

RECOMMENDATIONS FOR WASTE MANAGEMENT SCHEME AND MASTER PLAN IN BULGAN AIMAG



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INTRODUCTION

Since 2018, Ecosoum has been working on setting up a proper waste management system in Khishig-Undur soum, Bulgan aimag, with the initial and renewed support of The Asia Foundation. From 2020, Ecosoum’s activities became a part of the “Sustainable Plastic Recycling in Mongolia” project funded by the SWITCH-Asia-II program of the European Union¹, in partnership with four other partners working at the aimag and Ulaanbaatar level.

Now that a suitable waste management scheme has been designed and is being implemented in Khishig-Undur soum, it is of paramount importance to integrate soum-level actions into a proper aimag-level waste management system. This means not only adapting and replicating the Khishig-Undur scheme in all other soums of Bulgan aimag, but also designing a suitable scheme for the province capital itself.

Thus, this report aims to offer clear and practical recommendations to establish a proper waste management system in the city of Bulgan soum. These recommendations are intended to constitute the outline and justification of a scheme that can be directly transposed into an official waste management Master Plan, which shall be voted on and enforced as soon as possible.

As precise guidelines and recommendations were already shared for the soum-level², this report essentially focuses on Bulgan soum, the capital city of Bulgan province. Regarding rural soums of Bulgan aimag (such as Khishig-Undur), the only recommendations provided in this report are linked with coordination and integration of soum-level actions into the aimag-level system.

¹ www.switch-asia.eu/project/sustainable-plastic-recycling-in-mongolia/

² In December, 2021, Ecosoum published a guidebook entitled *How to set up waste management at the soum level*, in which step-by-step guidelines and recommendations are provided to soum-level actors. This guidebook was integrated into a *waste management kit* that includes all waste-related documents produced by Ecosoum over the years. The guidebook and the kit with all relevant material (including all specific reports referred below) are openly available on Ecosoum’s website (www.ecosoum.org/en-resources-and-reports).

CONTEXTUAL INFORMATION ON CURRENT SITUATION

The information summarized in this section comes from interviews with Bulgan administration and TUA³ representatives as well as official statistics and documents provided by Bulgan administration and the TUA.

GENERAL INFORMATION ABOUT POPULATION AND OTHER WASTE PRODUCERS IN BULGAN

As of 2021, according to the Mongolian Statistical Information Service⁴, Bulgan aimag accounts 16 soums (including the city of Bulgan soum) for a total population of 61,938 people divided into 19,069 households. Distribution of the population is detailed in Table 1.

Soums	People	Households	Living in soum-center	Living in rural baghs
Bulgan	12,810	3,819	100%	0%
Bayan-Agt	3,364	961	19%	81%
Bayannuur	1,858	509	32%	68%
Bugat	2,202	791	37%	63%
Buregkhangai	2,927	895	32%	68%
Gurvanbulag	3,286	967	17%	83%
Dashinchilen	3,049	908	30%	70%
Mogod	2,681	853	17%	83%
Orkhon	3,385	1,184	26%	74%
Rashaant	3,202	999	51%	49%
Saikhan	3,578	1,099	17%	83%
Selenge	3,330	1,084	31%	69%
Teshig	3,621	1,006	30%	70%
Khangal	4,543	1,493	65%	35%
Khishig-Undur	3,056	988	34%	66%
Khutag-Undur	5,046	1,513	40%	60%
Bulgan aimag (total)	61,938	19,069	47%	53%

Table 1 : Summary information about soums and population in Bulgan aimag (2021)

Bulgan soum alone accounts almost 13,000 inhabitants divided into over 3,800 households. Virtually all of them are sedentary city dwellers, although a few households living in the outskirts of the city are actually nomadic herders. The city is divided into 6 baghs with a relatively homogeneous repartition of inhabitants. One of the baghs (5th) corresponds to the city center with apartment housing whereas the other baghs are constituted of *khashaas* (fenced yards) with gers and/or houses. Information about baghs, households and type of housing in Bulgan soum are summarized in Table 2.

³ The TUA (Төхижилт Үйлчилгээний Алба – *Maintenance Service Department*) is a State-funded organization that is responsible for all the maintenance work – including waste management – of Bulgan soum.

⁴ www.1212.mn

Bagh	People	Households	Sedentary / Nomads	Type of housing
1-r bagh, Achuut	1,926	601	Sedentary	Gers and houses
2-r bagh, Khujirt	2,043	616	Sedentary	Gers and houses
3-r bagh, Aguit	1,980	573	Sedentary	Gers and houses
4-r bagh, Rashaant	1,750	509	Sedentary	Gers and houses
5-r bagh, Jargalant	2,112	620	Sedentary	Apartments
6-r bagh, Bulgan	2,999	900	Mostly sedentary, although some herders who live around Bulgan city belong to this bagh	Gers and houses
Bulgan soum (total)	12,810	3,819	Almost all sedentary	-

Table 2 : Summary information about baghs, population and type of housing in Bulgan soum (2021)

According to the information provided by Bulgan administration and the TUA, there are approximately 290 entities registered as waste producers (in addition to households). However, this number includes many entities that are actually regrouped under a single umbrella organization when it comes to waste management.⁵ In addition, some of the entities officially registered as waste producers are actually not formally included in the current waste collection scheme: they don't pay any tax or fee and it is unclear what happens with their waste.⁶ In the end, according to the TUA, there are currently 152 organizations (State institutions and agencies, schools, hospitals, private restaurants and businesses, etc.) that are officially included in the collection scheme.⁷

LEGAL FRAMEWORK REGARDING WASTE MANAGEMENT IN BULGAN

The legal framework in which Bulgan authorities operate in terms of waste management is primarily based on several national laws and policies, which mainly include the following: Mongolian Law on Waste (last modified in 2017); National Program to Improve Waste Management; Vision 2050 Mongolian Long Term Development Policy; Mongolian National Security Policy; Green Development Policy; Law on Development Policy, Plan and its Administration; National Program to Reduce Air and Environmental Pollution.

At the aimag level, the legislation is mainly framed by Bulgan Aimag Governor's Action Plan for 2020-2024 and Bulgan Citizens Representative Khural's decrees⁸, which, according to article 9.1.2. of the National Law of Waste, should include a "Local plan to improve waste management".

⁵ For example, the 43 booth tenants in the main shopping center only count as one aggregated waste producer. Likewise, the five public organizations regrouped in the aimag government building only count as one waste producer in the waste collection scheme.

⁶ Some of them probably dispose their waste in other waste producers' bins, which means their waste is actually indirectly included in the waste collection scheme. Some of them probably dispose their waste on their own, either in the official landfill or in other illegal places.

⁷ This number is actually to be handled with caution as it includes both organizations that steadily renew their waste collection contract with the TUA (approximately half of them) and organizations that are involved in a more inconsistent way. Official data shared by Bulgan administration is not always consistent from one table to the next, which makes it very difficult to have a clear picture of the current situation.

⁸ Decree No. IV/8 (2021) of Bulgan Citizens Representative Khural: Procedure on cleaning, sorting, collection, transportation, recycle, re-use, disposal of and ordinary waste, Булган Аймаг Журал, Тариф Батлах Тухай /Энгийн Хог Хаягдлыг Цэвэрлэх, Ангилал, Цуглуулах, Тээвэрлэх (legalinfo.mn).

In the end, waste management at the aimag level is supposed to be framed by a dedicated Waste Management Master Plan, which must comply with all the higher laws and regulations. This Master Plan is the main document that is intended to detail how waste should concretely be managed. The Master Plan is to be written by the public officers in charge of waste management and validated by the Citizens Representative Khural.⁹

Each of Bulgan aimag soums is also supposed to have their own Master Plan, although many don't always have such plans, nor necessarily enforce it when they do.

WASTE MANAGEMENT ACTORS IN BULGAN

The first stakeholder regarding waste management is the public administration of Bulgan, and more precisely the Department of Environment and Tourism. The Head of the Department (currently Mr. Gantumur) and its officer in charge of waste management (currently Ms. Altantsetseg) are the main public officers responsible for all waste-related issues.

Over the past years, Bulgan administration has had a contractual agreement with an individual (Mr. Sukhbaatar Purewdorj) who was delegated all operations in Bulgan soum's waste management facility. Mr. Sukhbaatar (with a few occasional employees) has been carrying out some sorting and recycling activities in the facility. However, despite their efforts, the current system has proved insufficient to effectively manage Bulgan soum's waste. The agreement between Bulgan administration and Mr. Sukhbaatar will soon reach its end and Bulgan administration considers transferring the management of the facility back to the public maintenance service (TUA).

Collection and transportation of waste is already operated by the TUA. This organization accounts 41 workers, but waste management is not their only responsibility: they actually are also in charge of a very large range of tasks, from cleaning the roads to repairing the lamps in addition to cleaning snow, planting flowers and various other activities that require maintenance and "handy" work. The main staff dedicated to waste management includes 17 people (in theory, 7 drivers, 7 loaders and 3 coordinators/inspectors). Two administrative staff are also attached to the waste management department. The public area cleaning team (10 staff) belong to another department, but it is worth mentioning that these workers are the ones in charge of emptying the street and public areas bins.

Today, besides the above-mentioned stakeholders, there are no other actors (formal or informal, private, NGO, etc.) involved at any stage of waste management in Bulgan soum.

DATA COLLECTION AND MAIN TYPES OF WASTE IN BULGAN

Waste production is not really monitored so there is no precise and reliable data about waste production and composition in Bulgan soum. Depending on sources, figures can actually be significantly different.

⁹ The Waste Management Master Plan is supposed to be renewed every four years and the previous one (2017-2020) has expired, which is why the new one needs to be written as soon as possible.

The last waste survey in the city was carried out in 2015.¹⁰ By extrapolating this data, Bulgan administration estimates the current waste generation rate in Bulgan soum to approximately 7.3 tons per day (including household and all other waste producers), which corresponds to approximately 2,665 tons per year. However, based on their own estimations¹¹, the TUA estimates that yearly waste production is close to 23,600 tons.¹²

As there is no proper and detailed data available, it is impossible to have precise figures regarding waste production or composition. Bulgan administration and TUA staff consider that the main types of waste produced in the city are: ash (in winter – from wood, coal and the new high-combustion fuel), plastic, glass bottles and jars, bones and organic waste, diapers, car oil (considered as hazardous waste), batteries, dry and wet tissues, and electric/electronic waste (broken phones, kettles, etc.). Also, along the roads: hygienic pads, toilet papers, plastic wraps, PET, beer and vodka bottles.

As there is almost no reusing or recycling processes in place today, virtually all this waste is currently landfilled.

CURRENT WASTE MANAGEMENT SYSTEM IN BULGAN SOUM

WASTE PRODUCTION AND AT-SOURCE SORTING

Almost all households are equipped with waste bins, which were provided by public administration a few years ago. The waste bins are installed in *khashaas* and have two openings (see pictures in Annex 2): one from inside the *khashaa* for families to drop their waste, and one from the street for collectors to empty the bins. All bins have two compartments: one for recyclables and one for ultimate waste.¹³

According to the law, households must sort at the source some types of recyclable waste and put them together in the single dedicated bin compartment. The types of waste to be sorted are the following: PET bottles, soft plastic, glass jars and bottles, metal, bones and paper. Organic waste and hazardous waste (essentially batteries) are not really segregated and they are put in the ultimate waste compartment. Approximately 50% of households have another dedicated bin for

¹⁰ The 2015 survey study report was not communicated to the authors of this report; therefore, the detailed information it may contain is not reflected in this report.

¹¹ The TUA does not measure the actual amount of waste that is collected and disposed in the landfill, but they keep track of all the collection trucks unloading waste in the landfill. Their estimation for waste production/disposal is calculated by extrapolating the number of transiting trucks with an average density of 0.6 tons per cubic meter (based on carrying capacity of trucks or estimation of waste volume actually contained in each truck going to the landfill). The TUA's estimation of 23,600 tons per year does not include coal ash from central heating plant and public showers but takes into account construction waste, individually transported waste, and waste picked up near roads, hills and rivers – in addition to waste formally collected from households, other waste producers and street bins.

¹² Another document provided by Bulgan administration also mentions a yearly waste production of 9,881 tons, which means that there seem to be at least three conflicting estimations for total waste production (varying from simple to tenfold).

¹³ In this report, for ease of speech and to reflect the common language, we use the expressions “recyclable waste” or “recyclables” as synonyms and in a broad sense that includes all types of waste that can theoretically be reused, recycled or downcycled (or other types of waste that should be treated as such). Oppositely, we use the expression “ultimate waste” to refer to all types of waste that cannot be recovered (through reusing or recycling processes) and that can only be disposed in landfills.

stove (wood and/or coal) ash, while the other half puts stove ash in the ultimate waste compartment. In any case, stove ash is always mixed with ultimate waste when it is loaded in collection trucks.

Other waste producers, including public institutions and private companies, also have sorting bins (usually acquired by their own means) and they are supposed to follow the same sorting rules.

INTERMEDIARY COLLECTION POINTS AND STREET BINS

There are no intermediary waste collection points or containers in Bulgan soum. However, there are 102 street bins as well as 34 mobile bins, which the TUA staff (public area cleaning department) uses to clean the streets and public spaces. All the street bins have two compartments: one for recyclables and one for ultimate waste. But waste is not always properly sorted between the two compartments and “recyclables” often have to be dumped as ultimate waste due to lack of proper segregation. These street bins are emptied every week by the TUA¹⁴. This frequency seems enough as, according to the TUA, bins are almost never full (except during special occasions and holidays).

WASTE COLLECTION AND TRANSPORTATION TO WASTE MANAGEMENT SITE

Waste is collected by the TUA directly from virtually¹⁵ all waste producers in the city (apartment and ger/house households, public institutions, private shops and companies) except for the central heating plant and public shower, which transport and dump their coal ash themselves to a specific location of the landfill area. Sometimes construction waste or other voluminous types of waste are transported directly by waste producers with their own trucks if the TUA staff cannot come quick enough. The TUA staff divided the trunks of some of their trucks into two compartments, which allows them to keep recyclables sorted by waste producers separated from the ultimate waste.¹⁶

Household waste collection was initially supposed to be operated on a monthly basis, although under the current conditions collection frequency is closer to once every three months. There are no clear and systematic collection scheme or routes so the collection planning is organized on a daily basis: the three coordinators/inspectors of the TUA’s waste management department (each in charge of two of Bulgan soum’s baghs) decide every morning where the collection trucks will go to pick up waste (after inspecting bins by themselves or receiving calls from people who need collection).

¹⁴ The process of emptying the street waste bins is actually carried out through collaboration of public area cleaning department and waste management department: the first one empties the bins and internally subcontracts the second for transportation to the landfill (public area cleaning and waste management departments have separate budgets with different origins).

¹⁵ As previously mentioned, although waste is theoretically collected¹⁵ from each waste producer, some small entities that don't pay any fee or tax seem to be left out of the collection scheme.

¹⁶ According to authorities, many households claim they do sort correctly but the TUA staff mix everything back together when they load waste into their trucks. When asked, TUA staff answered that they are aware of this complaint of households but they claim it is actually not true: this “myth” apparently comes from the fact that households cannot see that trucks are divided into two compartments, which leads them to believe everything is mixed together. It also happens frequently that TUA staff does have to throw “recyclables” in the ultimate waste compartment of the truck. But they claim they do so only when they observe that recyclables have not been sorted properly, which leads them to consider they cannot be recycled and have to be landfilled as ultimate waste. In any case, dividing trunks may not be the most practical solution depending on the collection system.

For other waste producers, the TUA usually makes yearly contracts with each of them to define the conditions and collection fees (which depend on size of organization, type of waste to collect, etc.). Collection is usually operated more frequently than for households, estimated to be approximately four times a month on average.¹⁷ Although the actual collection pace greatly varies from entity to entity as it depends on the needs of each one. Restaurants and small *tsainii gazar* usually need much more frequent collection, up to three times a week because of the high amount of organic waste they generate compared to other waste producers which may need waste collection less than once a month).

The TUA currently has 6 functioning vehicles for collecting waste (in theory, one per bagh): 3 “Kama” trucks (carrying capacity of 8m³ or up to 4 tons) and 3 “Porter” trucks (4m³ or 1.5 tons). Each of these trucks usually takes 3 to 4 collection rounds per day (i.e. one collection round currently takes two to two and a half hours, which also means that on average a truck takes approximately 75 rounds per month over approximately 22 working days).¹⁸ On average, a truck collects waste from 10 to 12 households per day (see figures in Annex 4).

These vehicles are in relatively poor condition, so maintenance and repair operations are usually necessary at least once a week. The TUA also owns a larger truck (“Compactor” with carrying capacity of 10 m³) but its engine is broken and, as of today, the parts necessary for repair could not be found. If it is eventually repaired, it shall be used for collecting ultimate waste¹⁹ in public institutions and apartment district. Bulgan administration also budgeted to acquire two new collection trucks in 2022, although they were not purchased yet at the time this report was written.²⁰

Collected waste is transported straight from waste producers to the waste management site.²¹

WASTE ARRIVAL AT WASTE MANAGEMENT SITE

Bulgan soum’s waste management site includes both a landfill (which is actually on Orkhon soum's territory) and a waste management facility next to it. Waste management site is located south east of the city, approximately 2km away from the closest houses and 4-5km from the city-center (see map #1 in Annex 1). On average, a waste collection round-trip thus corresponds to approximately 10km.

¹⁷ This estimation is a very rough approximation that must be handled with caution.

¹⁸ Each day, one of these rounds is dedicated by one of the Porter trucks to transport waste from street bins collected by the public area cleaning department.

¹⁹ The “Compactor” truck is a typical waste collection truck that includes an hydraulic system to compress the loaded waste. If recyclables also have to be collected where the Compactor goes, it is necessary to send a separate truck to pick them up.

²⁰ These trucks are intended to replace the oldest malfunctioning trucks rather than increasing the size of the waste collection fleet.

²¹ Despite few exceptions that are considered insignificant at the scale of Bulgan soum, the current system runs under the assumption that 100% of the produced waste is collected by the TUA (or, in some cases, directly brought by waste producers to the official landfill). Illegal dumping appears relatively negligible: the TUA acknowledges four illegal dumpsites around Bulgan soum, with a total amount of waste estimated to approximately 50 tons (which represents between 0.2 and 1.9% of yearly waste production).

The landfill is managed by the TUA, although there is currently no dedicated staff (only a guard at the entrance of the site who keeps track of the trucks coming in).²² When collection trucks arrive at the site, they go straight to the landfill unless they bring recyclables, in which case they unload in front of the facility. Trucks are emptied by hand with a shovel, before leaving for a new collection round.²³

The TUA currently has only one machine to manage the landfill: a crawler bulldozer (which function is to push waste with its blade, although it cannot carry out excavation work). The bulldozer, which essentially does not move from the landfill area, is used once a week to regroup and compact the waste that was unloaded from trucks over the past week. The bulldozer is operated by one of the waste collection truck drivers.

The landfill area is divided into compartments that are created, filled and closed one after the other. In general, a landfill compartment is used during one year (two years maximum). It is usually created by an outside subcontractor through a public tender opened by Bulgan administration (the TUA is not involved).²⁴ A piece of land of approximately 1 hectare (100x100m) is excavated (approximately 2m depth) and an embankment of similar height is created on the sides. Lately, a metal fence was added on top of this embankment to forbid entrance (this fence is supposed to be deconstructed when the compartment is full and re-assembled around the new compartment). When the compartment is full, the selected subcontractor closes it by covering the entire surface with soil.

WASTE PROCESSING IN THE MANAGEMENT FACILITY

The waste management facility covers approximately 2,000m² (45x45m) on the north western edge of the landfill area (see map #2 in Annex 1). It is constituted of a main building with an annex, a secondary building, a guardroom, outdoor open sheds and a container (see map #3 in Annex 1).

The main building is the core of the waste management facility, where most of the machines are supposed to be located, although the TUA's plastic press is currently stationed outdoor, in front of the northern shed.²⁵ The annex building is currently used for bone processing (as explained below). The secondary building was initially supposed to accommodate staff but it is not used. The sheds are being used to store some recyclables (mainly PET bottles and glass) while the container is meant for hazardous waste.²⁶

²² In theory, there should also be at least a field engineer, a heavy machinery operator and monitoring officer, but there is currently no budget to employ such staff.

²³ Hazardous medical waste, which is also collected and transported by the TUK, is disposed in a dedicated (fenced) part of the landfill.

²⁴ The amount of the last tender (2021) was 75 million MNT while the previous one (2020) was 45 million MNT (there is no dedicated budget planned for the landfill in 2022).

²⁵ The main building, as well as its annex, are currently occupied by Mr. Sukhbaatar and thus not accessible to the TUA (although it belongs to the TUA). Although in perfect condition, the plastic press is currently not functional because there is no access to electricity where it is positioned (and no budget to acquire a sufficiently long cable).

²⁶ Currently, there is only a small amount of polluted soil in the hazardous waste container.

Although it has not been used for some time, an access ramp provides access to the eastern side of the main building, where a functional conveyor belt can be used to move waste further into the building. The building also has a large gate on the other side (north east).

The main pieces of equipment currently installed in the waste management building are two grinders, one washer, one compressor, two melting machines, as well as two huge pots and specific small equipment for bone processing (which are property of Mr. Sukhbaatar, contrarily to the other pieces of equipment which belong to the TUA). Most of these machines are in poor condition and some consume a lot of electricity, which raises economic and environmental issues.

As of today, despite all these infrastructure and equipment, there is no systematic and sustainable processing for the main types of reusable or recyclable waste such as plastic or glass. Occasional efforts were made to shred or press plastic bottles, clean glass jars and gather other potentially valuable waste such as aluminum cans. Mr. Sukhbaatar has also been transforming some bone waste into livestock food and making soap and oil candles with livestock fat waste.²⁷ Overall, no systematic processes and management channels for sorted reusables and recyclables were ever established.²⁸

CURRENT WASTE MANAGEMENT TAXATION IN BULGAN

Each household currently pays a monthly 2,000 MNT waste management tax, which was decided by Bulgan Citizens Representative Khural. This tax is collected by the authorities by adding it to electricity monthly bill. Other waste producers pay according to the amount of waste they produce (usually 5,000 MNT per cubic meter of waste, although as mentioned above different tariffs can be applied by TUA depending on the contract with each waste producer).

Collecting fees and taxes doesn't seem to be a problem for Bulgan administration and the TUA: it is automatic for households and if other producers did not pay, TUA would simply not collect their waste (which does not seem to happen). However, some people consider this flat tax unfair (families of 1 or 2 members pay the same tax as families with 5 or 6 members, who obviously produce more waste) and would like to see the tax proportional to the number of household members – as it is supposed to be according to the National Law on Waste.

²⁷ When bones arrive at recycling facility, they are sorted and grinded before to be put into two huge 2 tons pots and cooked by vapor. Then, bones are put back into the grinding machine for two more rounds and mixed with other ingredients such as ivy, natural salt, etc. The mixture is finally put into 40 kg bags for marketing, although this product has not really been traded at significant level yet. Soap and oil candles are manufactured from livestock fat waste following an artisanal technique which involves other ingredients such as caustic soda and salt.

²⁸ Past attempts to manage plastic and glass waste all seem to have failed to prove financially viable, for several reasons. For plastics, the main failure reason is probably the relative disorganization in which it was sorting and pressing was carried out; while for glass the main reason certainly is the overly strict buy-back rules imposed by producers, as explained in Ecosoum's [Who produces our waste? Brand audit report](#) (2022). According to the TUA, countless hours were spent early 2022 to sort reusable glass bottles, which were supposed to be sold for approximately 4 million MNT according to the theoretical purchasing price at the time. But the concerned company accepted to pay only 89,000 MNT, claiming that the rest was not in good enough condition.

MAIN ISSUES AND CHALLENGES FOR WASTE MANAGEMENT IN BULGAN SOUM

IMPROPER HABITS OF WASTE PRODUCERS

According to authorities and TUA staff, the way most households sort their waste is currently not satisfying. Some families do sort relatively well (approximately 10% according to TUA staff), but very often there are so many unwanted types of waste in the recyclable compartment of the bins that everything just becomes useless ultimate waste, which goes directly to the landfill. Most people seem concerned about the waste issue, but it does not sufficiently translate into proper habits. Households and other waste producers need to learn how to properly sort waste and put that knowledge into action. At the same time, they must adapt their consumption patterns so as to reduce waste generation in the first place in line with the 3R principle.²⁹

LACK OF STAFF AND VEHICLES TO COLLECT WASTE FROM ALL HOUSEHOLDS EVERY MONTH

Currently, TUA manages to collect waste from households only once every three months instead of once a month in theory. According to TUA staff, this low collection pace is due to insufficient workforce and vehicles, but it actually is also to be linked with the current collection conditions: as waste is not properly sorted and is disposed in households' bins in a very untidy fashion, TUA needs a lot of time and effort to take all the garbage out of the bins, which makes it impossible to maintain the theoretical collection pace.³⁰

Indeed, the current conditions have created a vicious circle: as waste is currently so complicated to collect from the bins, time is lost and collection frequency decreases. As a consequence, more waste accumulates between collection rounds, which only tends to complicate the process. At the same time, since there is more waste to pick-up in each household, the trucks are quickly full and have to drive back to the facility more often than they should, which leads to losing even more time. Improvement in at-source sorting could thus lead to significantly increasing the collection frequency without necessarily requiring more staff or vehicles.

ABSENCE OF SYSTEMATIC WASTE PROCESSING CHANNELS

To this day, even if waste was properly sorted at the source, there are no systematic processing channels in place at the waste management facility. This situation also tends to create a vicious circle between waste producers and waste workers: as people know that their sorted waste is not properly managed, they see no reason to sort their waste; in turn, as waste is not properly sorted, it is impossible to adequately process each type of waste. Adequate and systematic processing

²⁹ 3R principle: Reduce, Reuse, Recycle. Reducing waste production at source by adapting consumption patterns should be the first concern of everyone, even before sorting for reusing/recycling. See more explanation below.

³⁰ Currently, a round-trip between collected households and waste management facility takes an average of two to two and half hours, for an average of 2 to 4 households (depending on trucks) per trip. With 3,819 households, it means that approximately 358 days (eight-hour work) are necessary to collect all household waste. With 6 trucks and 12 staff (2 per truck) fully dedicated to household waste collection, it corresponds to 60 days per truck, although an average month has only 22 work days (almost 3 times less, and waste collection to other waste producers is not even taken into account). This approximative calculation thus clearly shows that, under the current conditions, collecting waste from all waste producers at the expected pace (one a month from each household, more from other waste producers) is absolutely impossible.

channels thus need to be set up at the same time as waste producers are taught and required to sort their waste, in a synergic manner.

INADEQUATE LANDFILLING PRACTICES

Due to improper waste sorting and overall management, virtually all waste produced in Bulgan soum has been landfilled until now. This situation leads to filling landfill compartments at a very high pace, forcing Bulgan administration to create new compartments almost every year. As the TUA does not possess all the necessary machines to create the landfill itself, expensive subcontracting tenders are frequently opened, which leads to consuming important budgets that could be used for more sustainable waste management actions.

Here too, inverting the vicious circle by improving upstream waste management would lead to reducing landfilling expenses and thus increasing available budgets for proper waste management. In addition, the current landfilling practices need to be improved as they appear inadequate and insufficient to prevent wind scattering of waste and subsequent environmental pollution. If all relevant machines were available, adequate covering with soil could be carried out more frequently to reduce the pollution to a minimum.

HAZARDOUS WASTE MANAGEMENT

Hazardous waste seems to be an important concern for Bulgan administration, both because people don't know anything about it and because there is currently no proper way to manage it in Bulgan. Hazardous waste is theoretically supposed to be separated and processed through specific channels, but it is not done now because there is no proper segregation, no adequate temporary storage (except for an old container)³¹ and no budget for transportation – not to mention insufficient processing channels and adequate landfills (including in Ulaanbaatar).

LACK OF RESOURCES TO BALANCE WASTE MANAGEMENT BUDGETS

Lack of financial resources is a major issue because it translates into shortfall of staff and lack of necessary equipment, not only for waste collection but more broadly for implementing proper waste management. Increasing the local waste management tax can be part of the solution, but it raises fairness issues³² and does not seem enough to reach a balance point in overall waste management budgets.³³ Finding additional sources of funding (and/or decreasing expenses) appears as an absolute necessity.

³¹ A new hazardous waste storage building is supposed to be constructed this year with State funding, but the work had not started yet at the time this report was written.

³² The fact that waste management/collection tax is a flat tax (equal for all households no matter the number of family members / waste producers) is the cause of an injustice feeling among small households. There is a clear need to make the tax fairer to increase its acceptability among the entire population. As the tax is currently relatively low (2,000 MNT per month per household), it seems reasonable to increase it in order to bring part of the solution to the lack of public resources for waste management. But such an increase could only be possible if the tax is broadly accepted and respected by the population, which is why designing a tax that is perceived as fair is an absolute necessity.

³³ According to our calculations, waste management budgets in rural areas can only be in deficit under the current conditions. In Khishig-Undur soum, average gap between waste-related incomes and expenses is estimated to approximately 20 million MNT per year – see Ecosoum's [How to balance waste management budget at the soum level report](#) (2022). Budget estimation for Bulgan soum is presented and discussed in the next chapter.

OUTSIDERS PASSING THROUGH BULGAN

Lots of people pass through Bulgan soum and other soums of the province, especially during the holiday/touristic season. Travelers often camp by the roadsides and leave their waste on their campsites. Those who only drive through the city often drop large amounts of waste in or next to street bins, which often get overloaded during the holiday periods. Beyond awareness-raising of Bulgan inhabitants themselves, solutions need to be found to stop waste littering and improper unsorted disposal by passersby.

RECOMMENDATIONS FOR WASTE MANAGEMENT MASTER PLAN

Recommendations for setting up a proper waste management Master Plan for Bulgan soum are presented below in successive sections, following the logical order of the waste stream from generation and sorting to processing and elimination.

OVERALL CONSIDERATIONS: 3R PRINCIPLE AND SOCIAL RESPONSIBILITY

Overall, a waste management system – as described in a waste management Master Plan – should always remain consistent with the 3R principle:

1. **Reduce:** reducing the generation of waste at the source should constantly remain the paramount objective. It means not only prevention through raising awareness and calling for changes in production-consumption patterns, but also making sure that the measures taken at all stages of the waste management system are not producing counter-productive effects that may jeopardize the ‘Reduce’ supreme principle.³⁴
2. **Reuse:** as much as possible, waste that is produced should be reused (or repaired). It essentially means that production and packaging patterns should favor reusable materials (e.g. glass) rather single-use ones, even when theoretically recyclable (such as plastic). It also means that, whenever possible, waste management processes should enable effective reusing channels rather than setting up recycling processes (e.g. reusing glass bottles and jars rather than recycling this glass into new bottles and jars). The main reason is that, all things considered, reusing processes have a lower environmental impact than recycling processes (due to lower needs for energy and raw natural resources).
3. **Recycle:** whenever products and packaging cannot be made reusable, effective recycling should be promoted. This means favoring priority use of effectively recyclable materials and banning products and packaging with designs that make recycling impossible (e.g. single-use multi-layer sachets). In terms of waste management, it also means favoring *effective recycling* processes rather than *downcycling* channels.³⁵

Incidentally, it is important to highlight that **burning waste should never be encouraged nor authorized:** it is well established that, even intended as a so-called “*energy recovery*” process (i.e. producing energy by incinerating waste), incineration comes with much more negative (environmental, health, financial, etc.) effects than positive benefits.³⁶ This practice, under any form, should be excluded from all aspects of proper waste management.

³⁴ For example, as stressed in Ecosoum’s [Zero Waste and Circular Economy: The Way Forward](#) report (2021), massive investments in recycling facilities and/or equipment can lead to justifying ever-increasing consumption and waste production, which is counter-productive in the light of the ‘Reduce’ principle.

³⁵ Although there is no official definition of ‘recycling’ and ‘downcycling’, *effective recycling* can be intended as a recycling process that produces very little or no waste and that aims to recreate the same type of item (e.g. a broken glass bottle is recycled into a new glass bottle). On the contrary, *downcycling* refers to processes that produce a significant amount of waste and/or that turn alleged recyclable waste into a lower-grade item (e.g. PET bottles are often downcycled into clothes or carpets, that will end their life in a dumpsite). While true *recycling* contributes to closing the loop of the circular economy, *downcycling* does not.

³⁶ Zero Waste Europe, [9 reasons why we better move away from waste-to-energy, and embrace zero waste instead](#), 2018.

Finally, waste management systems should always be designed **taking into account the extended social responsibility of private corporations**. In other words, companies that produce and/or market products that end up constituting most of our waste (starting with the food and beverages companies, through packaging) should play a direct and active role in contributing to both reduce and manage this waste.

This responsibility is not only moral or ethical (those who pollute must be held accountable), but also very practical: without their financial and/or logistical involvement, it is absolutely impossible for public administrations to set up proper waste management systems nor to balance waste management budgets.³⁷

AT-SOURCE WASTE SORTING

OBLIGATION OF AT-SOURCE SORTING FOR ALL PRODUCERS

Proper waste management requires processing each type of waste separately because the solutions for each category of waste (plastics, glass, etc.) are all different. It means that the first essential step in any waste management system is always proper sorting at the source, meaning directly by waste producers in their homes and workplaces.

Therefore, as at-source waste sorting is the cornerstone of any proper waste management system, it cannot be optional: **at-source waste sorting must be obligatory for all waste producers** (households, public institutions and private businesses).

At-source waste sorting is intended as the **segregation of waste according to the following categories**, which must never be mixed together:

- Recyclable waste;
- Organic waste (mainly kitchen waste);
- Wood ash (from stoves);
- Hazardous waste (as defined by National legislation);
- Ultimate waste (all other types of waste).

All households should be equipped with a sorting bin provided by public administration to enable at-source waste sorting according to below recommendations.

Public institutions and private businesses are responsible for acquiring and organizing their own waste sorting equipment according to their needs, provided that this equipment does enable respecting the same at-source sorting rules.

³⁷ For more information, refer to Ecosoum's three above-mentioned reports – *Zero-Waste and Circular Economy* (2021), *How to balance waste management budget at the soum level* (2022), and *Who produces our waste? Brand audit* (2022).

RECOMMENDED PROCEDURES FOR AT-SOURCE SORTING AND PROCESSING

All categories of waste must be placed in adequate bags or containers (as specified below) and processed the following way:

- **Recyclable waste:**

- All recyclables are to be **placed in reusable bags** (30 to 50 L) that shall be supplied to households by Bulgan administration and/or the TUA.
- The **types of waste that should be treated as *recyclables*** are (at least) the following: PET bottles; other plastic bags, packaging and wrapping (both ‘soft’ and ‘hard’); glass bottles and jars; paper and carton; Tetra Paks; fabric; metal (aluminum and steel) cans and other scrap metal; clean bones. This list can be updated over time to match the evolving needs and reusing/recycling opportunities.
- **Recyclables must be relatively clean.** Washing all recyclables with soap is not necessary, but rinsing dirty food containers should be considered a must. If a recyclable is considerably soiled by food or other dirty substances, it may be preferable to exceptionally consider it as ultimate waste, to avoid soiling the rest of the recyclables.
- Ideally, **each category** of recyclable (glass, plastic bottles, plastic bags, paper, etc.) should be **placed in different bags** to facilitate the next stages of the waste management chain (i.e. sorting and processing in the facility). However, to limit the number of necessary bags, a relevant intermediary option could be have three bags for recyclables: one for all types of plastic waste, one for glass waste, and one for other recyclables.³⁸
- All **the bags with recyclable waste are to be placed in the *recyclables* compartment of the sorting bin.** When TUA staff will collect the full bags, they will replace them with empty bags so that waste producers can keep sorting recyclables following this procedure.³⁹

- **Organic waste:**

- Organic waste must **never be mixed with other categories of waste**, which is why it cannot be placed in the waste sorting bin.⁴⁰

³⁸ Segregating recyclable waste by sub-category of recyclable would greatly facilitate processing at the facility, and thus reduce the necessary workforce (and associated wages); however, it would lead to increasing significantly the budget for providing reusable sorting bags to each household. The above-suggested option with three bags for recyclables is intended to reflect the fact that the majority of recyclable waste is usually either plastic or glass. The relevance of sub-segregating recyclables at the source or not should be assessed through empirical experiments (possibly by testing each option in pilot areas).

³⁹ Bulgan administration and/or the TUA shall acquire enough reusable bags to provide all households with a sufficient number in line with the actual collection pace (probably 3 to 5 bags per household per year). After full bags are collected and transported, they are emptied at the waste management facility and ready to be distributed to other waste producers in replacement for full bags to be picked up.

⁴⁰ As mentioned above, the only exception is clean bones, for which specific recycling processes are to be implemented in the waste management facility. Bones should thus be considered as a *recyclable* and put in a *specific* bag (separated from other recyclables) in the *recyclable* compartment of the bin.

- Organic waste is primarily to be **composted⁴¹ on site** (outside homes for households, within their premises for other waste producers) by waste producers themselves. If possible, authorities should make composting mandatory, or at least provide incentives for composting.⁴²
- Households and other waste producers should thus be required to **dedicate a small area (approximately 2-3 m²) in a corner** of their yards or premises to start a compost.⁴³ Wooden boxes or compartments can be built to keep the composting zone ordered and clean, although a simple pile is also possible (in ger/house bags, not in apartment district) for those who can't afford to purchase a few wooden planks.⁴⁴
- Waste producers should, by their own means, **acquire one or two buckets to sort organic waste** within their home or building when it is produced (e.g. when households cook). After a few days, when the buckets are full, buckets are simply taken outside and emptied on the composting pile or within the composting wooden box/compartment.
- **Proper information and training must be provided** by Bulgan administration on proper composting techniques, so as to ease the process as much as possible for waste producers.
- When the compost is ready⁴⁵, it can be either **directly used on-site for home gardening⁴⁶ or given/sold to other stakeholders** who need good compost (hobby gardeners, professional households, etc.). In any case, compost shall be considered a valuable resource and shall not be collected by the TUA in the framework of the waste collection service.⁴⁷
- Waste producers that don't want to carry out on-site composting must also have the possibility to **dispose their organic waste directly in the composting area of the waste management facility** and/or the 'waste sorting and information

⁴¹ Alternative ways to naturally process organic waste, such as giving relevant organic waste to animals (livestock or dogs) are also recommended whenever possible.

⁴² A relevant way to facilitate on-site composting could be to link the issue of organic waste composting with the issue of dry toilets. Pit latrines commonly used in Mongolia can raise health issues and are problematic in urban areas, which is why public authorities should encourage more ecological and safe toilets, such as dry toilets. This type of toilet also relies on the composting process, which means that introducing and facilitating dry toilets in Bulgan soum would in fact translate into creating composts. These toilet composts could be used to dispose other organic waste as well.

⁴³ In apartment district (5th bagh), collective compost should be arranged for the whole building, under the supervision of the janitor. If there is no janitor, inhabitants of the building should elect one of them as the person in charge. If there is no space down a building to create a compost, an alternative location should be identified nearby (although the necessary space for a compost is very small, so it should be feasible in almost all apartment buildings).

⁴⁴ Pictures of examples of composting piles and boxes and dry toilets are provided in Annex 2.

⁴⁵ In Mongolia, due to the long and cold winters, composting usually takes more time than in other countries with warmer climate. However, the composting process theoretically takes only 3-4 months to be completed if properly carried out, which means that it can be performed over the course of the summer. However, for beginners who may not manage to keep the composting process at its optimum, it may take two summers to be completed. Sufficient space should thus be planned to keep a specific composting pile/box for up to two years.

⁴⁶ Beyond the scope of waste management policies, home gardening is a practice than should be promoted by public administration, as it usually is a good mean to help households adopt a healthier and more balance diet while decreasing food-related expenses.

⁴⁷ If for some reason the TUA must be involved in collected matured compost, it would be preferable that it falls under the responsibility of another department, for example the one in charge of public green spaces (as compost could be used for this gardening work).

center'.⁴⁸ Disposing organic waste there could be free of charge (unless experience shows that taking care of such large composting areas leads to significant expenses for the TUA), but in any case waste producers would have to bring organic waste by their own means.

- The only **exception to not collecting organic waste** from waste producers is when **professional activities are understandably and logically producing large amounts of organic waste**, such as restaurants, *cafés*, *tsainii gazars* or any other food processing companies. For such food waste generating businesses, the TUA should maintain organic waste collection, provided that all waste categories are properly sorted following the above rules.⁴⁹

- **Wood ash:**

- **Wood ash should be separated from all other waste** as it can easily be reused as a fertilizer or insect repellent in agriculture.⁵⁰ On the contrary, coal ash can contain unwanted, potentially toxic substances, so it should be disposed (in bags) as ultimate waste.
- Wood ash (not mixed with coal ash) is to be **put in a separate metal container or dedicated bags**.
- To avoid overloading the sorting bin, it is probably preferable to **keep wood ash bags or metal container aside**, next to the bin.⁵¹

- **Hazardous waste:**

- Hazardous waste (such as broken electronic devices) and substances (such as oils or paints) are to be **placed in a specific and clearly identified bag or hermetic container** (depending on the risks of leaking). **Batteries are to be placed in a dedicated PET bottle**.
- The bags and/or containers with hazardous waste must be **clearly marked and easily identifiable** by waste management staff.
- The clearly identifiable hazardous waste bags and/or containers produced (in small amount) by households or ordinary other waste producers are **to be placed in the recyclables compartment** of the sorting bin.⁵²
- The other waste producers with professional activities that lead to systematically producing **significant amounts of hazardous waste**⁵³ must have a **specific**

⁴⁸ This 'waste sorting and information center' currently does not exist, but the relevance of its creation is explained below.

⁴⁹ In order to make sure organic waste is never mixed with other types of waste through the collection process, the TUA should assess whether it is preferable to have one truck collecting only organic waste everywhere or to have a dedicated compartment in trucks that collect also other types of waste.

⁵⁰ Even if it is not actively used for agriculture or other interesting purposes, wood ash remains an organic matter that could simply be spread out in the steppe to fertilize it. As such, disposing wood ash in landfills really is misuse.

⁵¹ As Bulgan soum's bin only have two compartment, it is probably preferable to keep wood ash aside to avoid mixing different waste categories – unless adequate collection pace enables placing both recyclables and wood ash in the same compartment without overloading it.

⁵² Although hazardous waste are essentially not recyclable, putting them in the *recyclable* compartment will enable TUA staff to identify and process them separately, which would not be possible if it was mixed with ultimate waste.

⁵³ Such professional activities that produce significant amount of hazardous waste notably include, but are not limited to, hospitals, mining companies or factories that use hazardous products (such as auto repair shops). In theory, concerned

temporary storage area/container. These waste producers should be obliged to have a **permanent contract with relevant hazardous waste processing entities** and organize transportation and processing directly, by their own means, with these entities.⁵⁴

- **Ultimate waste:**

- **All waste that does not fall under any of the above-mentioned categories** can be considered as ultimate waste.
- Ultimate waste is to be **put in single-use bags** (either actual garbage bags or any other plastic bags from groceries) that waste producers must **acquire by themselves**.⁵⁵ Ultimate waste should never be disposed directly in the sorting bin: putting waste in **properly closed bags** is of paramount importance to enable proper waste collection.
- These ultimate waste bags are to **be placed in the *ultimate waste* compartment** of the sorting bin.

RECOMMENDATION TO ENFORCE OBLIGATORY AT-SOURCE SORTING

Overall, it is likely that all waste producers won't properly follow all these guidelines, at least not right away. It is also possible that some of them will hide organic waste, wood ash and/or hazardous waste in ultimate waste bags. This kind of improper practices will be very hard to identify (and punish). The most realistic position for authorities to adopt is probably *not to try* to actively track and punish contraveners (unless such infractions are too massive or obvious), but to **focus primarily on prevention by constantly raising the awareness of the people**. Over time, this prevention approach shall have better results than repression, and the proportion of improperly managed waste shall decrease.

However, as explained below, it is of paramount importance that at least two of the above rules are strictly applied: **proper segregation of recyclables** and **proper bagging of all categories of waste**. The reason why authorities should be strict on these two issues is that they are the key factors that will enable improving the waste collection system and bring it to a sustainable point: **without these requirements, it will be impossible** to properly implement the next waste management stages.

Therefore, no matter how tolerant authorities may be regarding the other rules, **adequate measures must be taken to effectively and strictly enforce the obligation to sort recyclables at the source and keep all waste in bags**. Therefore, after a brief indulgent transition period during which specific information and guidance must be massively provided to all waste producers, **a zero-tolerance policy must be applied**.

companies should be officially registered as they are supposed to require authorization from relevant authorities to implement their hazardous waste producing activities.

⁵⁴ Such entities with legal licenses to process hazardous waste exist in Ulaanbaatar and Erdenet for petroleum products, bio-hazardous waste from medical sector, chemical product packaging and accumulators (https://eic.mn/waste/upload/2021/tawasteinfo/20210318_2769.pdf).

⁵⁵ Supplying bags for recyclable waste but not for ultimate waste is to be considered an indirect incentive to sorting and reducing waste production at the source. Whenever possible, such 'soft' incentives are recommended.

Rather to directly fining contraveners⁵⁶, it would probably be more constructive to use waste collection service as leverage by establishing a simple rule: **waste shall not be collected anymore if it is not properly sorted and adequately placed in bags** according to Master Plan rules. In other words, if waste collection staff finds improperly sorted and/or bagged waste in the bins, they shall refuse to collect it and move on to the next waste producer without collecting the waste.⁵⁷

In such cases, a notice⁵⁸ shall be left by collection staff on the bin (or gate, or mailbox, depending on practical constraints) of the contraveners to inform them that they are **given one week** (starting on the date of the failed collection attempt, stated on the notice) **to re-sort and/or re-bag their waste and bring it by their own means to the waste management facility (or the ‘waste sorting and information center’)**. Only upon expiry of this delay, if the contraveners didn’t comply with the noticed order, their cases will be forwarded to relevant authorities, who will eventually apply a punitive fine.

Upon discovery of improperly sorted waste by collection staff, the name and/or address of the contraveners shall be immediately communicated to staff of the waste management facility (and/or the ‘waste sorting and information center’).⁵⁹ This way, waste management facility staff will always be up to date and can easily monitor contraveners to make sure that they all comply with the notice and eventually bring their waste as they were ordered (or, after the one-week delay, communicate the list of offenders⁶⁰ to relevant authorities).

When contraveners come to the waste management facility (or the ‘waste sorting and information center’) with their re-sorted waste within the one-week period, staff will welcome them with a constructive attitude and take the opportunity to raise their awareness and provide them with relevant information and guidance regarding waste sorting. Staff can show first hand how and why waste must be sorted as required, so that contraveners better understand the issues at stake and are more likely to comply with the at-source sorting rules.

Little by little, this systematic improvement of the waste producers’ awareness and understanding will tend to progressively reduce to zero the number of contraveners and ensure perfect at-source sorting everywhere in Bulgan soum.

⁵⁶ In this section, we refer as “contraveners” to the waste producers who are identified by waste collection staff as contravening to the obligation of properly sorting and bagging their waste at the source as previously recommended.

⁵⁷ Of course, the possibility that waste may not be collected from contraveners should not open the possibility that some waste producers decide to exit Bulgan soum’s waste management/collection scheme and stop paying their waste management/collection taxes/fees. Respecting the above-described rules shall remain mandatory for all waste producers: temporary suspension of waste collection is only a way to pedagogically incite contraveners to improve their waste sorting practices.

⁵⁸ A draft/example of what this notice could be is suggested in Annex 3.

⁵⁹ The most suitable procedure for communicating contraveners’ information is to be defined internally by concerned staff. A possible procedure could be as follows: the TUA waste collection staff who would observe the infraction to the sorting/bagging rule would fill the notice with date and name or address. Then, they would take a photo (with their phone) on which we could see both the notice (with name/address) and the inside of the bin where waste is improperly sorted/bagged (see example of such photo in Annex 2). Finally, they would send this photo to the TUA administrative staff for update of the list of current contraveners (the photo could also serve as a proof in case contraveners complain). The updated list (which could be set up in an online platform such as Google Drive) should be available to all relevant staff (at waste management facility and sorting and information center) likely to be confronted with contraveners coming to bring their waste.

⁶⁰ “Offenders” are intended as the *contraveners* who still did not comply after the one-week notice and shall thus be fined by relevant authorities.

WASTE COLLECTION AND TRANSPORTATION

WASTE COLLECTION TO HOUSEHOLDS

Unless they contravene the at-source waste sorting rules (as described above), **all households should benefit from waste collection service.**

The effective collection pace for households should be once a month.⁶¹ As the current pace is closer to one pick-up every three months, it means that, *if all else remains equal*, number of trucks and staff should be tripled to ensure that pace. However, budget constraints clearly forbid to plan such an increase of equipment and workforce, which means that collection pace must be increased through other means.

Calculations show that this one-month pace could actually be reached without increasing neither number of trucks nor workforce. The main two variables that can lead to increasing the speed of waste collection are the *number of households collected per round* (which reduces the total number of round to collect all households) and the *time spent per round* (which also reduces the total time spent to collect all households).

It turns out that **proper at-source sorting as recommended above would create a virtuous circle that shall improve collection conditions and enable reaching the desired collection pace:**

- If waste is properly sorted and bagged, TUA will need less time to collect waste from each household, which will mechanically increase the collection pace;
- If collection pace starts to increase, less waste will have to be collected in each household (less waste accumulates in one on month than in two or three), which will also reduce the time spent to collect waste in each household;
- If less waste is collected in each household, more households can be collected in one round, which contributes to reducing even more the total time needed to collect all households.

In the end, this virtuous circle leads to reach the desired collection pace without requiring an increase of trucks or staff. If number of households collected per round is tripled (from 3 to 9)⁶² and if the necessary time per round is reduced from an average of two hours fifteen minutes (2,25 hours) to one and a half hour (1,5 hour)⁶³, the necessary time to collect all households with 6 trucks would be reduced from 60 to only 13 eight-hour workdays (see Table 3).

⁶¹ In this section, we consider that the collection pace shall be once a month. However, it is important to realize that, considering the linear link between time and waste production (if more time passes, more waste is produced), the pace could be set to once every six weeks or two months without having any impact on the budget or necessary trucks and workforce (see calculations in Annex 4).

⁶² This tripling of households collected per round may appear very optimistic at first glance, but it actually would be a logical consequence of increasing the collection pace: if waste is collected three times more often (every month instead of 3 months), the average amount of waste accumulated by each household will be three times less. Consequently, there will be enough space in collection trucks to load the waste of three times more households (from 3 to 9). This estimation is actually quite conservative as it does not take into account the fact that some of the above recommendations shall lead to reduce the total amount of waste to collect (notably by excluding organic waste from the collection scheme).

⁶³ This expected 33% decrease in average time spent per collection round is linked with the two improvement parameters. Firstly, *all else being equal*, the threefold increase of collection pace, which would translate in a threefold reduction of waste production, would logically lead to also dividing by three the necessary time to pick up waste in each household (if the

VARIABLES	CURRENT SITUATION	IMPROVED SITUATION
<i>Number of households in Bulgan soum</i>	3,819	3,819
Number of households collected in one collection round	3	9
Number of necessary rounds to collect all households	1,273	424
Necessary time for one average collection round (hours)⁶⁴	2.25	1.5
Total time to collect all households once with 6 trucks (8-hour-workdays)	59.7	13.3

Table 3 : Summary calculation table of waste collection for households⁶⁵

WASTE COLLECTION TO OTHER WASTE PRODUCERS

For other waste producers, it appears that the collection pace does not need to be increased since it is already matching the expressed needs of the waste producers. However, in order to avoid disorganizing the collection scheme, it would be preferable to **stop on-demand collection and carry out regularly scheduled collection for all waste producers** – as it already is the case for many of them. For each waste producer, the desired collection pace (once a month, once a week, etc.) shall be agreed upon in advance and approximative collection timeslots shall be defined.⁶⁶

Although the number of rounds per month (76) won't be decreased⁶⁷, improved waste sorting and bagging will lead to reducing the necessary time per round (like for households), from

amount of waste is divided by three, the time to pick it up is also divided by three). However, based on our recommendations, not only collection pace will be increased, but also waste will be better sorted and *properly bagged* by waste producers, which will again lead to reducing by at least 50% the necessary time to pick up waste and load it on trucks (it will be at least twice faster to pick up a few bags of sorted waste than to extract mixed unbagged waste from bins, shovel by shovel). Let's finally mention that in this estimation, only the time spent in front of each household is reduced: the time to drive from households to waste management facility and back, as well as the necessary time to unload the trucks, are considered to remain unchanged (although the unloading time may also be reduced by proper sorting and bagging). In the end, this desirable 33% decrease in time per round appears not only realistic but even quite conservative.

⁶⁴ Both current and improved time per round include a 25-minutes round-trip drive between households and facility, as well as 20 minutes to unload trucks. The total time reduction only comes from reducing the time spent in front of each household, decreased from 30 minutes (currently) to 5 minutes (as mentioned above this sixfold reduction is the mechanical consequence of both to increasing collection pace threefold and saving 50% through proper sorting/bagging).

⁶⁵ Only the main figures are presented in this section's tables: detailed calculations are presented in Annex 4. The improvement variables are presented in bold; the other figures are automatically calculated based on these two variables. It should also be mentioned that these calculations make no difference between gers/houses baghs and apartment district households. However, we consider that this approximation has no significant impact on the results, firstly because calculations are based on averaged data (including households from both gers/houses and apartment districts) provided by the TUA, and secondly because the gain in time that may arise from collecting several households' waste in a single shared bin (in apartment district) must be at least partially offset by the fact that the amount of waste to be collected from each bin is linearly higher (and thus time-consuming).

⁶⁶ In case some waste producers would require an unscheduled additional pick up due to extraordinary waste production, they would have to manage it on their own or through the service of a third-party. If the need for such additional pick-ups was to happen often for a specific waste producer, it would mean that the contractual arrangement between the TUA and this waste producer is undersized: collection schedule/pace (and associated collection fee) should thus be updated to better match the waste producer's needs.

⁶⁷ In our calculations for improved situation, we also didn't consider that the number of rounds would increase, even though some of the waste producers that are currently not officially included in the collection scheme may eventually be. The main reason is that the imprecision of the figures characterizing the current situation makes it impossible to precisely evaluate how many entities are in fact missing, especially if we consider that some of them may actually have their waste indirectly collected by the TUA (if they discreetly dispose their waste in other waste producers' bins). Overall, we consider that the missing waste producers that may eventually be included in the scheme are relatively negligible in our calculations as they

approximately two and a half hour (2.5 hours) to approximately one hour and fifty minutes (1.8 hour).⁶⁸

Overall, the necessary time to collect waste with six trucks from the other waste producers each month at the adequate pace (4 times per month on average) should be reduced by approximately 28%, from 4.0 to 2.9 eight-hour workdays (see Table 4).

VARIABLES	CURRENT SITUATION	IMPROVED SITUATION
<i>Number of other waste producers in Bulgan soum</i>	152	152
Average number of waste producers collected in one collection round	8	8
Average collection frequency for one waste producer (round per month)	4	4
Number of necessary rounds to collect other waste producers	76	76
Necessary time for one average collection round (hours)	2,5	1,8
Total time to collect all other waste producers each month at adequate pace with 6 trucks (8-hour-workdays)	4.0	2.9

Table 4 : Summary calculation table of waste collection for other waste producers

OVERALL WASTE COLLECTION AND TRANSPORTATION IN BULGAN SOUM

In addition to collecting waste from households and other waste producers, the TUA also transports waste from street bins to the waste management facility. Currently, each of the 6 collection trucks dedicate the equivalent of one workday per month⁶⁹ to collecting street bins waste. **This pace is expected to remain unchanged.**

Overall, aggregating waste collection from households, other waste producers and street bins, calculations show that **the total time dedicated by the TUA trucks to waste collection each month could be reduced by almost one third, from 149 to 103 days** (see Table 5).

With 6 functioning trucks, it means that, in the improved situation, each truck would be running only 17.1 days per month (out of 22 workdays), which correspond to a 78% occupation rate.⁷⁰

don't produce so much waste anyway. It means that eventually including them would not significantly modify the results of our calculations (which is why our calculations are still based on the same number of waste producers – 152 – in the improved situation).

⁶⁸ The necessary time for one average collection round is expected to be slightly higher than for households because there are more waste producers to collect per round and collection involves a few additional time-consuming steps such as entering the premises.

⁶⁹ As previously mentioned, one of the six trucks dedicate – each day – one round (2,25 hour) to street bin collection. Over the course of 22 workdays (one month), it means that the total time dedicated to street bins reaches approximately 50 hours (a little over 6 eight-hour workdays). As there are currently six functioning truck, this estimation is equivalent to 1 workday per truck.

⁷⁰ Trucks occupation rate is calculated considering an average of 22 workdays per month. The fact that occupation rate in this modelling of current situation exceeds 100% means that some calculation parameters provided by the TUA were probably too pessimistic (their rounds may be slightly faster and/or they can load slightly more household waste in each truck than they estimate). It should be highlighted that this observation does not compromise the relevance of the calculations nor the possibility to improve the situation. On the contrary, as improved situation is linearly derived from current situation parameters, it is possible that waste collection in improved situation could be even more efficient and take even less time than expected in our calculation. Considering margins of error, the above-mentioned estimations should anyway be handled with caution and considered as orders of magnitude rather than precise figures; but this observation confirms that our results are not too optimistic and could actually be outmatched in reality.

Considering that some time must also be dedicated to trucks maintenance, it means that trucks would still be running close to full capacity – which confirms that, at the scale of Bulgan soum, **a fleet of 6 functioning waste collection trucks appears relevant and adequate** (increasing the number of truck does not seem necessary).

Currently, one collection truck requires 2.5 staff⁷¹ to operate, which means that the total number of workdays spent by TUA staff for waste collection is approximately 373 per month. However, **if a proper collection scheme with systematized planning and routes** was implemented, there would be no need for such inspectors, which means that **one truck could require only 2 staff to operate**. Therefore, the total number of workdays spent by TUA staff for waste collection could be decreased to 206 days per month. In other words, the number of (full-time equivalent) staff necessary to carry out overall waste collection in Bulgan soum could be reduced by approximately 45% to approximately 9.4 staff.

VARIABLES	CURRENT SITUATION	IMPROVED SITUATION
Total number of truck workdays necessary to carry out overall waste collection each month	149	103
Total number of workdays each of the 6 trucks must run each month	24.9	17.1
Waste management trucks occupation rate	113%	78%
Number of necessary staff per truck	2.5	2
Total number of workdays spent by TUA staff on waste collection each month	373	206
Total number of full-time equivalent staff necessary for waste collection each month	17.0	9.4
Ratio of waste collection workload / total TUA waste management workforce	100%	55%

Table 5 : Summary table of overall monthly waste collection in Bulgan soum

Considering that truck maintenance will remain necessary on a weekly basis and that a some time shall always be dedicated to coordinating the waste collection team, we can consider that **approximately 10 staff are necessary to adequately operate an improved waste collection scheme**. This means that, in the improved situation, the same TUA waste management team as today (17 field staff) could **dedicate approximately 7 full-time equivalent to other waste-related tasks** than collection and transportation.

While designing the systematized waste collection scheme (planning and route), the **TUA will have to clarify, for each type of waste producer, whether it is preferable for a given truck to collect all categories of waste at once** (recyclable, ultimate, etc.) **or to dedicate each truck to a specific category of waste** (one truck for recyclable, one truck for ultimate, etc.). Both options

⁷¹ Each truck requires a driver and a loader (2 staff). But in the current system where no systematized collection scheme is implemented, inspectors/coordinators are necessary to organize collection on a daily basis. As there are 3 inspectors and 6 trucks, it corresponds to 0.5 inspector per truck – which is why trucks currently require the equivalent of 2.5 staff to operate.

have advantages and disadvantages⁷², but feedback from experience should show which turns out more practical and easily implementable.

In any case, **the manner waste is collected and transported should never compromise in any way the other waste management stages**. It means that each sorted category of waste should never be re-mixed together in the trucks, and that each type of waste should be brought directly to the proper location in the waste management site depending on their specific processing channels (as described below).

WASTE MANAGEMENT FACILITY

GENERAL PLANNING AND INFRASTRUCTURES OF WASTE MANAGEMENT FACILITY

Building on the existing infrastructures and equipment, we recommend to organize the waste management facility (see map #3 in Annex 1) as follows:

- **Main building:** this building (14x11m) is the cornerstone of the system, where most machines should be installed and processes should be carried out. There should be at least **two plastic presses and one glass crusher**. Two **large tables on wheels** should also be installed to facilitate waste sorting and processing. Clearly organized space should be arranged for **temporary storage** nearby the North-Eastern door.
- **Annex building:** this extension of the main building should be **used for secondary processes**, possibly carried out by partners or subcontractors. For example, considering the current situation, at least part of the annex building could remain at the disposal of Mr. Sukhbaatar for processing bones.
- **Secondary building:** although the rest of the facility should not be accessible to the public, this secondary building, located right at the entrance of the site, should be **used to welcome visitors**. A long **sorting workbench**⁷³ should be installed so that people (especially passersby and local contravenors) can dispose their waste by category. **Informative posters, flyers and reports** should be displayed in this building to raise the visitors' awareness and provide relevant information.
- **Garage:** considering that waste management vehicles often don't start in winter if they are left outside during the night, it appears essential to **build a large enough garage to protect all vehicles from the cold**. Possible locations for the garage are next to the secondary building on the Western side or in the shed's stead in the Northern corner.
- **Sheds:** the existing sheds should be used for temporary storage of *processed* waste (ready to be shipped away to reusers and recyclers). If necessary, more sheds can be built to match logistical requirements.

⁷² If everything is collected in one truck, it will probably be easier to monitor the state of overall collection at a given time of the month, and to manage the situations where contravenors didn't sort properly. But, on the other hand, collecting all in one truck will probably lead to situations where one compartment (hopefully recyclables) is full before the other: in such a case trucks would have to drive back to the facility with one compartment partially empty, which would not be optimal. Rather than choosing one option once and for all in advance, the best approach would be to test the two scenarios (or combinations of them) and to conclude empirically which system is the most suited to Bulgan soum.

⁷³ A sorting workbench is a long counter with wheels, inside which carts or bags are installed to collect sorted waste. Once a cart is full, it can be moved to the main building where the waste contained in it can be processed. Pictures of an example of such sorting workbench are provided in Annex 2.

- **Hazardous waste container:** the existing container should be used for temporary storage of hazardous waste, as it is today. If possible, a state-of-the-art hazardous waste storage room should be built instead, to increase the level of safety.⁷⁴
- **Composting area:** as a large amount of organic waste is to be composted, it is essential to dedicate a sufficiently large area to this process.⁷⁵ If there is not enough space in the current premises, an extension should be planned next to it or in another relevant area (for instance, close to future compost users such as local farmers).
- **Wood ash temporary storage area:** if wood ash is effectively sorted by waste producers and relevant subsequent uses are implemented, it will be necessary to arrange a temporary storage area in or next to the facility. The relevance and location of such storage area should be assessed in line with the possible subsequent usage of wood ash, especially in the agriculture sector.

RECOMMENDED PROCESSES FOR EACH CATEGORY OF WASTE

Except for ultimate waste (which should be disposed directly in the landfill) and organic waste (which should be disposed directly in the composting area)⁷⁶, **all categories of sorted waste should be transported to the waste management facility**. When arriving, each truck should drive directly up the access ramp (see map #3 in Annex 1), where **waste bags will be unloaded on the conveyor belt**.

As waste bags will move inside the main building thanks to the conveyor belt, they will be opened and **staff will proceed with final sorting operations**. Then, unless necessities require otherwise, each type of waste should be processed as follows:

- **PET bottles** are to be uncapped and remaining liquid is to be evacuated before bottles are compacted in the main plastic press. Transparent soda PET bottles and dark beer PET bottles are to be pressed separately as their purchasing conditions are usually different. Pressed PET bottles are to be shipped⁷⁷ and sold to urban recyclers.
- **'Soft' plastic bags and wrapping** are to be grouped and pressed in a second plastic press.⁷⁸ If possible, thick wholesales wrapping should be pressed separately as it can usually be sold for a higher price. All the other types of 'soft' plastic bags and wrapping can be pressed together.⁷⁹ Pressed plastic bags and wrapping are to be shipped and sold to urban recyclers.

⁷⁴ As previously mentioned, the construction of such storage building is planned in Bulgan soum but it has not started yet.

⁷⁵ Pictures of large composting piles are presented in Annex 2 as an example of what should be done in Bulgan soum.

⁷⁶ If effectively sorted and subsequently reused, wood ash should also be disposed directly in its dedicated area. It is possible, however, that waste producers keep mixing ash with ultimate waste and/or that no relevant usage can be implemented right away, which means that ash would still be disposed in landfill for a while, until the new waste management system is perfectly and thoroughly implemented.

⁷⁷ All types of waste that are to be shipped to urban stakeholders shall temporarily be stored in (or next to) the facility, which is why temporary indoor and outdoor storage areas (and sheds) are necessary.

⁷⁸ A single press can be sufficient in the beginning to press all types of plastic, but eventually it may become more practical and efficient to have two presses (one dedicated to PET bottles and another one for other types of plastics).

⁷⁹ Such 'soft' plastic bags and wrapping (most of which are made of either LDPE or PP) mainly include: shopping, grocery and vegetable bags; plastic films; food (bread, noodles, chips, cookies and so on) packages; candy wraps; etc. Overall, most 'soft' plastics can currently be sold to recyclers/downcyclers – with the notable exception of multi-layered sachets (which include an aluminum layer) that are not recyclable at all (and thus worthless).

- **Non-PET ‘hard’ plastics**, which essentially include HDPE and PP containers⁸⁰, are to be grouped and pressed. Depending on selling opportunities, it may be relevant/necessary to sub-segregate by color or by type of product. Pressed ‘hard’ plastic are to be shipped and sold to urban recyclers.
- **Glass bottles and containers** are to be sorted by brand and sold back to each producer for reusing. Damaged glass that is not suitable for reusing should be either sold to recyclers or reused locally (for instance in replacement of gravel to make concrete). To enable local reusing (and possibly also for selling to some recyclers), crushing glass with a dedicated shredder will be necessary.
- **Paper and carton** can be processed in different ways depending on the amount arriving at the facility and the possibilities offered by other stakeholders. First, cartons in good conditions can actually be very useful to safely ship reusable glass to producers. If recyclers are buying paper and carton, it can also be sold to them. If not, paper can be used as organic matter for dry toilet or compost (unless they contain a lot of ink). In last resort, paper and carton may be burnt.⁸¹
- **Aluminum cans** are to be pressed, shipped and sold to urban recyclers.
- **Steel cans and Tetra Paks** are currently not purchased by any stakeholder, so there is no other solution but to dispose them in landfill. However, as much as possible, it can be relevant to sort and store these types of waste anyway until a proper processing solution can be found in the future – and/or to be used for advocacy and awareness-raising purposes.⁸²
- **Hazardous waste** (such as **e-waste** or **batteries**) should be safely and hermetically stored in the dedicate hazardous waste container or room until proper processing, possibly after transportation to Ulaanbaatar or Erdenet, can be operated. In case no adequate processing solution can be implemented within a reasonable timeframe, hazardous waste shall be disposed locally in a dedicated area of the landfill, where it will not be mixed with other types of non-hazardous waste. Hermetic containers should be used to prevent pollution, and reversibility principle should be applied.⁸³

The above recommendations for **processing each type of waste shall be updated** if new reusing or recycling opportunities arise in the future or, more broadly, if any modification in the context of waste management-related operations compromise the relevance of the said recommendations.⁸⁴

⁸⁰ Such non-PET ‘hard’ plastics mainly comprise food containers (yogurt bottles, jam containers, etc.), bottles for cleaning or body care products (shampoos, soaps, face creams, laundry products, etc.) or containers for car products (motor oils, anti-freeze, etc.).

⁸¹ Paper and carton are the only exception to the *no waste burning* rule because, as they are made of organic matter, their combustion doesn’t emit toxic substances in the same way synthetic materials (such as plastic) incineration does. Burning paper does emit CO₂ (which contributes to climate change), but if the amount of paper to be burnt is limited and no other solution is applicable, incineration can remain a reasonable solution. Ideally, if paper and carton are incinerated, it should be done as a relevant energy-production operation (such as heating the waste management facility).

⁸² Waste for which no actual management solution exist in Mongolia shall eventually be replaced by more sustainable packaging. Accumulating incriminated types of waste such as steel cans and Tetra Paks may be necessary to produce data, lead communication campaigns and force producers to modify their practices and packaging habits.

⁸³ Hazardous waste that may be landfilled in Bulgan is likely to eventually impact the environment (hermetic containers or any other measures to prevent leakage don’t last forever, which is why pollution is eventually unavoidable). Therefore, if/when landfilling hazardous waste, it is important to enable *reversibility*, which means that it should be possible to recover buried hazardous waste whenever an adequate processing solution is available in the future.

⁸⁴ As explained in Ecosoum’s above-mentioned *Who produces our waste?* report, companies should take more direct actions and facilitate waste management systems at the soum and aimag levels. Therefore, more sustainable and efficient solutions than those suggested here – which can all be implemented as of today – may become available in the future.

WASTE SORTING AND INFORMATION CENTER

As of today, there is no specific location in Bulgan soum dedicated to informing people about the waste issue. **Setting up such a 'waste sorting and information center' somewhere in the city-center**, in an easily accessible location, would be of great help both to raise awareness and improve the waste management system.⁸⁵

This waste sorting and information center should **be arranged for the main purpose of welcoming and informing people about waste**, similarly to the secondary building of the waste management facility (as described above). Informative posters, flyers, guidebooks and reports should be displayed so that everyone can **have access to extensive information** about waste in general and waste management rules and laws in Bulgan specifically.

A **sorting workbench should also be installed** in the building for anyone to be able to properly dispose sorted waste by themselves.⁸⁶ This disposal area will be particularly useful for two types of people: passersby (who will be required to dispose their waste in the center) and local contravenors (who shall be offered the possibility to dispose their re-sorted/bagged waste in the center within their one-week notice).

Considering the space necessary to arrange and properly use the workbench, as well as the space necessary to temporarily store collected waste (before it is taken to the waste management facility by the TUA), the **indoor dimensions of the waste and information center** should be at least 6 x 6 meters.

A **composting area** should also be arranged within the premises of the waste sorting and information center. This composting area should be sufficiently large for all households who do not wish to compost at home to be able to bring and dispose their organic waste.

The waste sorting and information center should be **sufficiently staffed to be extensively open**, not only during week days but also **during week-ends** – so that everyone, regardless of their work schedule and time constraints, can effectively have access to the center.

This waste sorting and information should be **placed under the responsibility of the TUA**, like the rest of the waste management system, so that staff can adequately be dispatched there depending on needs and transportation of collected waste to the facility can easily be coordinated with the rest of the waste collection operations.

PASSERSBY

The issue of passersby disposing their waste in Bulgan in an improper manner is complex to solve because, by definition, they are outsiders who cannot benefit from ongoing awareness raising and guidance like local people. There is no magical solution to solve this issue and it is likely to last until the entire country adopts better practices in terms of waste management. Nevertheless, efforts should be made to reduce the amount – or at least the probability – of improper disposal and littering by passersby.

⁸⁵ If possible, in order to save time and money, this waste sorting and information center should be arranged as soon as possible in an existing building belonging to either Bulgan administration or the TUA. If no suitable building can be made available, constructing a new building shall be necessary.

⁸⁶ See pictures of sorting workbench example in Annex 2.

We recommend to make it **officially mandatory for passersby to dispose their waste in the waste sorting and information center** (or in the waste management facility). Enforcing such legal obligation shall certainly be very difficult. But even if authorities can't follow each passerby to make sure the law is respected, having a clear and strict legal framework offers the possibility to take action whenever possible/relevant.⁸⁷

Large information signs must be installed at all entrances and strategic locations of Bulgan soum, to inform passersby of the obligation for them to stop by the waste sorting and information center if they have waste to dispose of. The location of the waste sorting and information center should be very clearly explained and many orientation signs should help passersby to easily find their way to the center. (The purpose of such numerous and precise signs and panels is not only to increase the probability for the law to be respected but also to make sure that, if caught while having improper practices, no one can honestly claim that they didn't know the rules.)

Once they arrive at the center, passersby will be welcomed by staff who will explain in more detail why they had to come to the center and how waste is managed in Bulgan soum and aimag. Over time, passersby's awareness will progressively be raised and their waste management practices shall hopefully improve little by little. Incidentally, passersby will progressively contribute to **disseminate information about Bulgan's waste management scheme and good practices**, which will tend to both increasing compliance with the law and display Bulgan aimag as an advanced pioneer when it comes to fighting waste littering.

LANDFILL

CREATION AND CLOSING OF LANDFILL COMPARTMENTS

The landfill area is to be **divided into compartments** (approximately 100x100m = 1ha) that are created, filled and closed one after the other. Although state-of-the-art landfills in Western countries theoretically include a double waterproof layer in the bottom (with very thin clay and hermetic plastic), such technology does not seem realistically applicable in the context of rural Mongolia, for financial and technical reasons.⁸⁸ Therefore, we recommend to **keep proceeding with the same kind of basic landfill compartments** as the ones that have been created and used over the past years.

When a new compartment is necessary, the ground is to be **excavated at a depth of approximately 2m** (see drawing and dimensions in Annex 5). An **embankment (approximately 2m high)** is also to be created all around the compartment and a fence should be put on top to strictly prohibit entrance to non-authorized people (and, as much as possible, roaming animals). With a surface of approximately 1ha, such a compartment represents a volume of up to 40,000

⁸⁷ To avoid being easily circumvented, this obligation to dispose waste in the center should be coupled with the prohibition to dispose large amounts of waste in street bins – for instance, not more than 1kg at a time. Once again, this rule would be hard to actively control and enforce, but it would at least provide the authorities with a strict and consistent legal framework to take action whenever possible/necessary.

⁸⁸ Such state-of-the-art landfills are not only very expensive to build, but they also are to maintain and operate. Covering the bottom with a waterproof layer implies to set up a lixiviate collection and treatment system, which is very costly and difficult to maintain (not to mention that this system degrades over time, especially after the landfill is full and stop being operated, which means that even such state-of-the-art landfills eventually let pollutants leak and contaminate the environment). Constructing and operating such a landfill, with the budgets and technologies available in Bulgan aimag, is thus unrealistic and not necessarily desirable.

m³.⁸⁹ Taking into account the drastic reduction of waste to be disposed in landfill thanks to improvement of sorting habits, such a landfill compartment shall be sufficient for several years.⁹⁰

When the compartment is full, waste shall be **covered with at least 50cm of clean soil**. Ideally, a **waterproof layer is to be installed on top of waste** (between waste and clean soil cover) so as to prevent rainwater to infiltrate landfilled waste.⁹¹ In such a case, a basic drainage system (with stones and gravel) should be planned to properly evacuate water running on top of the covering hermetic layer.

Rather than requiring the service of an external subcontractor through a public tender, we recommend for Bulgan administration and/or the TUA to **acquire the necessary machinery to carry out this work themselves**. As a crawler bulldozer is already available, it means that only an excavator and a large truck are missing. Acquiring these two machines appears all the more relevant that they will also be necessary for proper management and operation of the landfill (and possibly also for other tasks carried out by the TUA).⁹²

MANAGEMENT AND OPERATION OF LANDFILL

When collection trucks arrive with ultimate waste, they will **unload waste directly in the landfill** compartment.

If ultimate waste is properly bagged (as recommended above), wind scattering of waste shall be limited for at least a few days (until the integrity of bags is compromised by natural elements and/or wild birds than inevitably roam landfills). In any case, it is **expectable that at least part of the waste disposed in the landfill will be immediately subject to wind scattering** (non-bagged waste from street bins, waste falling from damaged or improperly closed bags, etc.).

Therefore, it will be essential to **compact and cover waste on a very frequent basis**. Depending on the amount of waste and quality of bagging, it will be necessary to cover waste at least once a week and possibly up to once a day. We recommend that, by default, the bulldozer is used every day to regroup and compact waste at the end of each day, and that excavator is used upon necessity (based on staff observation and judgement) to cover waste (no less than once a week).

Covering of waste can be done with soil, but other materials can also be used. For instance, it could be relevant to **use also dense coal ash from central heating plant**, especially if there is

⁸⁹ The actual volume of waste that can be disposed in a given compartment is usually lower (possibly closer to 30,000 m³), depending on exact dimension of excavation and embankment, and considering that the surface of the compartment shall eventually be covered by clean soil (which will occupy part of the volume).

⁹⁰ The exact life span of a given landfill compartment is hard to evaluate given the imprecision of the data regarding current waste production in Bulgan soum. The actual life span will also depend on how fast and effectively the above-mentioned waste sorting and processing recommendations will be implemented.

⁹¹ Pollutants can migrate underground and contaminate groundwaters only if they are mobilized by a liquid (essentially infiltrating rainwater). Therefore, preventing rainwater infiltration will drastically reduce the risk of environmental pollution, even if a waterproof layer is not installed *beneath* waste (at the bottom of the landfill compartment) but only *on top* of waste (in which case no specific lixiviate collection and treatment system is necessary – only basic drainage to guide rainwater towards the closest river).

⁹² In any case, considering the cost of externalizing landfill creation and covering (75 million MNT for the last tender, not to mention that, according to field observations, the mission was not properly completed), the investment for acquiring the excavator and truck shall be amortized within very few years, especially if we take into account the fact that the machines can be used to create and close the landfills of all soums in Bulgan aimag (which, overall, will lead to markedly reduce waste management expenses and ensure creation of proper landfills all over the province).

not enough clean soil available to perform frequent covering. In such a case, a pile of coal ash could be gathered in a corder of the landfill compartment (close to the entrance, where waste will be disposed last) and mobilized and used whenever necessary with landfill machinery.

DISTRIBUTION OF WASTE MANAGEMENT STAFF

According to our calculations (see Table 5 and Annex 4), reorganizing the collection scheme – which currently requires 17 staff (7 drivers, 7 loaders, 3 inspectors/coordinators) and leaves no one to work on other essential tasks – could lead to requiring only 9.4 full-time equivalent. Taking into account the time necessary for truck maintenance and coordination of waste collection team, this estimation means that approximately **7 staff could be dedicated to other tasks**, such as sorting and processing waste at the facility, welcoming and raising awareness of people at the waste sorting and information center, or carrying out necessary operations at the landfill.

Possible reorganization of the TUA waste management workforce is suggested in Table 6.

STAFF DISTRIBUTION (full-time equivalent)		CURRENT SITUATION	POSSIBLE REORGANIZATION
Waste collection	Drivers	7	4.7
	Loaders	7	4.7
	Coordination and maintenance	3	0.6
Waste management facility	Sorting staff	0	2.5
	Processing staff	0	2.5
Waste sorting and information center	Officer	0	1.75
Landfill	Officer	0	0.25
TUA administration	Admin staff	2	2
TOTAL		19.0	19.0

Table 6 : TUA waste management staff distribution in current situation and possible reorganized system

In this suggested scenario, the estimated 9.4 staff are divided into drivers and loaders for the 6 trucks.⁹³ 0.6 full-time equivalent is planned for maintenance and coordination of the collection team, which means for example that one of the drivers or loaders could dedicate three day per week (60% of his time) to maintenance and coordination tasks (of course, if relevant, this maintenance and coordination time can be spread amongst several staff). 5 staff could be based full-time in the waste management facility while 1.75 full-time equivalent could be dispatched in

⁹³ The fact that only 4.7 drivers and loaders are considered although there are 6 trucks to drive is not a mistake: it simply reflects the fact that, according to our calculations, trucks would be driven only 17.1 days out of 22 each month (4.7/6 is equal to 17.1/22). In real-life, there will indeed be 6 drivers and loaders working on the 6 trucks, but they will be working on other tasks for approximately 5 days out of 22. The same logic applies to all staff that are considered in fractioned numbers: we talk about 'full-time equivalent' although a given staff can work on different tasks.

the waste sorting and information center.⁹⁴ This scenario would leave a quarter-time (25%) for landfill operations, which corresponds to one staff operating landfill machinery for 2 hours per day on average.

This scenario is merely a suggestion that can be adapted depending on actual needs.⁹⁵ But these orders of magnitude show that **most recommendations provided in this report could actually be implemented even if no additional staff can be hired**. It is possible that workforce will eventually need to be increased to keep improving the waste management system in Bulgan soum; but, at least in a first phase, the current team should be enough to carry out the most important waste management tasks – which will quickly lead to tremendously improve waste management in Bulgan soum.

WASTE MANAGEMENT BUDGET

The sustainability of an improved waste management system in Bulgan soum would greatly depend on its financial viability. It is thus important to **consider all expenses and incomes** of the waste management budget not only through a yearly cashflow prism but **with a long-term perspective** (several decades), in order to take into account both **running costs and investments** (which can be reported to yearly expenses based on an amortization period).

Main expenses can be divided into two main categories: investments and running costs.⁹⁶ Investments essentially correspond to **infrastructures** (waste management facility, waste sorting and information center, and landfill) and **equipment** necessary for proper waste management at the soum level (trucks, bulldozer, excavator, glass shredder, plastic presses, tools and sorting bins). Running costs can be subdivided into six sub-categories: **maintenance** of infrastructures and equipment, **salaries** of waste management staff, **transportation** costs, household **sorting bags**, **awareness-raising** expenses, and **electricity and heating** costs.

Main expected yearly expenses are summarized in Table 7 and detailed in Annex 6. Estimations show that total yearly expenses associated with waste management in Bulgan soum add up to approximately **580 million MNT per year**. Amortization of main investments represent approximately 160 million MNT (28% of total) while running cost 420 million MNT (72%). The main budget line clearly is the salary of waste management staff (228 million MNT), which alone represents 40% of the total.⁹⁷

⁹⁴ 1.75 full-time equivalent corresponds to one staff being present in the center not only 8 hours per day during 5 week days (1 full-time equivalent – 40 hours work), but 10 hours per day during 7 days (70 hours work). In practice, this position would be spread among at least two of the TUA staff (possibly more, as a part-time task) and would enable keeping the center open part of the evenings and during week-ends, as it is necessary for the reasons previously explained.

⁹⁵ Flexibility is thus of the essence, which is why it is important that the entire waste management system falls under the responsibility of a single actor – the TUA.

⁹⁶ The values used in these budget tables are approximative estimations based on current expenses, calculated extrapolations and/or arbitrary estimations. Each value includes significant approximations and margin of errors, which is why they should be handled with caution and not considered as precise figures. However, although each of them could be argued and modified, they can be considered as realistic orders of magnitude.

⁹⁷ This table corresponds to the scenario of an improved situation based on the above recommendations. Salaries of TUA staff are slightly higher than in current situation because current wages are considered too low to sustainably maintain the workforce (according to head of TUA, recruitment of staff is very complicated because wage is too low). Salaries considered in this table thus reflect the necessary salary raise (relevant wage is estimated to 1 million MNT super-gross per month).

CATEGORY OF EXPENSE	TYPE OF EXPENSE	BUDGET LINE	YEARLY COST
Main investments	Infrastructure	WM facility construction (fence, buildings, outside arrangements, etc.)	5 000 000 MNT
		Waste sorting and information center in city-center	1 666 667 MNT
		Landfill construction (landscaping, fence, compartment, etc.)	10 000 000 MNT
	Equipment	Waste collection trucks	24 000 000 MNT
		Landfill bulldozer and excavator	56 000 000 MNT
		Landfill large truck	10 000 000 MNT
		Glass shredder	800 000 MNT
		Plastic presses	1 600 000 MNT
		Other small equipment and tools	5 000 000 MNT
		Household waste sorting bins	47 985 000 MNT
Other bins (public institutions, streets, etc.)	1 530 000 MNT		
Yearly running costs	Maintenance of main investments	Maintenance of infrastructure and equipment	40 900 000 MNT
	Awareness-raising	Awareness-raising and training expenses	10 000 000 MNT
	Reusable bags for waste sorting bins	Reusable bags for waste sorting bins	9 547 500 MNT
	Full-time staff	TUA waste management staff	228 000 000 MNT
	Electricity and heating	Electricity and heating of WM facility and information center	12 000 000 MNT
	Transportation	Gas for waste collection to all waste producers within soum-center	41 086 740 MNT
		Gas for landfill bulldozer	33 534 000 MNT
		Transportation costs of recyclables to urban facilities	42 390 900 MNT
WASTE MANAGEMENT SYSTEM APP. TOTAL YEARLY EXPENSES:			581 040 807 MNT

Table 7 : Estimated waste management yearly expenses in Bulgan soum

Main incomes can be divided into two main categories: public administration budget and trade of recyclables. Summary of expected incomes is presented in Table 8 and detailed in Annex 6.

The main income source for the waste management budget is the **aimag's general budget**, which is provided by the State but also includes all the waste management taxes and fees collected in the soum. This budget dedicated to waste management, which is approximately 228 million MNT in 2022, is provided by Bulgan administration to the TUA to perform its mission.

In addition to this main budget, **two additional budget lines are usually planned by Bulgan administration** for direct (not through the TUA) waste management expenses. The first one is for creating and closing landfill compartments. In our table, we plan 40 million MNT, which corresponds to the average of the past three years (45 million in 2020; 75 million in 2021; zero in 2022).⁹⁸ The second additional budget lines corresponds to waste management investments that are made directly by Bulgan administration. The value considered in our table (80 million MNT) corresponds to the budget planned in 2022 for purchasing two waste collection trucks).⁹⁹

The other main income source corresponds to the possible **trade of valuable recyclables**. The income planned in our table, which adds up to a total of **86 million MNT**, is based on the best purchasing prices found at the time this report was written (mid-2022).¹⁰⁰

⁹⁸ It should be highlighted that, as the expense table includes the purchase of the excavator and large truck that shall enable the TUA to create and close landfill compartment on its own, Bulgan administration should not have to plan such a high budget for landfill-related public tenders anymore. However, we still consider that this usual budget line could and should be maintained and included in the total waste management budget, even if it is spent to cover other waste-related expenses.

⁹⁹ This budget line is different every year and does not always correspond to purchasing collection trucks. But in any case it should be maintained on a yearly basis to a similar order of magnitude so as to keep the total budget relatively steady.

¹⁰⁰ It is important to stress that, contrarily to the previous three budget lines, this total amount currently does not exist in Bulgan aimag as there has been virtually no recyclable waste sorting and trading. These 86 million MNT are thus hypothetical: they correspond to the money that could be raised in the best-case scenario where all valuable recyclable waste produced in Bulgan soum were perfectly collected, sorted and traded. This amount is thus extremely (unrealistically) optimistic.

CATEGORY OF INCOME	SOURCE OF INCOME	COMMENT	YEARLY INCOME
Public administration budget	Yearly budget dedicated to waste management in Bulgan soum	Based on TUA total waste management budget in 2022	228 000 000 MNT
	Average additional budget dedicated to creating landfill compartments	Average budget planned over the past 3 years (2020 to 2022)	40 000 000 MNT
	Additional budget planned for waste management investments	Based on investments planned in 2022 (for 2 collection trucks)	80 000 000 MNT
Trade of recyclables	Soda PET bottles	Quantity (kg) estimated based on baseline study and waste audit results Average glass bottle weight : 500g / Average price : 50 MNT per bottle Average glass jar weight : 300g / Average price : 30 MNT per jar	28 642 500 MNT
	Beer PET bottles		3 437 100 MNT
	LDPE plastic bags and wrapping		22 914 000 MNT
	HDPE and PP containers		5 346 600 MNT
	Aluminum cans		9 165 600 MNT
	Glass bottles		13 366 500 MNT
	Glass jars		3 055 200 MNT
Contribution of large companies who produce our waste		Financial input or logistics contribution to reduce costs	- MNT
WASTE MANAGEMENT SYSTEM APP. TOTAL YEARLY INCOME:			433 927 500 MNT

Table 8 : Estimated waste management yearly incomes in Bulgan soum

Considering this ideal scenario where current public budget is maintained and all valuable recyclables are traded, total incomes add up to approximately **430 million MNT**.

Therefore, despite approximations and margins of error, calculated orders of magnitude show that Bulgan waste management budget would be in deficit of almost **150 million MNT per year**, which means that it cannot be financially sustainable if it is not significantly increased.

A first way to reach financial balance would be to **increase local waste management fees and taxes**. Current household waste management tax in Bulgan soum is only 2,000 MNT per month, which is certainly not enough as our calculations (see Annex 4) show that waste collection alone costs at least 4,000 MNT per household in the current situation (possibly more) and would still cost approximately 3,500 MNT per household (to which we should add all other waste management general expenses such as operating the waste management facility).

If this tax was raised to 5,000 MNT as it is currently considered by Bulgan administration, an additional 137 million MNT per year could be collected¹⁰¹ – which would almost be enough to break even. Increasing collection fees and/or introducing a waste producer's tax for other waste producers would similarly help to increase Bulgan soum's waste management budget up to a sustainability point.

However, even if local fees and taxes are increased, another improvement factor is certainly necessary: as explained above, estimated budget includes hypothetical income from trading recyclables, which shall eventually become reality only if **originating companies are required to take direct financial and/or logistical action** to improve Bulgan's waste management system.¹⁰²

¹⁰¹ This amount corresponds to an increase of 3,000 MNT per month (from 2,000 to 5,000 MNT) paid by all 3,819 households (provided that official statistics are correct).

¹⁰² For additional explanation regarding the necessity to enforce social responsibility of originating companies, refer to Ecosoum's above-mentioned reports – *Zero-Waste and Circular Economy* (2021), *How to balance waste management budget at the soum level* (2022), and *Who produces our waste? Brand audit* (2022).

AWARENESS-RAISING AND ADVOCACY

GUIDELINES FOR RELEVANT AWARENESS-RAISING

Raising awareness of all waste producers is essential if the population is to understand and accept the habit changes that are required from them (starting with at-source sorting). Therefore, it is important to carefully plan a **relevant awareness-raising strategy consistent with the waste management scheme** that is to be implemented. It is also essential to keep in mind that one-shot trainings are not enough: if the new practices are to be effectively and sustainably adopted and carried out, it is crucial to plan **ongoing follow up of all stakeholders**.

It is imperative that **awareness raising messages are shared at the appropriate time**, in line with the actual, real-life situation. Teaching people how to sort waste a specific way is counter-productive if the subsequent waste collection or processing channels are not in place. Such desynchronization can only lead to discouraging people, so it is vital to make sure that **everything that is taught to and required from the waste producers can actually be carried out immediately** after the end of the training / awareness-raising event.

Overall, we recommend to **constitute an awareness-raising kit** that should include all the necessary information on different relevant formats. This kit should be carefully prepared and **avoid unnecessary multiplication of similar material**, to avoid confusion that may arise from an overwhelming amount of information and messages. Each material should have a specific purpose, to spread a specific message, through a specific media.

Awareness should be risen on **three main topics**, which correspond to **three different levels** of the waste issue:

- **At-source sorting (*individual level*)**: waste producers need to understand very precisely how to sort and manage their waste at the source. This type of training must be very practical, with clear step-by-step guidelines. Each waste producer must eventually know without hesitation what to do with each type of waste they produce. The goal is to implant new practices that shall become automatic for everyone.
- **Waste management system (*soum/aimag level*)**: for waste producers to adopt the required practices at individual level, they need to understand the waste management system their actions are contributing to. They need to understand why they are required to perform waste sorting a certain way and not another, why their involvement is essential for the proper functioning of the soum/aimag-level system. Transparently explaining and justifying the choices that have been made in terms of law/regulation and budget/taxes may also be helpful to increase the people's understanding and acceptance.
- **Overall waste crisis (*national/global level*)**: more broadly, it is important that people understand the big picture and the root causes of the waste crisis. Globally, different interests and visions oppose each other when it comes to analyzing the causes and responsibilities of the waste crisis as well as the possible solutions. A lot of misleading information is constantly spread, which may lead some people to question the relevance of the soum/aimag-level waste management scheme and become reluctant to comply at individual level. That is why it is crucial to bring some perspective, clarify facts and

recontextualize local waste issues into the global crisis, so as to bring justification and legitimacy to local decisions while decredibilizing false promises and solutions.¹⁰³

Relevant material to efficiently raise awareness notably include¹⁰⁴, but are not limited to:

- At-source waste sorting practical guidebook and video-tutorials;
- Powerpoint training presentations about the three levels of the waste issue;
- Reports and other extensive informative documents;
- Short informative videos for local TV and social medias;
- Documentaires and films about waste and related topics (dubbed in Mongolian);
- Dedicated website pages;
- Flyers and posters;
- Signs and panels in public areas;
- Relevant goodies and non-monetary incentives such as reusable items.

Relevant events and activities to efficiently raise awareness notably include, but are not limited to:

- Public informative and/or discussion meetings;
- Trainings within each waste producers' group;
- Public screenings of waste-related films and documentaries, followed by open debates;
- Public cleaning and waste pick-up events;
- Waste-related contests and competitions;
- Tours and visits of the waste management facility (or other relevant locations);
- Implementation of proper waste handling with sorting during large-scale public events;
- Social media campaigns and challenges.

Overall, awareness-raising events and activities must be as **interactive** as possible (lectures can be necessary to some extent, but direct interaction and participation of target groups is usually more efficient). Rather than organising events specifically dedicated to waste, it can also be extremely effective to **include waste-related considerations in other events or activities** that people love to attend anyway.¹⁰⁵

GUIDELINES FOR RELEVANT ADVOCACY

As stressed above in the budget section, it is important to keep in mind that, *under the current conditions*, a **soum/aimag-level waste management system cannot be financially**

¹⁰³ For clarification about this *big picture* and the overall waste crisis context, refer to Ecosoum's [Zero Waste and Circular Economy: The Way Forward](#) report (2021).

¹⁰⁴ Many of these documents and material have already been developed by Ecosoum and are available on our website (www.ecosoum.org/en-resources-and-reports). Some can be used directly while others – that are specific to Khishig-Undur soum – may need to be adapted to Bulgan soum's context.

¹⁰⁵ For example, include waste-related contests into Women Summits or sports competitions. Another example can be to explicitly make Naadam a zero-waste event, with direct and active involvement of as many stakeholders as possible.

sustainable.¹⁰⁶ Therefore, besides the efforts that should be made to implement the best possible waste management scheme *under the current conditions*, efforts must be made to change and improve these unfavorable conditions. This necessity to **induce systemic changes thus requires to include active advocacy work** in the framework of all waste management Master Plans.

As demonstrated in Ecosoum’s above-mentioned *Who produces our waste? Brand audit* report, food and beverages companies (and, more broadly, consumer goods producers and distributors) are behind most of the waste that is produced by households, and should thus be at the frontline of the fight to solve the waste crisis. **Advocacy efforts should thus primarily target these companies**, either directly through communication campaigns or indirectly through an appeal to policy makers for strengthening the legal framework.

Regardless of the means that can be mobilized, the goal in terms of waste management should be to **require and obtain more financial and/or logistical support** from these companies. The result of such involvement should be to reduce waste management expenses and/or to increase incomes.¹⁰⁷ Incidentally, in line with the 3R principle, advocacy work should also (first and foremost) call for a **reduction of waste generation**: local waste management actors have a role to play in highlighting which types of packaging waste create the most problematic issues, so that companies can primarily focus on improving their practices regarding these specific items.

COORDINATION AT THE AIMAG-LEVEL

All the above recommendations focus specifically on Bulgan soum, the capital city. Nevertheless, many of them are also **directly applicable or easily transposable to all other soums** of the province. Each soum can thus design their own local waste management Master Plan based on these recommendations. Additionally, detailed step-by-step guidelines for soum-level actors are provided in Ecosoum’s [How to set up waste management at the soum level](#) guidebook.

The main recommendations that can be suggested here relate to **coordination that should be set up at the aimag-level** to increase the efficiency of waste management in each soum of the province. These recommendations essentially are:

- **Learn from each other:** all soums have their own specificities, but many problems and difficulties are similar. Soum-level waste management actors should thus gather and share their issues with each other, so as to find the best possible solutions to overcome them. Most advanced soums should invite representatives of other soums to visit their waste management facilities, so that the latter can better understand how they could improve their own system.
- **Coordinate recyclables transportation:** since most reusable and recyclable waste are to be shipped to relevant stakeholders in Ulaanbaatar, it can be relevant to coordinate transportation to reduce expenses. Several coordination options are possible, from centralizing all waste in aimag-center to simpler coordination between few nearby soums.

¹⁰⁶ This financial unsustainability is also explained in Ecosoum’s *How to balance waste management budget at the soum level* report (2022).

¹⁰⁷ Example of expense reduction: if companies used their supply trucks to take back their packaging waste, it would reduce the transportation costs for waste management actors. Example of income increase: if companies provided direct subsidies to local waste management operators and/or if recyclables’ purchasing prices were increased, it would help balance waste management budgets.

The best solutions have to be assessed by each soum depending on their actual needs and most relevant routes.¹⁰⁸

- **Share investments in equipment and machinery:** Some investments in heavy machinery may be too high for small soums. In such a case, it could be relevant to coordinate with nearby soums to acquire common equipment. This coordination appears particularly relevant when it comes to landfill heavy machinery, as discussed above in the *Landfill* section.
- **Coordinate relevant waste management processes:** Some processes such as local recycling may be more relevant if carried out at a larger scale to mutualise costs and increase financial viability of the process. It could thus be mutually beneficial that, for instance, a given soum recycles plastic coming from nearby soums, while these soums would in return recycle other types of recyclables (paper, glass, bones...).
- **Coordinate awareness-raising and advocacy actions:** Efficient ways to raise awareness may involve joint events, such as inter-soum waste-related competitions. Advocacy actions are also more impactful when carried out at the highest possible level: combining data, coordinating sensational actions, or speaking with one voice when addressing powerful counterparts all appear as relevant ways to achieve positive results.

¹⁰⁸ Coordination of transportation shall become even more important if/when polluting companies start taking actual direct actions to improve waste management in rural areas. It may be complicated for companies to get logistically involved in each and every soum, which is why it may become necessary to coordinate and centralize recyclables in key locations (aimag-center and/or strategic soums).

CONCLUSION

This report aimed to provide practical recommendations and suggestions to improve the current waste situation in Bulgan soum and set up a proper waste management system. These recommendations were presented step-by-step in successive sections following the logical order of the waste stream, from generation and sorting to processing and elimination, so as to embrace the full scope of the issue.

Overall, the recommendations provided in this report are intended to take into account real-life constraints and to realistically build on the current situation (especially in terms of available budget, workforce and equipment) – while being coherent with globally recognized best practices. In other words, this report constitutes the backbone of a suitable waste management scheme that could be immediately transposed by Bulgan administration into its official waste management Master Plan and implemented without delay.

Some recommended measures may appear radical or difficult to implement. In reality, most recommendations would doubtlessly make all waste management stages much easier to carry out for Bulgan soum's waste workers. The main difficulty to successfully implement the recommended scheme actually lies in the perception, understanding and acceptance of the public – especially when necessary new practices represent a significant change compared to long-established bad habits. Proper waste management requires to follow basic but strict rules that unfortunately can't be circumvented, which is why half measures avoiding the core issues can never be sufficient and systematically lead to failing waste management systems.

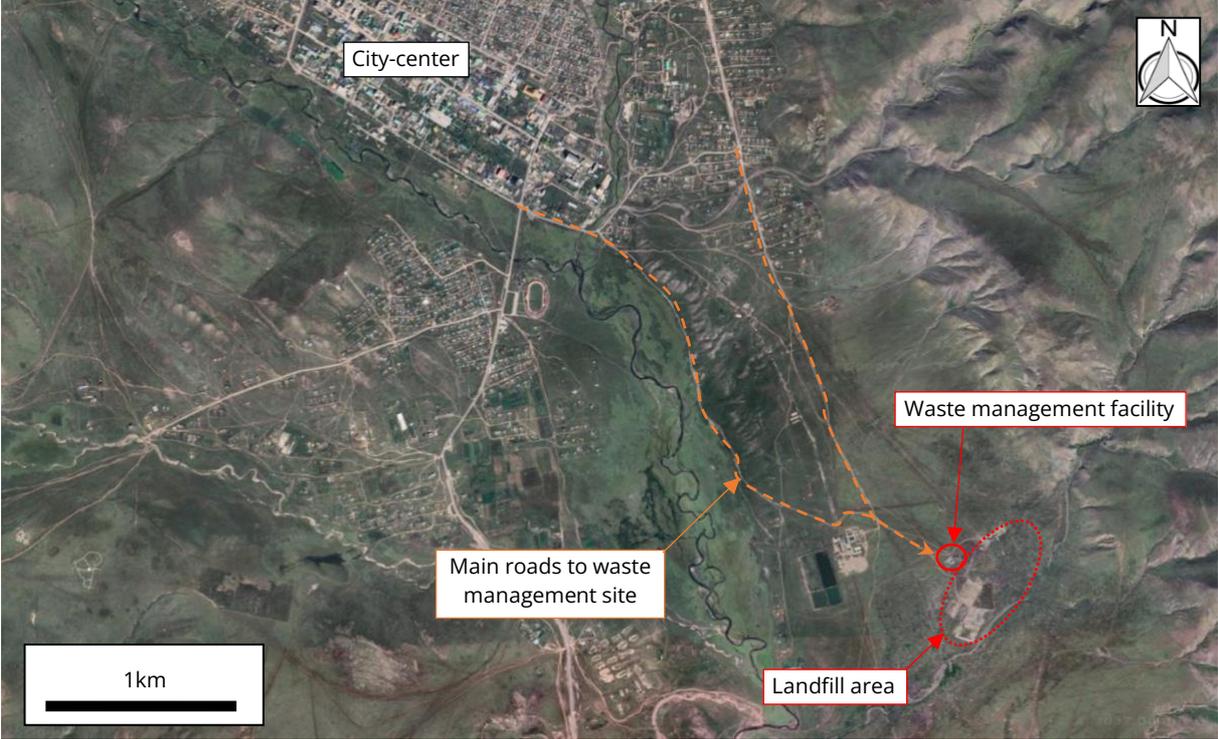
Calculations conducted in this study show that recommended measures, especially in terms of at-source waste sorting and reorganization of waste collection patterns, are definitely implementable and would immediately translate into a tangible improvement of waste management in Bulgan soum. Once again, considering the imprecision and relative unreliability of available data, calculation results should certainly not be considered as unarguable, precise figures, and must absolutely be handled with caution. However, our estimations can definitely be regarded as realistic orders of magnitude that clearly confirm the main trends to follow in order to solve the waste crisis in Bulgan soum.

Different solutions than those suggested above may also be relevant and authorities could choose to implement only part of our recommendations. However, it should be emphasized that this proposal for an adequate and sustainable waste management scheme finds its strength and relevance in its overall consistency: most suggested measures are only implementable and only make sense if they are adopted and enforced *along with the others*, as a holistic package that should be applied unsegmented and simultaneously.

Considering how improperly waste is managed all over the country, Bulgan aimag is given a new chance to maintain and take on its reputation of pioneer: bravely implementing the waste management scheme recommended in this report would undoubtedly place again Bulgan in a leading forerunner position that the rest of Mongolia shall look up to when it comes to solving the current waste crisis.

ANNEXES

ANNEX 1: LOCATION MAPS



Map #1: Location of Bulgan soum’s waste management site (facility and dumpsite)



Map #2: Position of Bulgan soum’s waste management facility and current landfill compartment



Map #3: Current arrangement of Bulgan soum's waste management facility

ANNEX 2: PICTURES

HOUSEHOLD / INDIVIDUAL COMPOST



*Example of simple **home composting pile** (in corner of khashaa)*



*Example of simple **home composting box** (in private khashaa or down apartment building)*

INDUSTRIAL / COLLECTIVE COMPOST



*Examples of **industrial composting piles** (in waste management facility)*

EXAMPLE OF DRY TOILETS IN MONGOLIA



Main structure of dry toilets (similar to usual pit latrine)



Possible arrangements of dry toilets: hole (similar to pit latrine) or seat (similar to apartment toilet)



*Back door to access **collection cart** (positioned below toilets)*



*Dry toilets **composting boxes** (which can also be used for organic waste) located right behind toilets*

WASTE SORTING WORKBENCH



Example of **waste sorting workbench** in waste management facility (in Khishig-Undur)



Example of waste producer disposing waste in **sorting workbench** in waste management facility

HOUSEHOLD WASTE SORTING BINS IN BULGAN SOUM



Example of waste bin in Bulgan soum (from outside a khashaa)



Example of waste bin in Bulgan soum (from inside a khashaa)

NOTICE FOR IMPROPER AT-SOURCE WASTE SORTING



Example of **photo** that TUA waste collection staff shall take when **notifying a contravener**

ANNEX 3: DRAFT/EXAMPLE OF NOTICE FOR IMPROPER SORTING

Date:

Name and/or address of the waste producer:

*This day, the TUA tried to collect your waste as planned in Bulgan soum’s waste management Master Plan. According to (name and date of relevant law/decre), all **waste producers are obligated to sort and bag their waste** following the Master Plan’s directives. However, we found that **your waste waste not properly sorted and/or bagged**, which made it impossible for our staff to collect it efficiently.*

*In line with (name and date of relevant law/decre) procedures, you are hereby notified that **you have one week (7 days) to re-sort and/or bag properly and bring it, by your own means, to Bulgan soum’s waste management facility or waste sorting and information center.** Should you fail to comply within this delay, your case will be forwarded to relevant authorities, who will proceed with fining you as planned in the regulations of (name and date of relevant law/decre).*

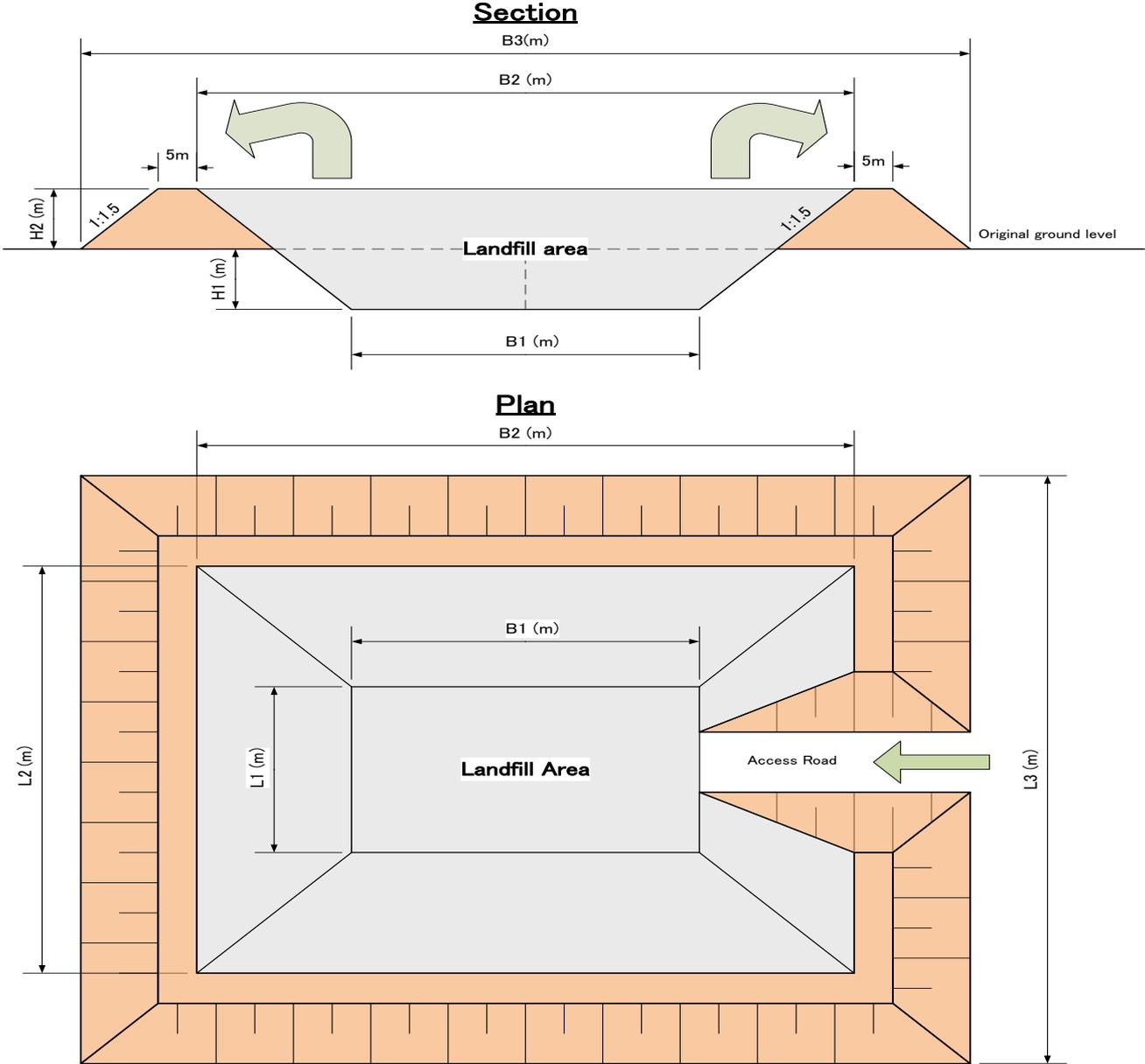
ANNEX 4: DETAILED CALCULATION TABLE FOR WASTE COLLECTION AND TRANSPORTATION

VARIABLES FOR EACH SCENARIO (CURRENT SITUATION AND IMPROVED SITUATIONS)		CURRENT SITUATION (3 months)	IMPROVED SITUATION #1 (2 months)	IMPROVED SITUATION #2 (1 month)
Collection pace objective (i.e. time between 2 collection rounds for households = 1 household waste collection per 'number of days')		66 days	44 days	22 days
Waste producers	Number of households in Bulgan soum	3819 households	3819 households	3819 households
	Number of other waste producers	152 waste producers	152 waste producers	152 waste producers
TUK waste management staff and trucks	Total number of waste management staff within TUK	17 staff	17 staff	17 staff
	Number of staff needed per truck	2,5 staff per truck	2 staff per truck	2 staff per truck
	Number of trucks	6 trucks	6 trucks	6 trucks
Collection pace for households	Number of households collected in one collection round (carrying capacity)	3 households	4,5 households	9 households
	Number of rounds to collect all households	1273 rounds	849 rounds	424 rounds
	Number of household waste collection rounds in one month	424 round per month	424 round per month	424 round per month
	Average time to drive the round-trip between collected households and WM facility	25 minutes	25 minutes	25 minutes
	Average time to pick-up waste from each household's bin	30 minutes	10 minutes	5 minutes
	Average time to unload trucks at WM facility and landfill	20 minutes	20 minutes	20 minutes
	Necessary time for one collection round	2,25 hours per round	1,5 hour per round	1,5 hour per round
	Total time to collect all households once (if only one truck)	2864 hours	1273 hours	637 hours
	Time to collect all households with available trucks	358 days (8-hours-work)	159 days (8-hours-work)	80 days (8-hours-work)
	Waste collection trucks occupation rate	59,7 days (8-hours-work)	26,5 days (8-hours-work)	13,3 days (8-hours-work)
Collection pace for other waste producers	Average number of waste producers collected in one collection round	8 waste producers	8 waste producers	8 waste producers
	Number of rounds to collect all waste producers once	19 rounds	19 rounds	19 rounds
	Average collection frequency for one waste producer	4 round per month	4 round per month	4 round per month
	Total number of rounds to carry out in one month for waste producers at proper pace	76 round per month	76 round per month	76 round per month
	Necessary time for one collection round	2,5 hours per round	1,8 hours per round	1,8 hours per round
	Total time to collect all waste producers each month at adequate pace (if only one truck)	190 hours	137 hours	137 hours
	Time to collect all waste producers each month at adequate pace with available trucks	24 days (8-hours-work)	17 days (8-hours-work)	17 days (8-hours-work)
	Waste collection trucks occupation rate	4,0 days (8-hours-work)	2,9 days (8-hours-work)	2,9 days (8-hours-work)
Collection pace for street bins	Average collection frequency for all street bins	18% of possible maximum	13% of possible maximum	13% of possible maximum
	Necessary time for one collection round	22 round per month	22 round per month	22 round per month
	Total time to collect waste from street bins each month (if only one truck)	2,25 hours per round	2,25 hours per round	2,25 hours per round
	Time to collect all waste producers each month at adequate pace with available trucks	50 hours	50 hours	50 hours
	Waste collection trucks occupation rate	6,2 days (8-hours-work)	6,2 days (8-hours-work)	6,2 days (8-hours-work)
Overall waste collection	Total time spent by TUK staff on waste collection each month	1,0 days (8-hours-work)	1,0 days (8-hours-work)	1,0 days (8-hours-work)
	Total full-time equivalent necessary for waste collection each month	5% of possible maximum	5% of possible maximum	5% of possible maximum
	Ratio of waste collection workload / total TUK waste management workforce	149 days (8-hours-work)	103 days (8-hours-work)	103 days (8-hours-work)
	Total time operated for waste collection each month with available trucks	24,9 days (8-hours-work)	17,1 days (8-hours-work)	17,1 days (8-hours-work)
	Waste management trucks occupation rate	113% of possible maximum	78% of possible maximum	78% of possible maximum
	Total time spent by TUK staff on waste collection each month	373 days (8-hours-work)	206 days (8-hours-work)	206 days (8-hours-work)
Ratio of waste collection workload / total TUK waste management workforce	17,0 staff (full-time-eq.)	9,4 staff (full-time-eq.)	9,4 staff (full-time-eq.)	
Ratio of waste collection workload / total TUK waste management workforce	100% of available workforce	55% of available workforce	55% of available workforce	

ECOSUM – RECOMMENDATIONS FOR WASTE MANAGEMENT SCHEME AND MASTER PLAN IN BULGAN AIMAG – JULY 2022

VARIABLES FOR EACH SCENARIO (CURRENT SITUATION AND IMPROVED SITUATIONS)		CURRENT SITUATION (3 months)		IMPROVED SITUATION #1 (2 months)		IMPROVED SITUATION #2 (1 month)	
Collection pace objective (i.e. time between 2 collection rounds for households = 1 household waste collection per 'number of days')		66 days		44 days		22 days	
HR costs	Daily (super-gross) salary of staff	30 000 MNT	MNT per day	45 455 MNT	MNT per day	45 455 MNT	MNT per day
	Total HR cost for household waste collection each month	8 950 781 MNT	MNT per month	7 232 955 MNT	MNT per month	7 232 955 MNT	MNT per month
	Total HR cost for other waste producers collection each month	1 781 250 MNT	MNT per month	1 554 545 MNT	MNT per month	1 554 545 MNT	MNT per month
	Total HR cost for street bins collection each month	464 063 MNT	MNT per month	562 500 MNT	MNT per month	562 500 MNT	MNT per month
	Total HR cost for waste collection each month	11 196 094 MNT	MNT per month	9 350 000 MNT	MNT per month	9 350 000 MNT	MNT per month
	Total HR cost per household waste collection round	21 094 MNT	MNT per round	17 045 MNT	MNT per round	17 045 MNT	MNT per round
	Total HR cost per other waste producers collection round	23 438 MNT	MNT per round	20 455 MNT	MNT per round	20 455 MNT	MNT per round
	Total HR cost per street bin collection round	21 094 MNT	MNT per round	25 568 MNT	MNT per round	25 568 MNT	MNT per round
	Share of household waste collection monthly HR cost per household	2 344 MNT	MNT per month	1 894 MNT	MNT per month	1 894 MNT	MNT per month
Share of other waste producers waste collection monthly HR cost per waste producer	11 719 MNT	MNT per month	10 227 MNT	MNT per month	10 227 MNT	MNT per month	
Diesel costs	Truck diesel consumption	19 L/100km		19 L/100km		19 L/100km	
	Price of diesel	3450 MNT/L		3450 MNT/L		3450 MNT/L	
	Average distance for 1 round	10 km round trip		10 km round trip		10 km round trip	
	Diesel cost for 1 average round	6 555 MNT	MNT per round	6 555 MNT	MNT per round	6 555 MNT	MNT per round
	Total diesel cost for household waste collection each month	2 781 505 MNT	MNT per month	2 781 505 MNT	MNT per collection cyc	2 781 505 MNT	MNT per collection cyc
	Total diesel cost for other waste producers waste collection each month	498 180 MNT	MNT per month	498 180 MNT	MNT per month	498 180 MNT	MNT per month
	Total diesel cost for street bins waste collection each month	144 210 MNT	MNT per month	144 210 MNT	MNT per month	144 210 MNT	MNT per month
	Total diesel cost for waste collection each month	3 423 895 MNT	MNT per month	3 423 895 MNT	MNT per month	3 423 895 MNT	MNT per month
	Share of diesel cost per household each month	728 MNT	MNT per month	728 MNT	MNT per month	728 MNT	MNT per month
Share of diesel cost per other waste producer each month	3 278 MNT	MNT per month	3 278 MNT	MNT per month	3 278 MNT	MNT per month	
Truck and other equipment costs	Trucks amortization (40,000,000 MNT per truck over 10 years)	2 000 000 MNT	MNT per month	2 000 000 MNT	MNT per month	2 000 000 MNT	MNT per month
	Trucks maintenance (4,000,000 MNT per truck per year)	2 000 000 MNT	MNT per month	2 000 000 MNT	MNT per month	2 000 000 MNT	MNT per month
	Tools and equipment for truck maintenance and waste collection (750 MNT per round on average)	318 250 MNT	MNT per month	318 250 MNT	MNT per month	318 250 MNT	MNT per month
	Total truck and other equipment costs for household collection each month	3 508 061 MNT	MNT per month	3 508 061 MNT	MNT per month	3 508 061 MNT	MNT per month
	Total truck and other equipment costs for other waste producer collection each month	628 310 MNT	MNT per month	628 310 MNT	MNT per month	628 310 MNT	MNT per month
	Total truck and other equipment costs for street bin collection each month	181 879 MNT	MNT per month	181 879 MNT	MNT per month	181 879 MNT	MNT per month
	Share of truck and other equipment costs per household each month	919 MNT	MNT per month	919 MNT	MNT per month	919 MNT	MNT per month
Share of truck and other equipment costs per other waste producer each month	4 134 MNT	MNT per month	4 134 MNT	MNT per month	4 134 MNT	MNT per month	
Total collection cost per month	Total average cost for one month of waste collection	18 938 239 MNT	MNT per month	17 092 145 MNT	MNT per month	17 092 145 MNT	MNT per month
	Total average cost for one round	36 257 MNT	MNT per round	32 723 MNT	MNT per round	32 723 MNT	MNT per round
	Total household waste collection costs for one month	15 240 348 MNT	MNT per month	13 522 521 MNT	MNT per month	13 522 521 MNT	MNT per month
		80% of total collection costs		79% of total collection costs		79% of total collection costs	
	Total other waste producers waste collection costs for one month	2 907 740 MNT	MNT per month	2 681 035 MNT	MNT per month	2 681 035 MNT	MNT per month
		15% of total collection costs		16% of total collection costs		16% of total collection costs	
	Total street bins waste collection costs for one month	790 152 MNT	MNT per month	888 589 MNT	MNT per month	888 589 MNT	MNT per month
		4% of total collection costs		5% of total collection costs		5% of total collection costs	
Share of total monthly household waste collection costs <i>per household</i>	3 991 MNT	MNT per month	3 541 MNT	MNT per month	3 541 MNT	MNT per month	
Share of total monthly other waste producers waste collection costs <i>per waste producer</i>	19 130 MNT	MNT per month	17 638 MNT	MNT per month	17 638 MNT	MNT per month	

ANNEX 5: LANDFILL COMPARTMENT DRAWING AND DIMENSIONS



Approximative dimentions:

- | | | |
|----------|------------|------------|
| - H1: 2m | - B1: 95m | - L1: 95m |
| - H2: 2m | - B2: 100m | - L2: 100m |
| | - B3: 110m | - L3: 110m |

ANNEX 6: BUDGET TABLES

ҮНДСЭН ЗАРДЛУУД / MAIN EXPENSES							
ЗАРДЛЫН ТӨРЛҮҮД / CATEGORY OF EXPENSE	ЗАРДЛЫН ТӨРӨЛ / TYPE OF EXPENSE	ТӨСВИЙН ЗАДАРГАА / BUDGET LINE	НЭГЖИЙН ҮНЭ / UNIT COST	QUANTITY / ХЭМЖЭЭ	АШИГЛАЛТЫН ХУГАЦАА (НИЛЭЭР) / AMORTIZATION PERIOD (YEARS)	ЖИЛИЙН ЗАРДАЛ / YEARLY COST	
Үндсэн хөрөнгө оруулалт / Main investments	Дэд бүтэц / Infrastructure	Хог хаягдал зохицуулах байгууламж (хашаа, барилга г.м.) / WM facility construction (fence, buildings, outside arrangements, etc.)	150 000 000 MNT	1	30	5 000 000 MNT	
		Булган сум дахь хог хаягдал ангилан ялгах, мэдээллийн төв / Waste sorting and information center in city-center	50 000 000 MNT	1	30	1 666 667 MNT	
		Хогийн цэгийн тохижуулалт (газар шорооны ажил, хашаа г.м.) / Landfill construction (landscaping, fence, compartment, etc.)	10 000 000 MNT	1	1	10 000 000 MNT	
	Тоног төхөөрөмж / Equipment	Хогны машин / WM trucks	40 000 000 MNT	6	10	24 000 000 MNT	
		Бульдозер / Landfill bulldozer and excavator	280 000 000 MNT	2	10	56 000 000 MNT	
		Хогийн цэгийн том оврын ачааны машин / Landfill large truck	100 000 000 MNT	1	10	10 000 000 MNT	
		Шил бутлагч / Glass shredder	8 000 000 MNT	1	10	800 000 MNT	
		Хуванцар пресслэгч / Plastic press	8 000 000 MNT	2	10	1 600 000 MNT	
		Бусад жижиг тоног төхөөрөмж, багаж / Other small equipment and tools	5 000 000 MNT	1	1	5 000 000 MNT	
		Өрхийн хог ангилал сав / Household waste sorting bins	300 000 MNT	3199	20	47 985 000 MNT	
Бусад хогийн сав (төрийн байгууллага, гудамж г.м.) / Other bins (public institutions, streets, etc.)	300 000 MNT	102	20	1 530 000 MNT			
Жилийн урсгал зардал / Yearly running costs	Үндсэн хөрөнгө оруулалтын засвар үйлчилгээ / Maintenance of main investments	Хог хаягдал зохицуулах байгууламжийн засвар үйлчилгээ / Maintenance of WM facility	2 000 000 MNT	1	/	2 000 000 MNT	
		Хог хаягдал ангилан ялгах, мэдээлэл өгөх төвийн засвар үйлчилгээ / Maintenance of waste sorting and information center	1 000 000 MNT	1	/	1 000 000 MNT	
		Хогийн цэгийн засвар үйлчилгээ / Maintenance of landfill	1 000 000 MNT	1	/	1 000 000 MNT	
		Хогны машины засвар үйлчилгээ / Maintenance of WM trucks	4 000 000 MNT	6	/	24 000 000 MNT	
		Хогийн цэгийн тээврийн хэрэгслийн засвар үйлчилгээ / Maintenance of landfill machines	4 000 000 MNT	3	/	12 000 000 MNT	
		Бутлагч болон пресслэгч машины засвар үйлчилгээ / Maintenance of shredder and press	300 000 MNT	3	/	900 000 MNT	
	Хэвлэл нийтлэл, зар сурталчилгааны зардал / Awareness-raising	Хэвлэл нийтлэл, зар сурталчилгааны зардал / Awareness-raising and training expenses	10 000 000 MNT	1	/	10 000 000 MNT	
		Дахин ашиглагдах хогийн үүт / Reusable bags for waste sorting bins	500 MNT	19095	/	9 547 500 MNT	
		Бүтэцтэй ажилтан / Full-time staff	Төхивжилт үйлчилгээний зөвхөн хог хаягдал менежментийг хэрэгжүүлэхтэй холбоотой ажилчдын цалин / Tuu waste management staff	12 000 000 MNT	19	/	228 000 000 MNT
		Цахилгаан, халаалт / Electricity and heating	Хог хаягдал зохицуулах байгууламж болон мэдээллийн төвийн цахилгаан, халаалт зэрэг ашиглалтын зардал / Electricity and heating of WM facility and information center	500 000 MNT	24	/	12 000 000 MNT
Тээвэр / Transportation	Сум доторх хог хаягдал цуглуулах тулш шатахууны зардал / Gas for waste collection to all waste producers within soum-center	3 423 895 MNT	12	/	41 086 740 MNT		
	Бульдозерийн тулш / Gas for landfill bulldozer	621 000 MNT	54	/	33 534 000 MNT		
	Төв суурингийн үйлдвэрүүд рүү дахивар тээвэрлэх зардал (тонноор) / Transportation costs of recyclables to urban facilities (per ton)	148 000 MNT	286	/	42 390 900 MNT		
ХОГ ХАЯГДАЛ ЗОХИЦУУЛАХ ТОГТОЛЦООНЫ ЖИЛИЙН ЗАРДАЛ ДУНДЖААР / WASTE MANAGEMENT SYSTEM APP. TOTAL YEARLY COST:						581 040 807 MNT	

ҮНДСЭН ОРЛОГО / MAIN INCOMES						
ОРЛОГЫН ТӨРӨЛ / CATEGORY OF INCOME	ОРЛОГЫН ЭХ ҮҮСВЭР / SOURCE OF INCOME	ТАЙЛБАР / COMMENT	НЭГЖИЙН ҮНЭ / UNIT AMOUNT	ХЭМЖЭЭ / QUANTITY	/	ЖИЛИЙН ОРЛОГО / YEARLY INCOME
Улс, аймгийн төсөв / Public administration budget		Булган суманд ТҮА-ийн хог хаягдал менежментэд зориулсан жилийн төсөв / Yearly budget dedicated to waste management in Bulgan soum	228 000 000 MNT	1	/	228 000 000 MNT
		Булган сумын хогийн цэгийг булшиж устгахад зориулсан жилийн дундаж төсөв / Average yearly budget dedicated to waste management in Bulgan soum-landfill	60 000 000 MNT	0,67	/	40 000 000 MNT
		Булган суманд хог хаягдал зохицуулалттай холбоотой машин, тоног төхөөрөмж худалдан авахад зориулсан нэмэлт төсөв / Additional budget dedicated to waste management in Bulgan soum for trucks and machinery	80 000 000 MNT	1	/	80 000 000 MNT
Дахиварын худалдаа / Trade of recyclables	Ус, ундааны сав / Soda PET bottles	Хэмжээ (кг) суурь судалгаа болон хогны аудитын үр дүнд суурилсан тооцоо : Шилэн локхны дундаж жин 500гр / Дундаж үнэ : нэг шил 50 төг Шилэн савны дундаж жин : 300гр / Дундаж үнэ : нэг сав 30 төг Quantity (kg) estimated based on baseline study and waste audit results Average glass bottle weight : 500g / Average price : 50 MNT per bottle Average glass jar weight : 300g / Average price : 30 MNT per jar	500 MNT	57 285	/	28 642 500 MNT
	Пивоны сав / Beer PET bottles		300 MNT	11 457	/	3 437 100 MNT
	Хуванцар уут, баглаа / LDPE plastic bags and wrapping		600 MNT	38 190	/	22 914 000 MNT
	HDPE болон PP сав / HDPE and PP containers		700 MNT	7 638	/	5 346 600 MNT
	Хөнгөн цагаан лааз / Aluminum cans		1 200 MNT	7 638	/	9 165 600 MNT
	Шилэн локх / Glass bottles		100 MNT	133 665	/	13 366 500 MNT
Шилэн сав / Glass jars	100 MNT	30 552	/	3 055 200 MNT		
Хог хаягдал үүсгэгч том компаниудын оруулах хувь нэмэр / Contribution of large companies who produce our waste		Мөнгөн хэлбэрээр эсвэл логистикийн шийдлээр зардал бууруулахад хувь нэмэр оруулах / Financial input or logistics contribution to reduce costs	- MNT	0	/	- MNT
ХОГ ХАЯГДАЛ ЗОХИЦУУЛАХ ТОГТОЛЦООНЫ ЖИЛИЙН ОРЛОГО ДУНДЖААР / WASTE MANAGEMENT SYSTEM APP. TOTAL YEARLY INCOME:						433 927 500 MNT