other areas. If possible, it is preferable to arrange a site visit to these area of good practices.

c. The 3Rs

In general, the recycling is considered the best option. However, it is important to propagate the concept of 3Rs since the recycling itself cannot help reduce the consumption of natural resources and solve environmental problems. Waste should primarily be reduced at source where possible. Where waste is generated, we should actively Reuse and Recycle. Then, the rest of them should be treated in appropriate manner. We will ensure that the waste hierarchy will be advocated through its education efforts.

d. Establish the slogan

The slogan is a word or phrase that is used in advertising to attract people's attention

and could lead them towards the certain direction. In Japan, such a slogan as “Waste if mixed, resource if separated” has been used to promote waste separation at source by citizens, which was also utilized in preparation of the PR tools in the PP and already became familiar with the UB citizens. In public awareness raising activities, it is useful to apply this kind of slogan or logo that is easy to understand, catchy and consistent.

Figure 1.1: 3R promotion booklet with the slogan of “waste if mixed, resource if separated”

e. Identify the information that the citizens want to know

In promotion of waste separation, it is important to identify not only the information that the city wants citizens to know but also the information that the citizens want to know and that could motivate people to cooperate. In the PP, as a part of public awareness raising activities, Apartment Owner’s Union (AOU) meeting was held on a regular basis to obtain the information from the AOU leaders who understand well about the resident’s reaction to the PP. The information was then utilized in the preparation of the PR tools. For example, in addition to the basic information that the city wants citizens to know such as the rules on waste separation, the information on “why the waste separation is necessary” and “how and where those recyclables are going to be treated” would motivate citizens to change their behaviors.

Figure 1.2: Waste separation calendar with the explanation of RPF materials reflecting the comments in the AOU meetings in SBD＃7

f. Continuous improvement by trial and error

It is acknowledged that the community we live in is diverse. Therefore, taking a “one size fits all” approach can not always be applied to all districts. The UBC shall strive to develop diverse forms of public awareness raising activities that are inclusive of cultural diversity through trial and error. In order for anybody to update or modify easily the PR tools, it is also important to use the commonly used software such as Microsoft power point.

1.2 Objectives of the Strategy for Public Awareness Raising

The objectives of the strategy for public awareness raising in SWM in the UBC are the followings;

- Minimize the amount of waste generation in the UBC
- Promote public participation on waste separation and recycling
- Improve and maintain public awareness on SWM
- Promote understanding of the UB citizens on the waste hierarchy of the 3Rs (Reduce, Reuse, Recycle)
- Reinforce collaboration among various stakeholders (concerned public agencies, schools, business entities, communities, NGOs etc.)
- Develop stakeholder's problem-solving abilities in SWM
- Develop the capacity of public awareness raising and PR activities of the public officers in charge of SWM

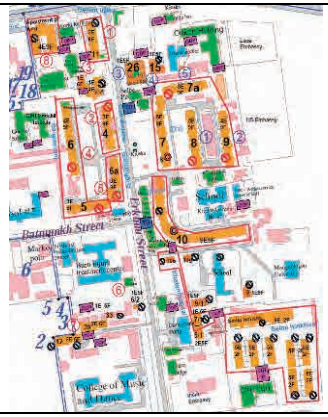
1.3 Specific Methods of Public Awareness Raising

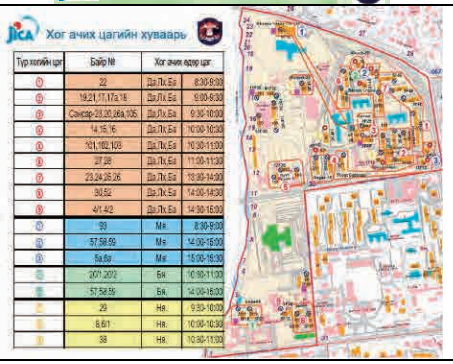
Specific methods of public awareness raising in SWM including the cases developed in the PP are the followings;

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Apartment Owner's union (AOU) meeting	Khoroo governor、AOU leader、WSF officer 、district PSD 、collection provider	Each few apartments in the khoroo belong to the AOU and the AOU leader is selected for each AOU. Since AOU leaders work as a media of the communication between the khoroo governor and the residents, they are considered communication channels in the PP as well. AOU meetings were organized by the EPWMD and JET since the middle of April 2010, many issues such as improvement of waste discharging manner and waste collection manner, waste separation at sources, means of PR activities etc. were discussed in the meetings. Such a way of frequent communication and information sharing among stakeholders helped improve problem-solving abilities of the whole khoroo. In total, 64 times of AOU meetings were held in the PP Phase 1, 2.	
Public meeting	Khoroo governor、AOU leader、WSF officer、Apartment residents	In winter in 2010, the public meetings on trial basis were held in order to directly encourage public participation in the PP. Taking into consideration that many members of households would be out during weekdays, it was decided to have the meeting on the Saturday afternoon, and the AOU leaders via Kheseg leaders have informed the dates of the meeting and called residents to participate actively in the meetings, and the notices were put on the entrance doors. However, there was not sufficient number of participants. Judging from the low percentage of participation rate, it can be said that such public meetings that require a lot of resources and efforts to organize are not so much effective. Therefore, the PR through mass media such as TV or newspaper would be considered more effective PR tools. In total, 6 times of public meetings were held in the PP Phase Ⅰ.	
Business entities meeting	Business owners in BZD # 7 、khoroo governor 、AOU leader、WSF officer (in charge of SWM)	Since there were many restaurants and foods business running along the main street in BZD#7, waste scattering by those businesses was a big issue. Therefore, business entities meeting was held in order to call for the participation in improvement of waste discharging manner and waste separation. According to the T&M survey, 30 % of the total wastes comes from the business entities, they should be targeted in the future as well. Also in this way, it is important to identify the specific problem of each khoroo and to focus on it, when conducting public awareness raising activities. In total, 4 times of business entities meetings were held in BZD# 7.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Waste education in schools	Approx. 500 students of the 4th and 5th grades of the school #48 in BZD#1	On Nov. 4th in 2010, as a part of public education activities, the waste education lecture was given to the students of the 4th and 5th grades of the school #48 in BZD#1. In the lecture, the importance on how to manage waste at household and how to recycle was explained. It is important to educate people not only through AOU meetings and public meetings, but also through school educations as the children would transfer the knowledge to the adults at home. For the future use in school education in the UBC, the 3R promotion booklet was also developed later.	
House-to-house visit	1404 households of target apartment of the PP on separate collection in SBD#7	In May 2011, before implementing the PP on separate collection in SBD# 7, the house-to-house visit was conducted to increase public participation in the waste separation. in order for residents to understand how to discharge waste on the designated date of the separate collection, the calendar was distributed while explaining the purpose of the PP. Although house visit was conducted during the daytime, only approx. 40% of the households were at home, which could be concluded that it's efficiency is not so high. However, many residents showed the willingness to cooperate by paying a direct visit to each house. Since this kind of PR activities requires an intensive manpower, it is necessary to call for the voluntary participation of the Kheseg leaders or 3R promoters.	
Public event on waste education	Approx. 660 UB citizens	"Mongolia-Japan 3 R Public Event" was held at the Japan Center from April 29 to May 1, 2011. The purposes of this event are to enhance the public awareness on the waste issues and promote active participation in our waste separation & recycling PP. Especially for this event, a famous environmental cartoonist Mr. Hiroshi Takatsuki and 6 other volunteers were invited from Japan. The 3-days program including exhibition of environmental cartoons, recycling hand work, original eco-bag making, Japanese tea ceremony and 3R quiz etc. was very effective for UB citizens to lean about SWM through entertainment and was good way of advertizing the project itself. This kind of event shall be incorporated to the activities for "the World Environment Day (June 5th) in collaboration with stakeholders.	

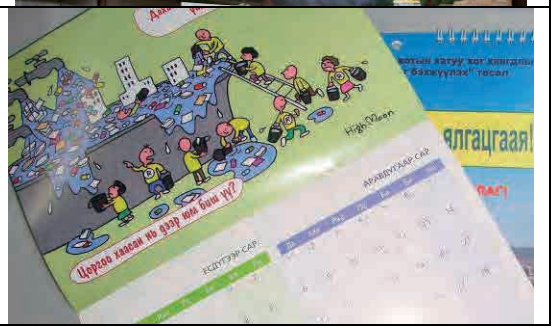
PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
3R seminar	City officers, concerned peoples in each target district of the PP、、collection providers、khoroo governor 、AOU leaders、NGOs、mass medias etc. approx. 300 peoples	On April 14th in 2010, Nov. 25th in 2010, and Nov. 24th in 2011, the 3R seminars were held in the Ulaanbaatar hotel three times throughout the project. City officers, concerned peoples from each target khoroo, collection providers、khoroo governors、AOU leaders、NGOs、mass media etc. approx. 100 peoples participated in each seminar. In the seminar, the progress of each target khoroo and lessons were shared and the discussion on the waste separation and recycling plan for the UBC were made among participants. It was great opportunity for target khoroo members to learn and stimulate each other and very effective to advertize the PP though mass media.	
Site visit to the good practices	City officers in charge of SWM in 20 Aimags	As a part of the programs of "the Workshop for formulation and implementation of SWM Master Plan at local level based on the experience in UBC" from June 28th to 30th in 2011, the site visit to SBD#7 was made. Since the scale of one aimag is just about that of the khoroo in the UBC and they face the problem of the scarcity of landfill site, it was great opportunity for them to learn from the experiences of SBD # 7 on community recycling and PR activities in order to reduce the amount of waste transported to the landfill site. Such kinds of site visits to good practices would also be one of the effective ways of advertising the PP.	
Site visit to the landfill	AOU leaders in SBD#7	As a part of the programs of "the Workshop for formulation and implementation of SWM Master Plan at local level based on the experience in UBC", some of the AOU leaders of the SBD#7 participated in the site visit to the NEDS and the RPF plants. This kind of activity helps concerned people to understand the importance of waste separation at source and improve awareness on SWM by directly observing how our waste is recycled and treated at the landfill site.	

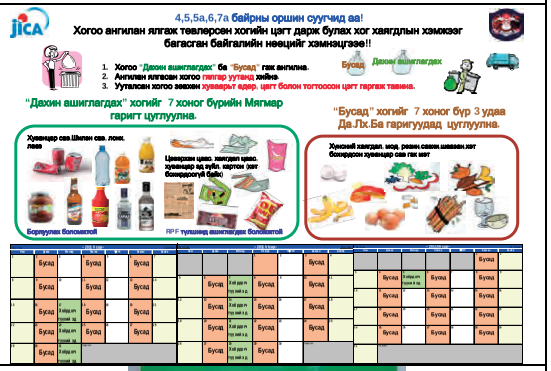
PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Basic information map	EPWMD、AOU	Before implementing the PP, baseline information on population, numbers of household, AOUs and their responsible apartment buildings, apartment jijuurs, number of entrances, floors of each khoroo etc. was collected and plotted onto the khoroo maps. These information were made use for the calculation of PR tools such as posters and leaflets to distribute while also used in the discussion in the AOU meeting. The digital maps were received from the Urban Planning Department of Ulaanbaatar city, and edited and input the relevant data using Microsoft PowerPoint. The use of commonly available software would allow the counterparts to update and modify the maps by themselves. Date shall be updated whenever necessary.	
Waste discharge rule & waste separation poster （A3）	Residents of the PP Phase 1 target khoroo	Before implementing the PP on waste separation and recycling, the poster on how to separate waste and how to discharge waste were prepared for the residents of the target khoroo for PP Phase 1 and posted onto the 350 entrances of each apartments. Although it helped attract resident's attention whenever they were getting into the apartment, it is more prone to be tore away as a time goes by. In order to make it last longer, it is necessary for jijur to keep watching them. Prepared in A3 sized hard paper。	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Waste discharge rule & waste separation 3- fold flier （A4）	Residents of the PP Phase 1,2	Before implementing the PP on waste separation and recycling, the fliers on waste discharging manner and waste separation were prepared and distributed to 12,000 households of the target khoroos of the PP Phase Ⅰ Ⅱ. When preparing the contents on waste discharging rule, the comments from AOU leaders and the city officers were adopted and lots of pictures and illustrations were applied in order to make it easier for residents to understand. However, it was unclear to say how many people got information through the fliers. Prepared in A4 sized 3-fold paper, both sides brilliant paper.	
Waste discharge rule & waste separation leaflet（A4）	Residents and business entities of the PP Phase 1	In June 2010, when implementing the PP Phase 1, the leaflet on how to separate and discharge waste were prepared and distributed to 770 households and business entities in the PP Phase Ⅰ. Since the leaflets were not able to be kept longer at home, it was substituted for the calendar in the Phase Ⅱ. Prepared in A4 sized normal paper.	
Waste collection schedule poster （A4）	Residents of the PP Phase 1,2	Before implementing the PP, the collection schedule was prepared based on the results of the T&M study. When preparing collection schedule and route, all the concerned member such as AOU leaders, Khoroo governor, collection providers, EPWMD got together to discuss in the AOU meeting. The schedule posters were posted onto the 650 orts of the target apartments and the collection providers were instructed and monitored to follow the schedule. Prepared in A4 sized hard paper.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Plastic sack for recyclables	Jijurs of the PP Phase 1	When implementing the PP, many of the residents requested plastic bags for separated waste. However, it is decided to provide the plastic sack (120cm x 70cm size) that can last longer for jijurs to keep recyclables instead of providing a plastic bag for each household as it is not a sustainable way in the long term. The plastic sacks were distributed to the 250 jijurs of the target khoroos of the PP Phase I with the name of the project printed on it.	
Collection vehicle sticker	Residents of the PP Phase 1	When implementing the PP, the banners on which printed such messages as "Let's put waste into the plastic bag", "Let's discharge waste on the designated day and time" and "Let's separate waste into recyclables and others" were posted onto 10 collection trucks of the target khoroos of the. PP Phase I. Prepared in size 1m x 1m, waterproof sticker. In the following year, when implementing the PP of the separate collection in SBD#7, the original white color were changed to a more striking yellow color with the slogan of "waste if mixed, resource if separated!"	
Music with message for bell collection	Residents of the PP Phase 1	Although the bell collection system with the music of "Ouma no Oyako" was already introduced in the previous JICA development study, new amplifiers with the music and messages were provided and installed to the collection trucks of the target khoroo of the PP Phase 1 that had not been equipped with these items. The same kinds of messages that were used for the stickers were utilized for this as well. The bell collection system has been successfully implemented to help people discharge waste in the TDP and still prevails in the UBC.	
Music for separate collection vehicles	Residents of the PP on separate collection SBD#7	When implementing the PP of separate collection in SBD#7, in order to distinguish separate collection from the regular collection, the music of "Million Roses" that is familiar with everybody in Mongolia was adopted. At the same time with the distribution of the calendar for separate collection, it was very helpful for residents and jijurs to identify the date and time of separate collection.	♪♪♪

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Banner for closure of ODP	Residents who disposed waste into the ODP of target khoroos of the PP	The banners for closure of ODP were posted to 20 spots where the ODP were closed in the target khoroo of the PP Phase 1, 2. The banner itself was provided by the project but was posted by each khoroo. Afterwards, they were prepared and posted by the initiatives of the khoroo and AOU gradually. Prepared in size 1m x 1.2 m, waterproof. As for other options, flowers can also be planted after the closure of ODP but only in the summer time.	
Poster for closure of DC	Residents who disposed waste into the DC of target khoroos of the PP	The posters for closure of DC were posted onto approx. 300 closed DCs in the target khoroo of the PP Phase 1, 2. Posters give instructions for residents to discharge waste in the plastic bag on time and to the designated place. In the case that the poster was tore away as time goes by, the khoroo and AOU prepared and posted by themselves. Prepared in A4 sized normal paper.	JICA **PLEASE DO NOT USE THE DUST CHUTE !** **PUT YOUR WASTE INTO THE PLASTIC BAG and put it beside the DC or the landing UNTIL 12:00 !** **Do not put your waste in the landing after that.** **Waste collection is once a day.** **Thank you very much for your cooperation! to keep our sanitary environment**
Banner for banning night time discharge	Residents and business entities living along the main streets in BZD #7	There was a big issue of waste scattering by the business entities on the main streets such as Ikh Toiruu street in the BZD#7. Especially in order to prohibit the business entities from illegally dumping waste at night time, the banners were posted onto 3 spots of these main streets. Prepared in size 1 m×1.2m with waterproof materials reflecting for light at night. Afterwards, the monitoring camera was also installed by the WSF and khroo, the great improvement was achieved in BZD#7.	JICA **PLEASE DO NOT DISPOSE YOUR WASTE AT NIGHTTIME!** **Thank you very much for your cooperation to keep our place in good sanitation!**

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Bookmark	Students and participants in the environmental event	Bookmarks for waste separation were made and distributed to approx. 500 students in the school education in the school #48 in BZD#1 in Nov. 2010. The rest of them were also distributed in the various environmental events and seminars (total 2000 sheets). It seemed that the students were pleased with that.	
PR calendar 2011	Residents and business entities in the PP Phase 1 target khoroos	In Dec. 2010, the calendar for 2011 which contains the waste discharging rule, waste separation, the process of recycling and waste treatment were prepared and distributed to 7500 households and business entities of the PP Phase 1. The front page of the calendar shows the slogan of “waste if mixed, resource if separated”. Prepared in A 3 sized with 4 sheets （8pages）, 250ｇ brilliant paper、colored in both sides, bound with wire coil.	
PR calendar 2012	Residents and business entities in the PP Phase 2 target khoroos	The calendar for 2012 was prepared with the informative cartoons on 3Rs whose design was provided by Mr. Hiroshi Takatsuki of the Kyoto university (penname High Moon). They were distributed to 5000 households and business entities of the target khoroos of the PP 1 Phase 2 in January 2012. Prepared in A4 sized（16pages）、250ｇ brilliant paper、colored in both sides, stapled.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Calendar for separate collection (2011. May -July)	The target residents of the PP on separate collection in SBD#7	Before implementing the PP on separate collection in SBD#7, in order for residents to easily distinguish separate collection from regular collection, the calendar that clarify the date of separate collection were made and distributed to 1450 households of the target apartments. The distribution was made through the public meeting and house-to-house visit. The back page of the calendar explains the RPF plants upon request of the AOU leaders.	
3R promotion booklet	Residents of the PP Phase 2	3R promotion booklet was prepared with many pictures and photographs in order to be used as a waste education guidebook to the students and general citizens of the UBC. The contents include actual situation of SWM in UBC, the knowledge of 3Rs, the importance of waste separation etc. They were distributed to 3000 organizations such as AOUs, khoroos, Ministry of Education, schools, kindergartens, universities of the target khoroos of the PP Phase 2 together with the 3R promotion DVD. Prepared in A4 sized, colored in both sides, total 16 pages. It is desirable to utilize in the “Civil Education Class”（68 hours）in the school curriculums in Mongolia as a supplementary reader.	
Brochure for better waste discharging manner (both sides)	Residents and business entities of the PP Phase 2	In the target area of the PP phase Ⅱ, especially in the ChD 4 (the number of business entities: 600) some business entities disposed waste illegally on the street. Therefore, in order for residents and business entities to dispose waste according to the rule, the simple brochure for better waste discharging manner was prepared. One side contains the explanation of waste discharging rules for residents and the other side contains that for business entities. 10,000 sheets of the brochure were distributed to the khoroos, AOUs, schools, universities, kindergartens and the Ministry of Education in the target khoroos of the PP Phase 2. Prepared in A4 sized colored paper in both sides, brilliant paper.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
3R promotion TV program (2 types)	UB citizens	• 3R promotion TV program-1: Contends: SWM in UBC, Waste amount, waste composition, collection system, NEDS, RPF plant, interview with EPWMD and CMPUA (17min.) • 3R promotion TV program-2: Waste separation PP in SBD#7, instruction on how to discharge waste for residents and business entities, promotion of waste reduction and 3R (13min.) Film producer : New Lord Co., Ltd. *broadcasted by MNV in the evening on April 29th, 2012.	
3R promotion CM(2 types)	UB citizens	• 3R promotion CM-1: Sending message of prohibition of littering of cigarette bud and banana peal etc. by residents (25sec.) • 3R promotion CM-2: Sending message of "Waste if mixed, resource if separated!" (13,15,15 sec. each) Film producer : New Lord Co., Ltd. *broadcasted by NTV: 36times, UBS: 20times, TV9: 20times, and MNB, SCH etc 30 times for free of charge in April 2012.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
3R promotion DVD	Residents of PP Phase Ⅱ	The above mentioned 3R promotion TV programs and CMs were compiled into DVD and distributed to 300 organizations such as AOUs, Khoroos, Ministry of Education, schools, kindergartens, universities of the target khoroos of the PP Phase Ⅱ. It is desirable to utilize in the school curriculums in Mongolia together with the 3R promotion booklet.	
Project website	Japanese and Mongolian citizens	The specific website on the project was developed in Mongolian, English, and Japanese. The information such as the description of the project, announce of the events, seminars, and workshops, the report on surveys were updated regularly throughout the project implementation.	
Newsletter	Concerned Japanese and Mongolian people of the project	After the launch of the project, newsletters were issued regularly. The contents include project activities, announcement of the event, seminar and workshop etc., report on the waste composition survey, interviews with counter parts. Each edition of newsletters was distributed in the occasion of the public events. When preparing newsletters, it is important to involve as many stakeholders as possible and try to make it easier for residents to read. These contents of the newsletter were uploaded in the website. Issued in Mongolian, English, Japanese approx. 100～300 copies x 7 times.	

PR tools & Activities	Target	Descriptions and its Results	Samples and Pictures
Eco-bag campaign	UB citizens	Although in the UBC, the regulation on the banning of the use of plastic bag has been issued in 2008, there are not so many citizens using eco-bags for shopping. In the "Mongolia-Japan 3 R Public Event" the participants made their own original eco bags. It is possible to appeal to the UB citizens to reduce the use of plastic bags and to promote 3R activities through this kind of events. The city officers shall collaborate with NGOs and business entities to promote the use of eco bags in the future.	

1.4 Evaluation of Public Awareness Raising Activities

The results of the public awareness raising activities in the PP on waste separation and recycling were evaluated by; 1) Public opinion survey (POS) for apartment residents, 2) Purchase amount of recycles shops operating in the target khoroos. In addition, the cost-effectiveness of each PR tool was analyzed.

1.4.1 Results of the POS

In order to assess the results of the public awareness raising activities, the results of POS conducted in May 2010 at a time of the commencement of the PP on waste separation and recycling, September 2010 at the midterm of the PP, and October 2011 at the closure of the PP were compared.

The degree of recognition on waste discharging date and the level of cooperation on waste separation at source increased greatly after implementation of the PP.

Table 1.1: Results of POS－1

	May 2010	Sept. 2010	Oct. 2011
Percentage of residents who replied “yes” to the question “Do you know the date of waste collection?”	41%	66%	67%
Percentage of residents who replied “yes, always” and “yes, sometimes” to the question “Do you separate waste at home?”	38%	59%	65%

In the 2nd POS conducted in Sept. 2010, the percentage of those who replied “Yes” to the question “Do you know about the PP” was 66%. Then, regarding the question “How did you know it?”, those who answered “calendar” shows highest (33.5%), followed by “from AOU leaders/Kheseg leaders” (23.2%), “posters” (21.3%) and “brochure” (20.5%).

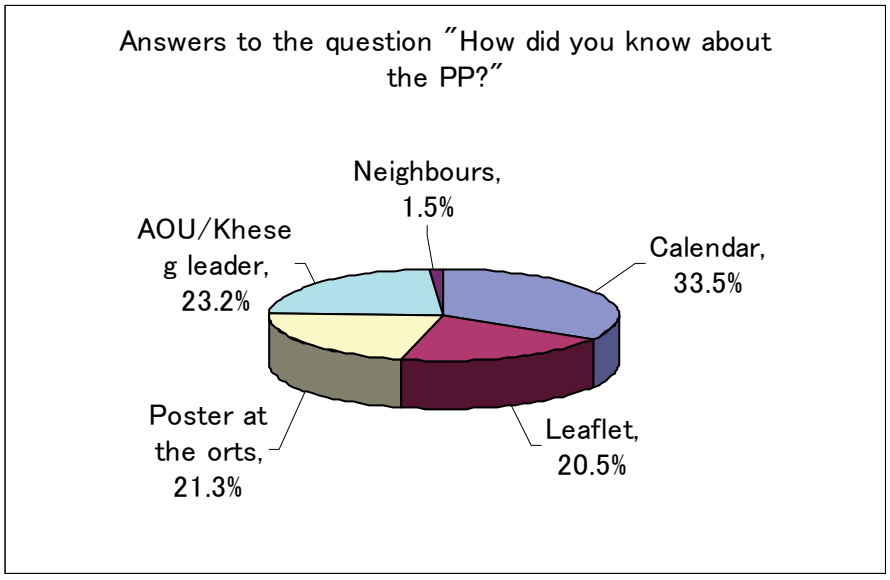


Figure 1.3: Results of POS－2

Based on the above results, it can be concluded that the public awareness raising activities have contributed to the improvement of waste discharging manner and waste separation in each target khoroo and that the calendar that can be put on the wall at home for a long period was relatively effective.

1.4.2 Amount of Recyclables Purchased at Recyclable Shop

In order to understand the recycling rate at generation source, the monitoring on recyclables amount sold by residents was conducted in cooperation with the recycle shop located in SBD#7. The amount of recyclables purchased at this shop is shown in the figure below;

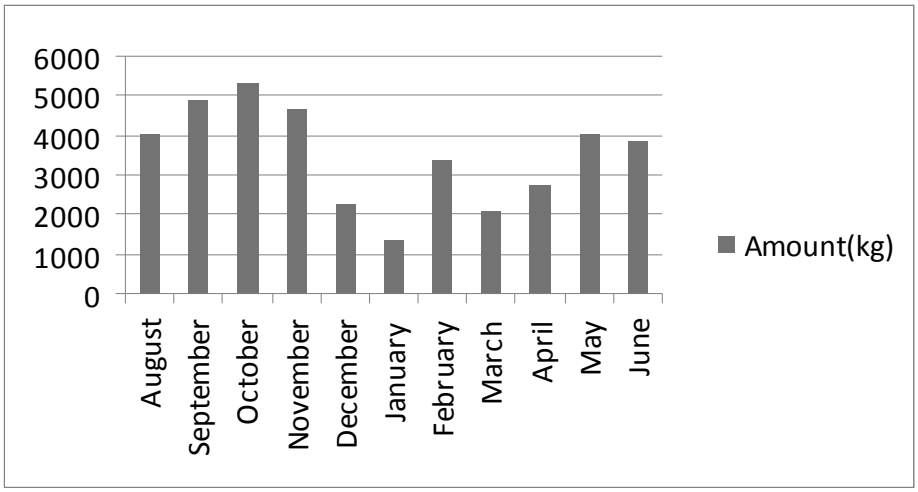


Figure 1.4: The amount of recyclebles purchased by the recycle shop in SBD#7 (kg)

The amount of recyclables purchased by the recycle shop located in SBD#7 increased by 25% for the initial 3 months (from August to October 2010). It can be said that various tools to promote waste separation activities and AOU meetings have contributed well to the above results.

One of the reasons for the decrease of purchase in Nov 2010 was resulted from the disputes on property rights of the shop between the owner and the AOU. As this caused the shop to stop operation for many days, the amount of purchase decreased in Dec. 2010. However, the amount increased gradually afterwards.

1.4.3 Cost-effectiveness of the PR Tools

The cost-effectiveness was calculated based on the costs spent for making PR tools and the estimated number of the target peoples in the table below.

Table 1.2: Necessary cost of PR tools per person

PR tools	Estimate of the costs	Target	Estimated no. of the target (person)	Cost (Tg)	Cost-effectiveness (Tg/person)	Remarks
Waste discharge rule & waste separation poster	each apartment orts of the PP phase 1, 350 orts x@ 1600tg	residents of the PP phase 1	25,400	560,000	22.0	
Waste discharge rule & waste separation 3- fold flier	PP phase 1, 2, 12000 households x@155tg	residents of the PP phase 1, 2	42,100	1,860,000	44.2	
Waste discharge rule & waste separation leaflet	PP phase 1, 7700 households and businesses x @95tg	residents and businesses of the PP phase 1	26,000	731,500	28.1	
Waste collection schedule poster	each apartment orts of the PP phase 1, 2, 650 orts x @800tg	residents of the PP phase 1,2	42,100	520,000	12.4	
Plastic sack for recyclables	each jijur of the PP phase 1, 250 persons x@1750tg	jijurs of the PP phase 1	250	437,500	1,750.0	
Collection vehicle sticker	collection vehicles of the PP phase 1, 10 vehicles x@ 10000tg	residents of the PP phase 1	25,400	100,000	3.9	
Music with message for bell collection	music "Ouma no oyako" in MP3 + cost for message recording	residents of the PP phase 1	25,400	80,000	3.1	
Music for separate collection vehicles	music "million roses" for PP on separate collection in SBD#7, 1vehicle x 20,000	residents of the PP on separate collection in SBD#7	5,600	20,000	3.6	
Banner for closure of ODP	closed ODP of the PP phase1, 2, 20 ODPs x@ 6000tg	residents of closed ODPs in the PP	3,000	120,000	40.0	estimating 150 persons use one ODP

PR tools	Estimate of the costs	Target	Estimated no. of the target (person)	Cost (Tg)	Cost-effectiveness (Tg/person)	Remarks
Poster for closure of DC	closed DC of the PP phase1, 2300 DCs x@100	residents of closed DCs in the PP	9,000	30,000	3.3	
Banner for banning night time discharge	Main streets in BZD#7, 3 placesx@15000	population living along the main streets in BZD#7	1,000	45,000	45.0	
Bookmark	students and event participants, 2000persons x @100tg	students and event participants	2,000	200,000	100.0	
PR calendar 2011	PP phase 1, 7500 households and businesses x@770	residents and businesses of the PP phase 1	26,000	5,775,000	222.1	
PR calendar 2012	PP phase 2, 5000 households and businesses x@2300	residents and businesses of the PP phase 2	17,500	11,500,000	657.1	
Calendar for separate collection (2011. May -July)	PP on separate collection in SBD#7, 1450 households x @235	residents of closed DCs in the PP on separate collection in SBD#7	5,600	340,750	60.8	
3R promotion booklet	PP phase 2, 3000 organizations such as schools, universities, kindergartens, AOU etc.x@1317tg	residents of the PP phase 2	16,700	3,951,000	236.6	
Brochure for better waste discharging manner	PP phase 2, 10000 organizations such as schools, universities, kindergartens, AOU etc.x@110tg	residents and businesses of the PP phase 2	17,500	1,100,000	62.9	
3R promotion TV programs （2 types）	production costs for TV programs @3000000tgx2 types	UB citizens	122,100	6,000,000	49.1	estimating average audience rating 10% of the population in the UBC 1221000 persons (2012)

PR tools	Estimate of the costs	Target	Estimated no. of the target (person)	Cost (Tg)	Cost-effectiveness (Tg/person)	Remarks
3R promotion CM（2 types）	production costs for CMs @1,800,000tg×2types	UB citizens	122,100	3,600,000	29.5	estimating average audience rating 10% of the population in the UBC 1221000 persons (2012)
3R promotion DVD	PP phase 2, 300 organizations such as schools, universities, kindergartens, AOU etc.×@ 3300	residents of the PP phase 2	16,700	990,000	59.3	

The above calculation was based on the following information of each target khoroo of the PP on waste separation and recycling.

	Population	Household	Jijur	Orts	AOU	Biz Entities
Phase 1						
BZD1	6,088	1,716	80	100	13	177
BZD7	7,262	1,790	60	100	7	212
SBD5	4,103	1,258	30	70	10	122
SBD7	7,874	1,980	60	70	10	150
Sub total	25,327	6,744	230	340	40	661
Phase 2						
ChD4	3,882	1,193	10	106	14	590
KhUD2	7,142	1,867	39	115	10	89
BZD15	5,639	1,646	55	55	7	97
Sub total	16,663	4,706	104	276	31	776
Total	41,990	11,450	334	616	71	1,437

According to the above analysis, the cost-effectiveness of the PR tools is summarized for the followings.

- The brochures and fliers distributed to each household can only give limited information and possibly can be discarded without seeing carefully after distribution. On the other hand, residents might pay more attention on the posters posted onto the orts for the certain period of time habitually even though it would be torn away as a time goes by. In addition, the posters does not need to be printed in large quantity, therefore the cost-efficiency is considered high.

- The collection vehicles with stickers, music and messages could play the role of a sound truck as they run throughout the city everyday. Therefore, the impact given to the residents and the cost-efficiency are considered high.

- Although making calendar costs more than making brochure and poster, it can be said that the cost-efficiency is high because it can be used for longer period of time at home as shown in the results of the POS. The calendars in the PP Phase Ⅰ Ⅱ were prepared to give residents incentives for waste separation but when introducing separate collection system in the other area, it is necessary to prepare the same kind of calendar developed in SBD#7 that can clearly give the information on the date of separate collection.

- Regarding the 3R promotion booklets and DVDs, since they can be used in the other provinces and school educations in the future, which is not for temporary use, the cost-efficiency is considered high in the long run.

1.5 Things to be Considered in Public Awareness Raising Activities

The following points should be considered in order to successfully conduct public awareness raising activities.

1.5.1 What？

①Choose what kind of information to be given？

Information in PR activities on waste issues can be roughly divided into the following two categories;

1) Information on for the observance of rules（minimum information for citizens to understand）
   - Waste discharging Rules（discharging date and time, and discharging point）
   - Waste separation methods
2) Information to promote more active participation（additional information to deepen people's understanding）

- Information on how and where those recyclables are treated after separation (Actual conditions)
- Essential information on why the waste separation is necessary（Environmental incentive）
- Information that could warn people about the environmental crisis such as scarcity of landfill site （Environmental incentive）
- Information on the cost for collection, transportation, treatment, recycling and land filing of the waste. (economic incentive）
- Suggestive information on how much of the costs and natural resources will be saved if the residents put more efforts on waste separation at source（economic and social incentives）

For example, when we want residents only to understand the rules, it is sufficient to give minimum information on how to separate and discharge waste, which could be one of the strategies when such minimum information is given constantly. However, when we want people to be more motivated for waste separation, to be more environmental friendly and to change their behaviors, we shall strive to conduct such PR activities that can give people incentives for more active participation.

① Balance between information that the city want to give and that the residents want to know！

Only giving one-way information from the city cannot encourage people's willingness to participate. It is sensible to fill in the gap between the information that the city wants to give and that the residents want to know. In order to do so, it is necessary to have active communication among various stakeholders through the AOU meetings etc.

② Show the specific progress and results in the process！

It is important to give the information on the specific progresses and results achieved in the waste separation frequently so that people can maintain their motivation to work. Generally speaking, the quantitative data and explanation will help people understand them easily.

③ Give not only positive information but also negative information！

In order to establish a trust worthy relationship with residents, the city shall give all the information even if it is negative one. In this way, the ideas for the further improvement would be created among all.

1.5.2 How？

① How to make information？

Residents understand what kind of information they want to know. There are many cues in the discussion of workshops and seminars as well as the questionnaires and even in the complaints.

② How to give the information ?

If too much information is given at the same time, people do not pay much attention, which will result in no information to be given. It is reasonable to consider well how to give the information with simple sentences, full of graphs and pictures.

③ Repeat the important information !

In order to establish a new rule among people, it is necessary to have a long-term point of view. Even though the positive effect is found after the first intensive PR activities, there could be the signs of a rebound after certain period. Necessary information shall be given repeatedly.

④ Think effective way of information sharing !

The roles of the kheseg and AOU leaders who understand well about the community should be utilized to effectively share the information. At the same time, they can help us obtain necessary information such as requests form residents. The manpower of the local volunteers, students and NGOs shall also be utilized.

⑤ Confirm to whom the information reached !

Generally speaking, once the information is given, its effect and result is not well monitored. In order to constantly send the information in effective way within the limited budget, destination of information shall be researched.

⑥ Learn from the others !

Not only in Mongolia but also in other countries such as Japan, various kinds of public awareness raising activities are being developed by trial and error. Since a variety of PR tools was already developed in the PP, they should be utilized effectively and it is also important to have such opportunities of information sharing to find the ideas and hints from one another.

1.6 Lists of PR Tools

The lists of the PR tools developed in the PP on waste separation and recycling were summarized in the table below. Type of activities should be chosen by the characteristics of the area and the affordability of the budget. However, we sincerely hope that these tools on the lists would be utilized through modification according to the actual conditions in order to solve the waste problems in the future in Mongolia.

Table 1.3: List of PR tools -1

#	Title	Format	Language	Year	Remarks
1	Basic information map	A4, power point	Mongolian	2010	
2	Waste discharge rule & waste separation poster	A3, hard paper	Mongolian	2010	Translation in English
3	Waste discharge rule & waste separation 3- fold flier	A4, normal paper, both sides	Mongolian	2010	Translation in English
4	Waste discharge rule & waste separation leaflet	A4, normal paper	Mongolian	2010	Translation in English
5	waste collection schedule poster	A4, hard paper	Mongolian	2010	Translation in English
6	Plastic sack for reciclables	Plastic sack	Mongolian	2010	
7	Collection vehicle banner	1m x 1m, water proof sticker	Mongolian	2010	Translation in English
8	Music with message for bell collection	MP3	Mongolian	2010	
9	Music for separate collection vehicles	MP3	Mongolian	2010	
10	Banner for closure of ODP	1m x 1.2m, water proof sticker	Mongolian	2010	Translation in English
11	Poster for closure of DC	A4, normal paper	Mongolian	2010	Translation in English
12	Banner for banning night time discharge	1m x 1.2m, water proof noctilucence sticker	Mongolian	2010	Translation in English
13	Bookmark	21 x 4cm, hard paper, both sides	Mongolian	2010	
14	PR calender 2011	A3 8pages, 250g paper, both sides	Mongolian	2011	Translation in English
15	PR calender 2012	A3 16pages, 250g paper, both sides	Mongolian	2012	Translation in English
16	Calender for separate collection (2011. May -July)	A4, hard paper, both sides	Mongolian	2011	Translation in English
17	3R promotion booklet	A4, text book, 16pages, both sides	Mongolian	2012	Translation in English
18	Brochure for better waste discharging manner	A4, normal paper, both sides	Mongolian	2012	Translation in English

Table 1.4: List of PR tools-2

#		Title	Format	Language	Year	Remarks
1	3R promotion DVD	3R promotion TV program (2 types)	1)17min. 2)13min.	Mongolian	2012	Script in English
		3R promotion CM(2 types)	1)25 sec. 2)13sec. 15sec. 15sec.	Mongolian	2012	