Annex 9

Draft Guideline for Environmental Auditing of Solid Waste Landfill, Palestine

Prepared by

Dr. Yasumasa Tojo, JICA Expert (Hokkaido University)

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Abbreviation

ACGIH	:	American Conference of Governmental Industrial Hygienists
BD	:	Board of Directors
BOD	:	Biochemical Oxygen Demand
CCL	:	Compacted Clay Liner
CFC	:	Chlorofluorocarbon
COD	:	Chemical Oxygen Demand
DO	:	Dissolved Oxygen
EC	:	Electrical Conductivity
EPA	:	Environmental Protection Agency
EQA	:	Environmental Quality Authority
GCL	:	Geo-synthetic Clay Liner
GM	:	Geo-membrane
JSC	:	Joint Service Council
LCRS	:	Leachate Collection and Removal System
LGUs	:	Local Governmental Units
LTF	:	Leachate Treatment Facility
MBAS	:	Methylene Blue Active Substances assay
MLSS	:	Mixed Liquor Suspended Solids
MoLG	:	Ministry of Local Government
MSW	:	Municipal Solid Waste
ORP	:	Oxidation-Reduction Potential
SAR	:	Sodium Adsorption Ratio
SS	:	Suspended Solids
SVI	:	Sludge Volume Index
TDS	:	Total Dissolved Solids
TKN	:	Total Kjeldahl Nitrogen
TLV	:	Threshold Limited Values
TOC	:	Total Organic Carbon
TSS	:	Total suspended solids
U.S.EPA	:	United states Environmental Protection Agency
VFA	:	Volatile Fatty Acid

Executive Summary

This guideline on the environmental auditing of solid waste landfill was technically developed basing on the literature review and the world experience in the field. Performance requirement on the operation and maintenance of the sanitary landfill significantly depends upon the surrounding environment of the site, such as topography, climate, distance from residential area, groundwater depth, nearby surface water system, industry of the surroundings, etc. Guidelines referred in the creation procedure of this guideline were published in several countries which are mainly located under wet climate condition. Thus, there are many aspects that cannot be directly introduced in Palestine, since it is located arid/semi-arid climate.

Thus, this guideline is created by aiming at making proper evaluation/assessment of the landfill management in especially Palestine possible and also it is created by considering that the auditing procedure is feasible in Palestine, as prerequisite.

Therefore, the structure of the guideline is as follows;

Chapter 1: Fundamental requirement of landfill

Basic infrastructure and fundamental facility necessary for landfill are described. Evaluation is done for their existence and effectiveness of their performance.

Chapter 2: Management of landfill operation

Appropriate operation modes regarding waste acceptance and the waste filling procedure are described. Auditing can be done based on the appropriateness of these processes.

Chapter 3: Leachate management

In order to confirm appropriateness of the leachate management, necessities of the prediction and the measurement of leachate quantity and control of the leachate head are described. Besides, the effluent standards in Palestine is shown for assessing the correctness of effluent management.

Chapter 4: Landfill gas management

Necessary measures for the landfill gas management are described in terms of pressure, toxicity, ad explosion.

Chapter 5: Routine inspection and maintenance

Necessary inspection and maintenance for facilities and equipment's are described. Items for inspection are listed with regard to each equipment/facility.

Chapter 6: Safety

Necessary measures to protect workers in landfill and required system for emergency response are described.

Chapter 7: Littering and Vector

In order to prevent the littering of waste and the nuisance caused by bird/insect/animals, necessary measures which should be taken are described.

Chapter 8: Environmental monitoring

To assess the impact on environment is regarded to be significant for landfill auditing. Required environmental monitoring are described in terms of gas migration, leachate leakage, impact on surface water and air quality, and odor.

In each chapter, check list is provided to make the auditing more concrete.
Besides, in this quideline, Zahret Alfinjan sanitary landfill in Palestine was taken as case study, in order to adapt the international guidelines to the Palestinian context.

Preface

MSW sanitary landfill is the facility that protects environment from various adverse impacts derived by the waste. Thus, there is the requirement on its structure and operation that has to be fulfilled.

At present, there are three landfills in Palestine, which were designed by different donors, then constructed and put into operation by Palestinian party up to now. Each of these landfills was designed according to the international standards and state-of-the-art equipments were introduced. Besides, operation is conducted based on the detailed manual prepared for each landfill to be properly managed. However, at present, there are no concrete standards which can be commonly applied for landfill in Palestine and each landfill is operated by specific concept of its own. So, it is difficult to evaluate each landfill on its operation suitability and appropriateness on environmental protection effort, this becomes the problem not only for the competent authority but also for the person who is involved in landfill management. Thus, purpose of this document is to provide detailed information regarding the standard landfill structure and management in order to realize consistent evaluation of these landfills. It is expected that reasonable evaluation on the operation and environmental protection become possible based on this document.

In this guideline, various design and operational standards/critear are described. However, currently, the landfills in operation, use their own standards/criteria for design and operation. Some of them are much stricter or much more in detail. Hence, the standards/criteria applied in this guideline are regarded as the minimum requirements and all developed operational manual shall meet the minimum values presented by this guideline.

Beside, in order to setup the standards/criteria, various guideline/ordinance/standards, etc in various countries are implemented in the guideline. However, if there is concrete standards in Palestine, there are introduced as much as possible.

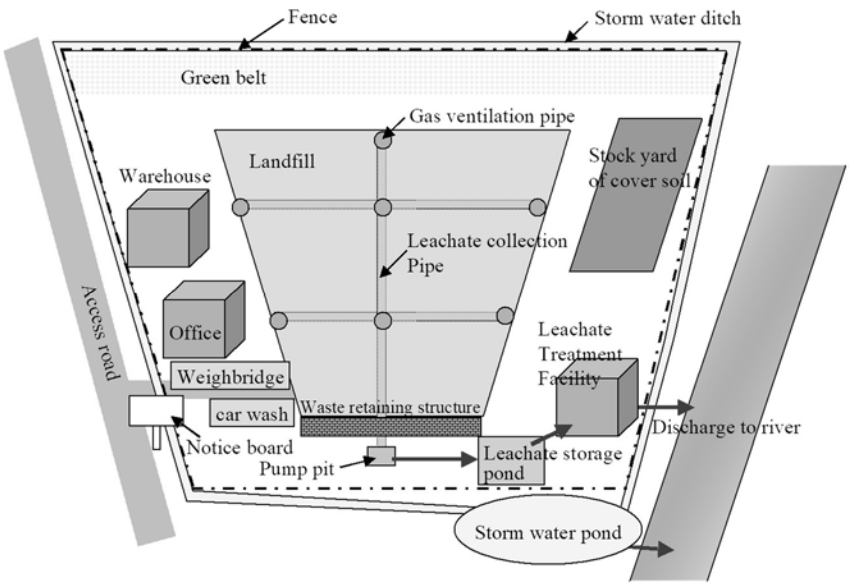
1. Fundamental requirement of landfill

1.1. Introduction

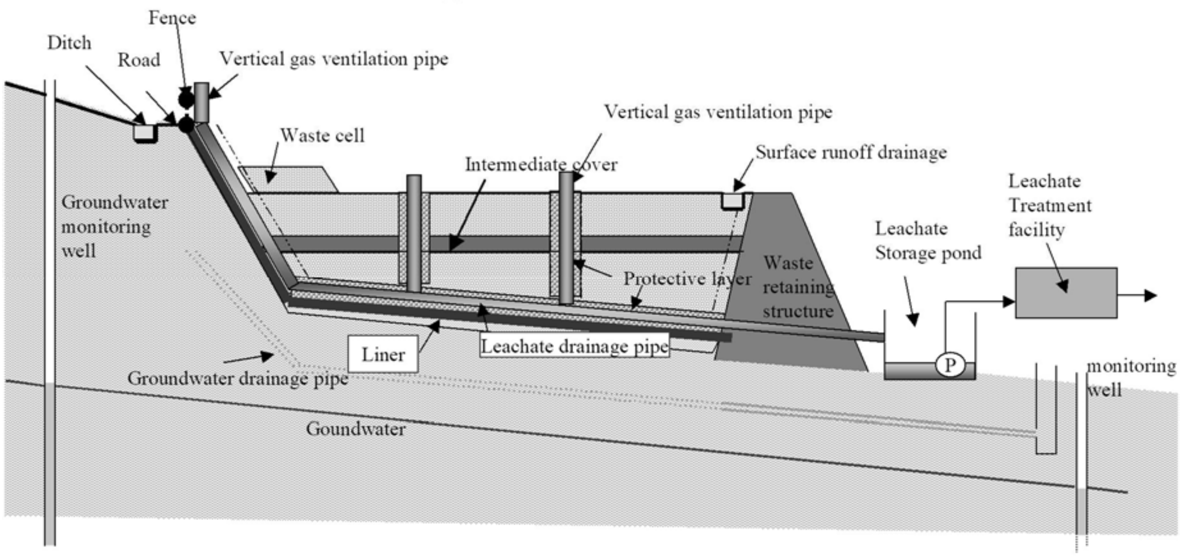
As the first step of audit, it is necessary to confirm whether the target landfill is designed and constructed properly or not. In this section, basic design requirement and necessary infrastructure for landfill are outlined.

1.2. Basic infrastructure

Figure 1.1 shows basic infrastructure of the sanitary landfill. These facilities must be properly designed and constructed.



(a) Plan view of the landfill



(b) Cross section of the site
Figure 1.1 Plan view and cross section of the sanitary landfill and its basic infrastructure

1.2.1. Fence

The fence must be constructed to partition the site's premise and outside. This fence helps intensifying site's security by preventing unauthorized access from outside and also it helps mitigating the scattering of waste from the landfill. Enough care must be paid to unauthorized access from outside because it gives rise to illegal dumping of waste. It can also prevent invasion of animals. The fence must have height of at least 2m and must be unclimbable structure. It should have steel mesh with concrete base. Besides, it must enclose the site's territory, continuously and completely, except for site's entrance.

1.2.2. Site notice board

At the entrance of the site, a notice board must be set up to notify about landfill. The necessary information on the board are as follows; the site name; the name, address and telephone number of the site; operating hours; types of waste accepted, types of waste not accepted; and the contact and emergency telephone numbers.

1.2.3. Site access road

The site access road must have enough width that the carrying vehicle can intersect. Moreover, it is necessary to be paved to prevent the noise and dust. Unpaved roads should be avoided. In case of dry condition, water spray by the watering truck to prevent dust is likely to be necessary. The sign might be installed on the access road so that those who deliver the waste may distinguish the route easily.

1.2.4. Weighing system

The amount of the waste carried in the landfill site must be accurately measured, and be recorded with high precision. This data is useful for not only the management of the landfill but also statistics of the amount of waste in the region. To achieve this purpose, the weighbridge is necessary. The weight of the waste can be determined by the difference of the weight of truck before and after waste unloading. In general, the weighbridge is installed at the entrance of the landfill. And several staffs are arranged at the acceptance control house located at the side of weighbridge in order to confirm those who carry and the carrying vehicle, usually. Weight data is measured automatically and is recorded also automatically.

1.2.5. Road inside the landfill

This is the road temporarily set up in landfill for the vehicle carrying waste that heads for the dumping yard. Though this road is likely to be regarded lightly, it is quite important for appropriate operation. If this road isn't constructed properly, the transport vehicles are forced to run over the weak ground comprised of soil and waste. Sometimes, the vehicle is hampered to reach to the working face by this condition. And it results in the sprawling dumping. This leads to the creation of the widespread dumping area and inefficient operation. The road need not be paved. However, it must possess enough load bearing strength on which the vehicle can pass by using gravel. The road must not become muddy even in rainy day. Sometimes, steel plate, which is often used in construction site, is placed to create the road instead.

To set up signs indicating the route for the dumping yard along with the road is also recommendable.

1.2.6. Wheel washing facility

Waste and mud adhere to the transportation vehicle which ran about the landfill. Then, it causes the scattering of waste and the drop off of mud outside the landfill after the vehicle leaves the site. Therefore, it is necessary to wash mud and the waste of the vehicle before it leaves the site. For this purpose, the pool where water was put must be provided. Waste and mud can be removed by letting the vehicle pass there. At the bottom of the pool, the ragged iron plates or circular tubes are placed to promote removal of mud and waste.

1.2.7. Office

An office is constructed for resting of working staffs, management data on the waste quantity, storage of various data and documents/reports, rooms for analysis and measurement, etc. Safety gears for workers are also stored in this building. In the building, water and electricity supply, restroom, communication equipment, shower for workers should be provided.

1.2.8. Warehouse

The warehouse is set up in keeping heavy equipment and other equipment for landfill operation, keeping the spare parts, and keeping the chemicals etc.

1.2.9. Stockyard for cover soil

The soil cover material is an extremely important material for the sanitary landfill. It is necessary to secure not only an amount necessary for the daily cover but also sufficient amount of the cover soil for several days. Moreover, when a landfill fire occurs, extinction by using the cover soil is most effective measure in general. So, it is necessary to secure plenty of the cover soil to allow for this purpose.

1.2.10. Inspection yard and quarantine place

The transportation vehicles should be regularly inspected by a surprise inspection on the load. For this inspection, flat smooth place should be prepared. At there, the waste is unloaded and the contents of load are inspected thoroughly. The base of inspection yard should be sealed by the iron plate or geomembrane sheet. This yard is also used to conduct regular waste composition analysis.

The rejection and returning of waste is a principle measure when the waste doesn't comply with acceptance criteria. However, this measure results in the illegal dumping to the surrounding environment when there is no receptor of the waste. Therefore, occasionally, to keep such waste in this quarantine zone is necessary for the period until appropriate measure is instructed.

1.3. Fundamental facility required for MSW landfill

1.3.1. Leakage prevention system

The leakage prevention system is constructed to protect groundwater around the landfill from polluting by leachate. It works robustly not only during operation phase but also after closure. In general, it is difficult to achieve this function by leakage prevention system alone. Though leakage prevention system is constructed to minimize leachate leakage, multiple-safety concept (i.e. to reduce leachate head at the bottom, to minimize leachate formation, etc.) is necessary to further prevention of leakage.

There are two types of leakage prevention system, i.e. surface liner and vertical impervious wall. Decision on which type should be utilized is made according to the base ground condition. If there is bedrock with extremely low permeability, vertical impervious walls can be applicable. On the contrary, surface liner can be applicable for almost anywhere. However, whether the surface liner is appropriate or not should be carefully examined, considering the environmental conditions of the site and/or geographical features.

The surface liner system creates the containment structure for waste and leachate, where Geomembrane (GM) and/or clay liners (including GCL) cover all the surfaces of landfill bottom and slopes.

Specification of the liner differs country by country.

The followings are the references [1].

Figure 1.2 Necessary characteristics for the base ground when using vertical impervious wall (Japan)

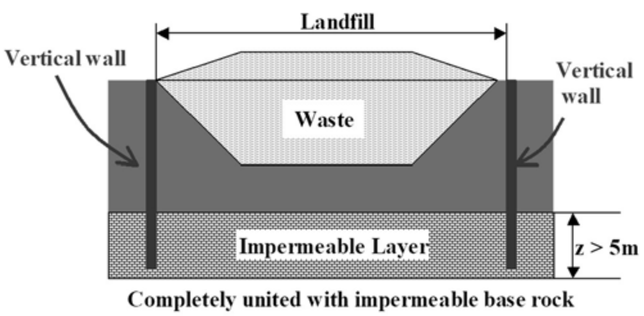
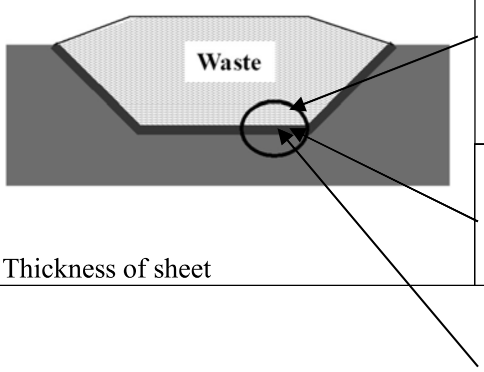
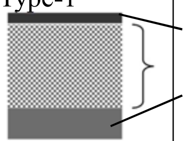
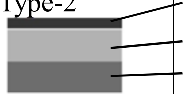
	Requirements for impermeable layer Hydraulic conductivity Ks ≤ 10^{-5}cm/s In case of bedrock, Lugeon's value; Lu ≤ 1 Impermeable layer should extend to entire area and be not discontinuous.

Figure 1.3 Requirement for surface liner (Japan)

	Type-1 	Geomembrane Clay layer (thickness > 50cm, Ks < 10^{-6} cm/s) Base ground
Thickness of sheet	Type-2 	Geomembrane Asphalt layer (thickness> 5cm, Ks < 10^{-7}cm/s) Base ground

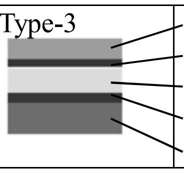
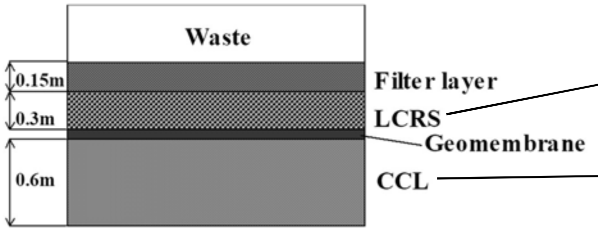
For asphalt sheet: more than 3mm Other sheet: more than 1.5mm	Type-3 	light shielding sheet Geomembrane Filling material Geomembrane Base ground

Figure 1.4 Requirement of base liner for MSW landfill (USA)

	LCRS: leachate collection and removal system; Ks>0.01cm/s CCL: Compacted clay liner; Ks < 10^{-7}cm/s

Besides, the lining system adapted in the landfill already existing in Palestine, which was approved by the regulatory authority, is also allowable. Figure 1.5 indicates the lining system installed in the Al Minya landfill.

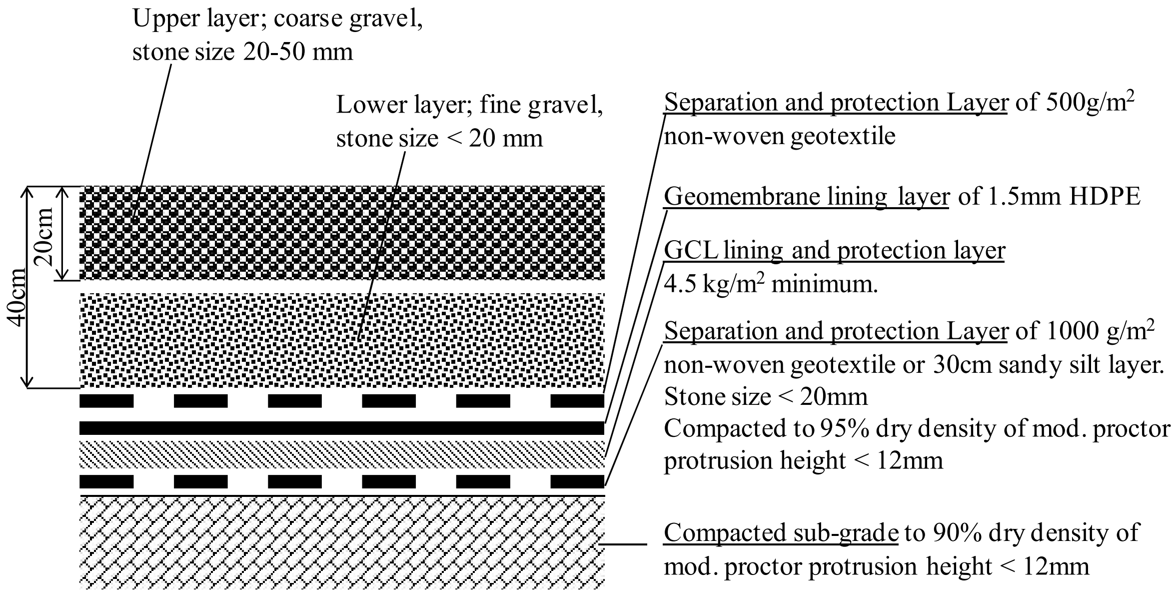


Figure 1.5 The lining system installed in the Al Minya landfill

1.3.2. Waste retaining structure

Waste retaining structure is a kind of a dam that can store wastes for a long time. There are various configurations depending on the topographical condition of landfill sites. The function of it is to keep the waste in the landfill semi-permanently. It also must prevent overflow of landfilled wastes and collapse of landfilled waste. Besides, it works to prevent discharge and seepage of leachate from the waste layer.

There are several types on waste retaining structure, such as; concrete dam, earth fill dam (bund, dike, earth embankment), retaining wall, etc.

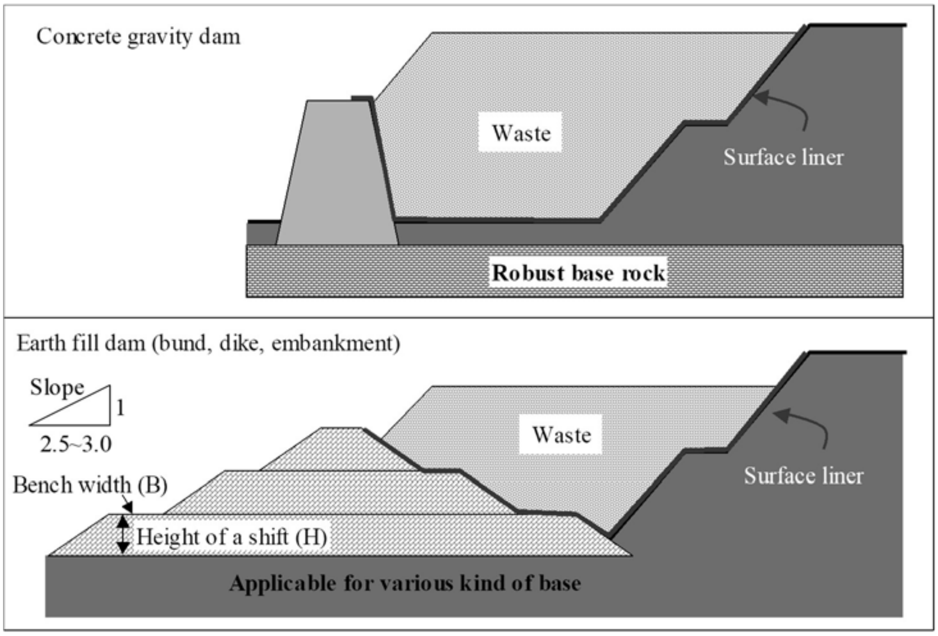


Figure 1.6 Major types of the waste retaining structure

Major types are concrete dams and earth fill dams (figure 1.6). Concrete gravity dams are typical in the former. This type of dams normally requires robust foundation such as bedrock. But it allows higher storage capacity for waste. Homogeneous earth fill dams are typical in the latter. This dam can be adoptable to wider range of foundation, though it offers less capacity than a concrete dam. To prevent seepage of the leachate, slope of landfill-side of the dam must be lined.

The pressure on the structure consists of mainly waste weight and hydrostatic pressure and the structure must be rigid and stable enough for the pressure. In addition, seismic effect is also considered in areas of major earthquakes.

Stability of the waste retaining structure is evaluated by the sliding of the dam base at the boundary of foundation for concrete gravity dam and slope stability for earth fill dam (dike and earth embankment). In both cases, dead loads, static waste pressures, hydrostatic pressure, uplift force, and seismic effect are taken into account as the loads for the stability analysis. In case of the earth fill dam (dike and earth embankment), slope stability is analyzed by the method of slices for circular arc analysis of slopes and minimum requirement of the factor of safety (FS) is defined to above 1.2. Based on the analysis, height of a shift (H) and width of the bench (B) should be carefully determined.

Moreover, although gradient of the slope is basically determined so as not to cause slope failure by stability analysis and construction material, standard gradient range is from 1:2.5 to 1:3.0 (vertical height versus horizontal length).

1.3.3. Leachate collection and removal system (LCRS)

The LCRS collects and drains leachate from the landfill area, promptly. It consists of pipe network and/or sand/stone layers. If semi-aerobic structure is adopted, the pipes also function to let air flow in the landfill body and to expand aerobic zone in landfill layer. Stone/sand drainage layer on surface liner is also important for leachate collection and drainage. Figure 1.7 shows basic structure of LCRS. In general, it is comprised from main drainage pipe, branch drainage pipe, slope pipe and vertical drainage pipe.

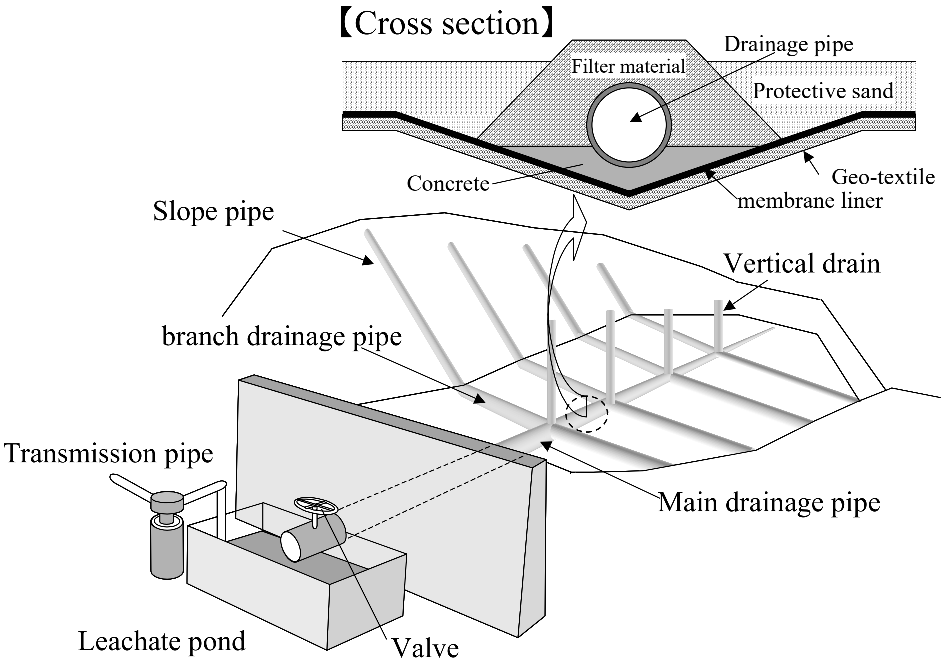


Figure 1.7 Basic structure of Leachate Collection and Removal System

Table 1.1 shows types of pipes used for leachate collection and removal system. Usually perforated, centrifugal reinforced concrete pipes (150 to 3000mm diameter) and perforated synthetic resin pipes (500 to 1500mm diameter for fiber reinforced plastic pipes, and 100 to 400mm for HDPE pipes) are used.

Table 1.1 Types of pipes used for leachate collection and removal system [1]

Types	Diameter (mm)	Bottom Main	Bottom Branch	Slope pipe	vertical pipe	Feature
Perforated reinforced concrete pipe	150~3000	√			√	Very rigid. Use when prevention of deformation is requested
Strengthened plastic pipe	500~1500	√			√	High strength, Durable for corrosion. Use for deep landfilll
Hard HDPE pipe	100~400		√	√		Flexible, Durable for corrosion, Suitable for small diameter
Hard PVC pipe	100~800	√	√	√	√	High strength, but weak for heat
Permeable concrete pipe	100~700		√			Less flexible, Care is necessary for clogging
Permeable synthetic pipe	100~600		√			Flexible, Care is necessary for clogging
Rock fill	-		√	√	√	Suitable for short-term use. Care is necessary for clogging

Diameter of the pipe should be carefully determined based on the estimated leachate quantity that must be drained. For example, diameter of the main drainage pipe is designed as follows;

1) Estimation of the leachate quantity

The main sources of the leachate are in general rainfall and moisture of waste. Main drainage pipe should have sufficient cross section of which the maximum quantity of leachate estimated can flow. There are several method to estimate leachate quantity such as the water balance model, rational formula, etc. Prediction of leachate quantity by water balance model is described in section 3. The estimation by the rational formula uses the following equation;

$$Q = \frac{1}{360} C \cdot I \cdot A$$

Here, Q: leachate quantity [m^3/s], C: discharge coefficient [-], I: rainfall intensity [mm/h], A: catchment area [ha]. The discharge coefficient expresses the percentage of rainfall water that becomes leachate finally. It can be determined roughly by subtracting quantity of evaporation from rainfall quantity. Selection of rainfall intensity vary site by site. If heavy rainfall is expected at the site, higher intensity should be selected from the past meteorological statistics.

The alternative method is to use surface infiltration rate. In this method, surface infiltration rate is multiplied by the surface area and the product is summed up for entire section as follows;

$$Q = \sum \left(k_S^i \times A_i \right)$$

Here, k_s^i is surface infiltration rate [m/hr] of section i, and A_i is surface area [m^2] of section i.

Table 1.2 shows the saturated hydraulic conductivity of various soil as an example.

Table 1.2 Saturated hydraulic conductivity of various soil [13]

Grain-Size Class	Saturated Hydraulic Conductivity, *ks* [m/hr]
Clay	$<1.1 \times 10^{-5}$
Silt, clayey	$1.1 \times 10^{-2} \sim 4.6 \times 10^{-2}$
Silt, slightly sandy	5.7×10^{-2}
Silt, moderately sandy	$9.1 \times 10^{-2} \sim 1.0 \times 10^{-1}$
Silt, very sandy	$1.1 \times 10^{-1} \sim 1.4 \times 10^{-1}$
Sandy silt	1.4×10^{-1}
Silty sand	1.6×10^{-1}

2) Calculation of the pipe diameter

Flow of leachate in the pipe should not be the pipe flow but the open-channel flow as indicated in the figure 1.8.

In general, 30% to 50% of cross section being wetted perimeter is preferable. In the open-channel flow, flow velocity can be expressed by the Manning equation;

$$V = \frac{1}{n} R^{\frac{2}{3}} i^{\frac{1}{2}}$$

Here, V: flow velocity [m/s], n: roughness of the pipe [-], R: hydraulic radius [m], and i: hydraulic gradient [-]. By multiplying the flow velocity and the section area of flow (i.e,, $V \cdot A$), flow quantity can be obtained. Thus, pipe diameter that can satisfy this condition is determined.

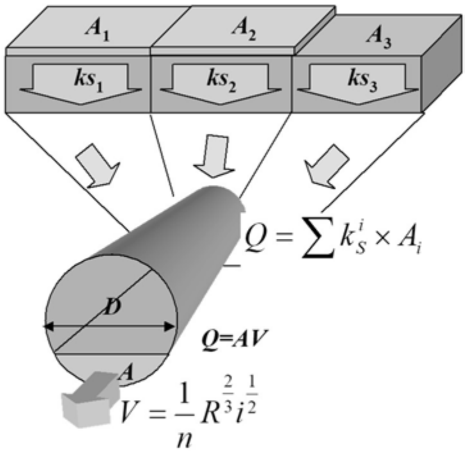
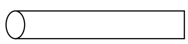
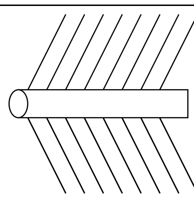
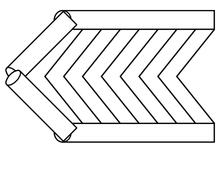


Figure 1.8 Relationship among estimated leachate quantity and velocity of leachate in the main drainage pipe

Besides, since destruction such as buckling/collapsing may occur if the waste load is extremely heavy, loading condition should be better to consider. The pipes must form a net structure and it consists of the main pipes and the branch pipes at the bottom. The feature of the network configuration is shown the following table (Table 1.3);

Table 1.3 The feature of the network configuration

Method	Image	Feature
Straight		•For small landfill, and when bottom slope is steep •Applicable for sanitary anaerobic landfill •Feature ･Inexpensive construction cost ･Less air introduction, Expansion of aerobic zone is unexpected. ･Leachate collection efficiency ; low
Branch		•Widely used, •Suitable when slope gradient is sufficient •Feature ･Enough air introduction. ･Leachate collection efficiency; High
Network		•Used for flat landfill •Suitable when slope gradient is insufficient •Feature ･Enough air introduction ･Robustness for accident (i.e. function even if some part damaged)

Crushed stone layer should be placed around the pipes as filter material to reduce the pressure of waste load and prevent fine particle from entering the pipes. To prevent clogging by microorganism and calcium carbonate, to use larger crushed stones is preferable. Generally, gravels or crushed stone of 50mm to 150mm diameter are regarded as suitable under semi-aerobic landfill. In case of anaerobic landfill that is applied in existing landfills in Palestine, gravel or crushed stone of 19-50mm of range is common. They are installed as bottom drainage layer as indicated in Figure 1.9. And the thickness of the crushed stone layer should be 40cm as minimum.

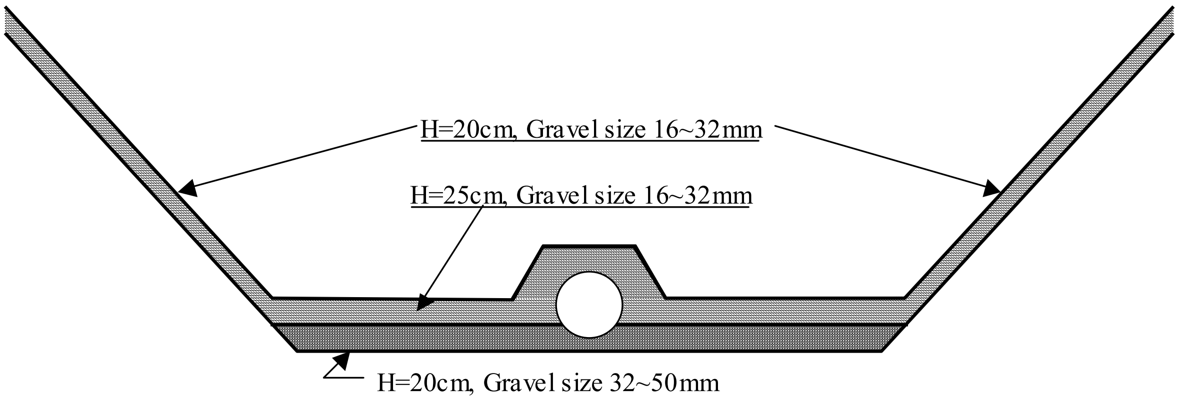


Figure 1.9 The bottom drainage layer structure and the drainage material (installed in Zahart Al Finjan landfill as an example).

According to the regulation of U.S.EPA, leachate head on the liner should be controlled less than 30 cm [11]. So, leachate collection and drainage system should be designed to achieve this requirement. The pipes are normally arranged with 20 to 30m of interval to promote leachate collection and drainage.

1.3.4. Gas collection/ventilation system

The function of the gas collection pipe is to collect and discharge (or treat) landfill gas. Landfill gas flows to all directions due to the pressure gradient when the gas pressure rises by the generation of landfill gas. It is also transported by the diffusion. The main composition of landfill gas usually consists of methane (CH_4) and carbon dioxide (CO_2) with trace odorous substances and chemicals contained in the end-of-use products. Landfill gas including methane moves upward through waste and cover soil layer if no countermeasures are taken. Sometimes, plants on the landfill surface blight because of the oxygen deprivation in the root zone, and/or temperature increase by the methane oxidation. If no measure for gas collection is taken, the gas can migrate to surrounding environment and also invades and stays in the basement of residential buildings/facilities and may result in explosion, though rarely. The explosion limit of methane is 5-15% in the atmospheric pressure in normal temperature. The transport of the methane is resulted from the flow of the gas through covered conduit, drainage ditch, clacks of base ground, etc. To prevent such migration of the gas, gas collection is indispensable. When all bottom and slopes of the landfill are covered by surface liner, gas collection pipe must be installed inside the landfill with appropriate distances to avoid its accumulation inside, because such accumulation perhaps triggers fire and/or explosion. The installation of gas vents/gas release wall is also helpful to prevent landfill gas moving outside the landfill.
There are two types of landfill gas collection system. Active gas collection system collects landfill gas actively to decrease environmental risks and to use the gas as heat/energy source. Meanwhile, passive gas

collection system collects and releases landfill gas by pressure gradient between inside and outside of the landfill. In this case, the gas will be combusted at the exit of gas vents when landfill gas pressure is high. The gas collection pipe is indispensable when large amount of organic matters is contained in the waste.
Most vertical landfill gas collection pipes are perforated pipes enclosed by crushed stones. It is stretched as the landfill surface rises. Polyethylene pipes and vinyl chloride pipes (typical diameter ranges from 125 to 600mm, and 200mm is most frequently used) are used as vertical pipes. Diameter of slope landfill gas pipe ranges from 75 to 300mm. When the filling operation ends and the geomembrane is used as top cover, i.e. final cover, it is necessary to install the horizontal landfill gas drainage layer and gas collection pipes under the sheet. In this case, a layer of crushed stones or flexible geosynthetics is used because differential subsidence may occur in the waste layer. Figure 1.10 shows the schematic diagram of active gas collection system introduced by USEPA [14],

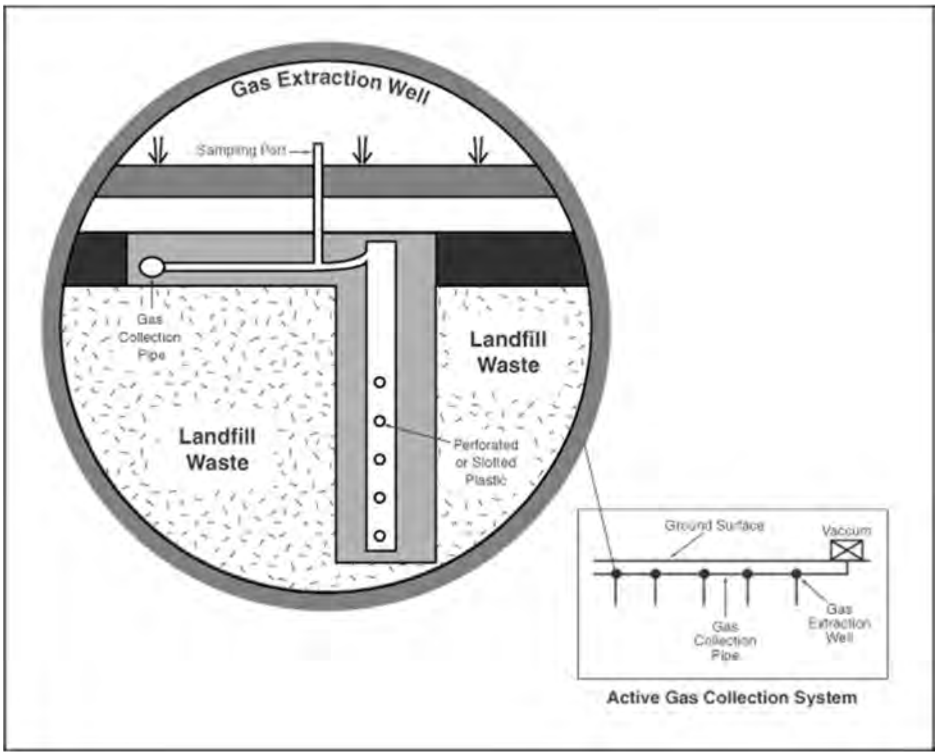


Figure 1.10 schematic diagram of active gas collection system [14]

1.3.5. Storm water collection and drainage

Although Palestine is located in arid/semi-arid climate, the unexpected storm event cannot be excluded, especially in wet season. In order to minimize quantity of leachate, storm water should be drained promptly before contacting with the waste. The drainage network for storm water is important to prevent the inflow of storm water to the landfill. There are various kinds of storm water drainage facility (figure 1.11).

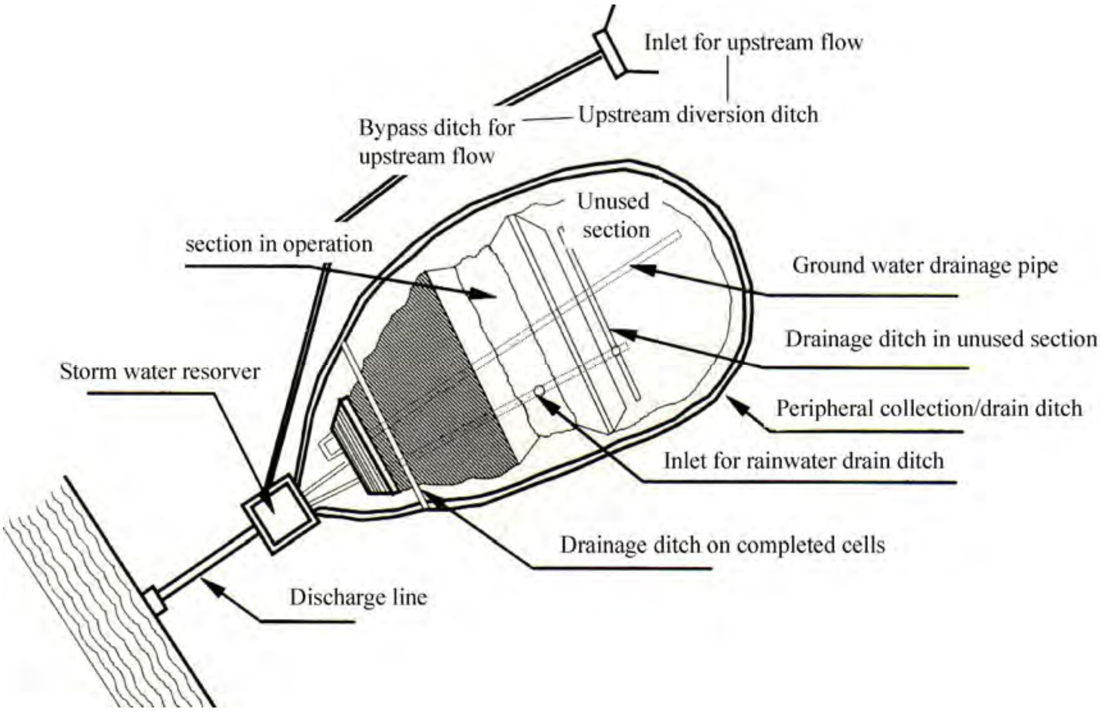


Figure 1.11 Systems involved in storm water collection and drainage

1) Upstream diversion ditch:

The by-pass ditch is installed to divert water current upstream and then it is led to the storm-water reservoir for flood control. Sometimes, the dam with intakes is installed in the upstream, and the upstream water current is discharged through culverts.

2) Peripheral collection and drain ditch:

The drain ditch is installed around the landfill site in order to prevent from surface runoff water entering to the site. It is often installed along the road around the landfill. Drain ditch should be wide and deep enough to prevent hydraulic jump into the landfill.

3) Temporary rainwater collection and drain ditch on the completed cells:

The collection and drain ditch (open channel) is temporarily installed at suitable intervals to collect surface runoff on the final cover and to drain it intact. This decreases the volume of the water infiltrating, then results in the reduction of leachate.

4) Rainwater collection and drain ditch in the unused section:

A collection and drain ditch is installed to drain the rainwater from the unused landfill section.

5) Rainwater collection and drainage ditch after landfill completion:

It is a ditch installed to divert the surface runoff on the final capping system after closure. Care must be necessary to prevent damage of the ditch by the differential subsidence.

6) Storm-water reservoir for flood control:

This reservoir is constructed in order to prevent rapid outflow, which can affect downstream area, from the site and to play a role of buffer. All the water collected by the above-mentioned equipment is led to this reservoir.

The collection and drain of the rainwater fell on the working cell is thought to be difficult. However, it is necessary to minimize the working face as much as possible.

1.3.6. Leachate Management Facility

Leachate storage pond

It is necessary to remove the leachate as promptly as possible to prevent the hydraulic pressure rise on the liner by leachate storage inside the landfill. The removed leachate flows directly into the leachate pond or is maintained in pit once, then is sent forcefully to the leachate storage pond by pump. Leachate storage pond should have enough capacity that can store leachate generated even if it is a rainy season. In order to design the capacity of leachate storage pond, it is necessary to estimate beforehand the amount of leachate generated by using statistics regarding past leachate generation or using the water balance model (Schroeder, et al., 1994).

Generally, leachate storage pond is constructed to buffer the difference between fluctuation of real leachate quantity and treatment capacity of the leachate treatment facility, which is constant. However, here, it is constructed for leachate evaporation. So, by taking into account the evaporation rate from the pond, and the balance of inflow and evaporation, capacity of the leachate pond should be designed. Lining by geo-membrane sheet (i.e. HDPE sheet) at the bottom of the leachate storage pond is indispensable for preventing leakage of leachate. Moreover, installation of fence around the leachate pond is necessary to prevent the fall accident.

1.3.6.1. Leachate recirculation network

When evaporation is adopted as a major management strategy of the leachate, evaporation from the surface of the landfill is expected as well as evaporation from the leachate storage pond.

Therefore, the leachate is pumped up forcefully from the leachate storage pond, and then the leachate is fed to landfill surface by various means.

Major methodologies of recirculation are as follows;

1) Leachate recirculation onto the landfill surface and distributing it by using sprinkler/spray nozzle, or open channel trench (or sometimes open shallow pond, etc),

2) Leachate is recirculated to the subsurface just below the surface of the landfill by using trench filled by rubble or perforated pipes (subsurface pads with drainage material are also used),

3) Leachate is recirculated to the much deeper vertical wells existing inside landfill, such as borehole.

Figure 1.12 shows several types of leachate recirculation.

For the purpose of promoting evaporation, recirculation onto the surface is recommended. However, this type of surface irrigation often causes the odor issue by the dissipation of leachate.

Even if any methodology is chosen, it is necessary to install pump which has an enough ability to send the leachate to the surface of the landfill, pipe arrangement, the sprinkler that spray the leachate at the surface, construction of the blind trench, etc.

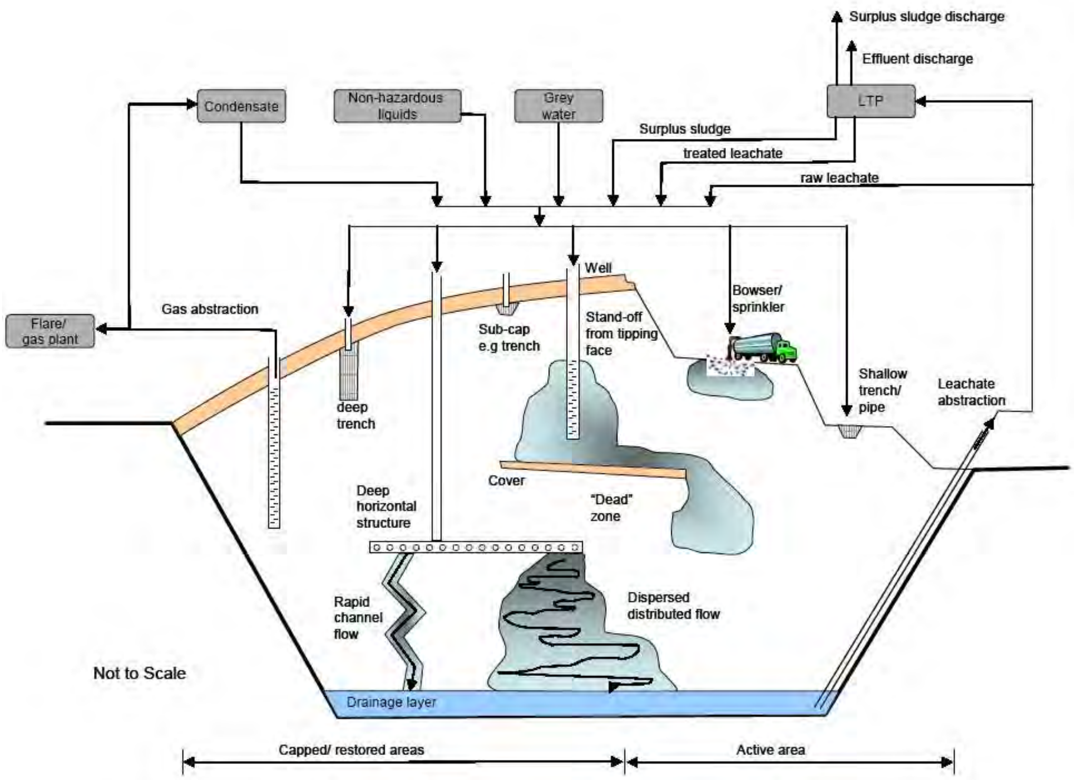


Figure 1.12 Several types of leachate recirculation systems. ([8] UK Environment agency (2009))

The required performance differs by purpose and size of the landfill, etc. UK Environment agency conducted a survey on leachate recirculation [8]. Some actual application rates used at field scale are indicated in Table 1.4 as an example.

Table 1.4 some actual application rates used at field scale [8].

System type	Sub-set	Infrastructure application rate	Areal application rate (m^3/ha/day)
Low pressure surface application	Infiltration lagoons	5.2-7.9 l/m^2/day	2.5
	Irrigation at tipping face	10-66 l/m^2/day	
Trenches and horizontal pipes	Tyre-filled trench	830 l/m/day	
	Gravel-filled trench	137 l/m/day	
	Deep (5-7m) tyre filled trench	205-274 l/m/day	
	Perforated pipes in gravel-filled trenches	10 l/m/day	1.1
	32 mm HDPE pipe	12-70 l/m/day	11-13
	75mm PVC pipe in gravel-filled trench	10 l/m/day	2.4-6.1
	Perforated pipes in injection trench	7 l/m/day	9
Pads	50 x 50 x 2 m tyre-filled pad	24 l/m^2/day	
	13 tyre-filled pits at 8 m spacing	19 l/m^2/day	27
	60 x 9 x 0.15 m blanket of crushed recycled glass	28 l/m^2/day	
Wells	18 injection wells at 30 m spacing	90 l/m/day	8.9
	134 vertical wells in 45 clusters at 15 m spacing	50 l/m/day	8.4
	12 shallow pin wells at a spacing of 10–15	l/m/day	11.7

Issues regarding the leachate recirculation confirmed through various experiences up to now are as follows; odor, clogging of pipe network/spray nozzle, flooding of gas vents by the storage of leachate, the collapse of the recirculation system on the surface due to the non-uniform settlement, slope instability, surface outbreaks, etc. Therefore, careful design and construction by paying attention on these issues are significant.

1.3.6.2. Leachate treatment facility (Not necessarily required here)

It is necessary to consider deliberately the purpose of the installation of leachate treatment facility. In general, the leachate treatment is to be required because leachate has to be discharged to outside when the amount of the leachate exceeds the capacity of which the site can control. As a matter of course, to prevent negative impact on the environment caused by leachate discharge, the strength of leachate should be weakened to the degree that never threatens the surrounding environment. If there is concrete effluent standards, treated leachate should satisfy it. Also, if there is the environmental standards, the discharge of leachate must not disturb it at the point of compliance. Therefore, the discussion regarding the installation of leachate treatment facility should be started from the prospect on the necessity of the leachate discharge.

Under wet climate, landfill is subjected to constant rainfall event. In such condition, the situation of leachate discharge is inevitable.

On the other hand, rainfall event is limited in arid/semi-arid climate. In some locations, annual water budget may become negative because evaporation exceeds rainfall. If such condition is satisfied, control of the leachate without discharge may be possible and leachate treatment facility isn't necessary. This condition should be carefully inspected by past meteorological data and water balance calculation. If there is a possibility to control the leachate without discharge, the strategy is further secured by promoting evaporation using the re-circulation, an immense evaporation pond, etc.

If leachate treatment facility is intended to install even though leachate is controllable without discharge, conceivable purposes of it can be summarized as follows;

1) When the leachate re-circulation is carried out, re-circulation of the treated leachate is more effective for waste stabilization than non-treated leachate. (it can eliminate factors that obstruct biodegradation by dilution)

2) When emission of strong odor from the leachate storage pond is concerned, appropriate leachate treatment process can reduce the emission of odor.

3) If the leachate strength is weakened, impact on surrounding environment can be minimized even if the unintentional leachate discharge happens under extreme heavy rain. (Since landfill should confine leachate inside, this event should be avoided basically.)

If the leachate treatment facility is installed according to these purposes, requirements on the facility are whether the facility can achieve each purpose or not.

To the contrary, leachate treatment facility must be installed, if the leachate discharge is intended due to its overbalance against the controllable amount of the site. In this case, leachate treatment process should be designed to satisfy the required effluent standards, of course. The configuration of the process depends on the objective. Various configurations are possible. The quality of the leachate changes drastically along with the time depending on the landfill condition. Initially, leachate with high BOD is generated and it is suitable for the biological treatment. Then, it gradually changes to the characteristics with high concentration of COD and ammonia, and physicochemical treatment becomes to be more suitable. The ratio of BOD/COD is a useful indicator for choosing appropriate treatment process. Specific condition of the landfill in arid climate is that there is sometimes no river outside. In such condition, much higher quality of effluent (i.e. low concentration of constituents) is required because no dilution is expected after its discharge. Thus, as for the leachate treatment in landfill under arid climate, special attention should be paid on the effluent quality.

1.3.7. Monitoring facility

Various monitoring equipments are necessary to be installed to understand the condition of the landfill and to comprehend the impact of the surrounding environment.

1.3.7.1. Leachate monitoring well

To grasp the real leachate characteristics, analysis of the quality of leachate obtained at the outlet of leachate collection system is necessary. However, sometimes, determination of the variation of leachate quality by location is required. In such case, several monitoring wells inside landfill are installed. If vertical gas vents reach at even the landfill bottom, leachate quality can be monitored by using the leachate stored in the wells instead. Meanwhile, management of leachate head at the bottom is quite important to evaluate the risk of leachate leakage. Thus, monitoring wells to measure the water table inside landfill need to be installed.

1.3.7.2. Landfill gas monitoring well/pipe

Gas monitoring wells are installed to trace the transition of the landfill gas composition. If the vertical gas vents or horizontal gas drainpipes are installed, they can be used instead of the monitoring well. All monitoring wells should be capped to keep the landfill gas and to prevent air invasion. If to confirm migration of gas (especially, methane) to the surrounding environment is necessary, sometimes, simple gas wells are set up at peripheral area of the site (outside of the lining system), and it can be used as the monitoring well.

1.3.7.3. Groundwater monitoring well

The purpose of the setting up this well is to detect leachate leakage from the bottom of the landfill. Thus, a monitoring well needs to be constructed at each upstream and downstream of the site, respectively. By this well, influence of landfill on the groundwater can be seized. The depth of the well should be what can reach to the uppermost aquifer. When the existing well, which is utilized for domestic/agriculture purpose, is alternatively used, care must be necessary. To identify the influence of the landfill becomes difficult because of other pollution source or long travel time, if the well is far apart from the site in horizontal direction or the groundwater table is too deep. In such a case, to examine the flow direction of groundwater below the site beforehand is necessary. In addition, possible flow path of leachate in case of leaking must also be examined beforehand.

1.4. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Basic infrastructure	Fence ·The height of the fence. ·Unclimbable structure ·Enclose the territory completely					
	Site notice board ·Installation ·Information provided					
	Site access road ·Width of the road ·Pavement and dust condition ·Access sign					
	Weighing system ·Installation of the weighbridge ·The staff's arrangement at acceptance					
	Road inside the landfill ·Construction ·Quality (strength, dust prevention)					
	Wheel washing facility ·Installation					
	Office					
	Warehouse					
	Stockyard for cover soil ·Quantity of the soil stocked					
	Inspection yard and quarantine place ·Existence ·Location/Condition ·Capacity for temporary storage					
Fundamental facility required for MSW landfill	Leakage prevention system (Liner) ·Installation ·In conformity to standards ·					
	Waste retaining structure ·Installation ·Robustness (not collapse) ·No erosion and cracks ·					
	Leachate collection and removal system (LCRS) ·Installation ·					
	Gas collection/ventilation system ·Installation ·					

	Storm water collection and drainage · Upstream diversion ditch · Peripheral drain ditch · Drainage ditch on the closed cell · Drainage ditch in unused section · Storm-water reservoir					
	Leachate Management facility					
	Leachate storage pond · Capacity · Bottom lining · Installation of the fence					
	Leachate recirculation network(Not necessarily required depending on the site structure) · Installation · Functioning					
	Leachate treatment facility(Not necessarily required here)					
	Monitoring facility					
	Leachate monitoring well (borehole inside landfill)					
	Landfill gas monitoring well/pipe (borehole inside landfill)					
	Groundwater monitoring well					

Overall comment
Other observation / (Immediate) Action is Required on;
Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

2. Management of landfill operation

2.1. Introduction

In this section, basic procedures on landfill operation are described, which are necessary for audit. The explanation on each operation described here becomes the standard for preferable landfill operation.

2.2. Management of waste acceptance

2.2.1. Setting up waste acceptance criteria

There are unacceptable wastes, even if the landfill equips various environmental protection functions. They are wastes such as especially hazardous, infectious, possible to cause deterioration of leachate, etc. Thus, each landfill has to set clearly the items that are acceptable beforehand.

The waste acceptance criteria are set based on the function of the landfill site and the pollution control agreement with surrounding community.

Followings are examples of the criterion.

1) Prohibited wastes:

They are hazardous waste including a highly soluble heavy metal, material containing persistent organic pollutants, agricultural chemicals (pesticide, herbicide, etc.), inflammables, infectious waste, etc. Special attention is necessary for sludge and cinder (ash) because they sometimes contain hazardous substances. So, they must be analyzed before acceptance and clear identification on its contents is necessary.

2) Waste with high moisture content:

Liquid waste, sludge with high moisture, waste acid and alkali, waste oil, etc. Moisture content higher than 85% should not be disposed of in terms of the control the leachate generation.

3) Asbestos:

If asbestos waste is accepted, it should be covered immediately with soil in order to prevent uncontrolled dispersion and to protect workers health.

4) Organic wastes which are particularly putrescible:

They decompose rapidly and start to emit strong odor. So, animal carcasses, slaughterhouse waste, hospital waste (non-infectious), etc. should be covered immediately if they are accepted.

5) Bulky waste:

They consume landfill space and lead to inefficient filling. So, they should be crushed before disposal so as not to create hollow spaces in the landfill, if they are accepted.

2.2.2. Waste inspection at acceptance

Inspection of waste at the delivery is important to assure safety of landfill management and protect environment. Any one or combination of the followings can be used as the inspection method to observe the carrying waste;

1) Visual inspection of waste on the transporting vehicle:
Waste is visually inspected by reception staffs regarding its appearance. And the staff confirms whether other waste, which does not comply with acceptance criteria, exists in the load.
2) Visual inspection at the dumping yard:
The waste is inspected in detail by being laid on the dumping yard inside the landfill site if the load is judged to be mixed with other types of waste at the entrance. In the case of waste being suspicious, it is needed to be sampled and analyzed. As an alternative method, reception staff informs to the landfill tipping area staff about the vehicle number by wireless etc., and then he inspects the waste on the unloading location. TV camera is also used for visual inspection here too.
3) Sampling and analysis of waste:
The waste possibly violating the acceptance criteria is carried to the temporary storage location and is sampled, analyzed and determined whether to be accepted or rejected.

2.2.3. Measure for the waste not comply with criteria

At first, suspicious waste should be moved to the quarantine zone until concrete decision is made. If leachate formation or odor emission is too intense, impermeable sheet should overlies/underlies the waste. Enough distance should be secured between the quarantine zone and site office building since there is possibility of waste containing hazardous substance.
When a violation is found, the content is recorded in the report, and the waste generator and the waste transportation contractor are informed about the rejection of the waste. The methods may not seem to be effective as it is not a thorough inspection. However, the actual effect is high because this type of penalty system (i.e. reject the waste to the generators) prompts produces/carriers to abide by the regulation.

2.2.4. Waste quantity measurement

The acceptable waste is weighed by weighbridge and the necessary data are collected and recorded. Data on the waste should be recorded by each vehicle. Necessary data are; the area of waste collection, the license number of the vehicle, types of the waste, weight of the waste, volume of the waste, information on transportation ID, with/without inspection, etc.
The data is summarized daily basically. But monthly aggregated data is also necessary to submit the report.
In addition, the administration office instructs the driver about the suitable location at where each waste is to be dumped.

2.2.5. Inspection/Periodical analysis

Waste composition analysis should be carried out periodically. Composition data is important for understanding the trend of MSW generation and examining the possibility of recycling activity by the competent authorities.
Waste sample is taken from the incoming loads randomly. The amount of sample depends on the number of worker possible to be involved. The frequency of analysis depends on the type and quantity of waste received. Records of these analyses must be kept.

2.2.6. Data recording and reporting

Data on quantity of waste delivered, result of inspection, report on the measures taken to the unacceptable waste, result of composition analysis, etc. should be kept appropriately.
These data and reports are used to submit annual report to the competent authority.
For the landfill operation management, the quantity of the waste and location of waste disposed of are indispensable for estimate future operation plan.
The following tables (Table 2.1 – 2.3) show examples of records.

Table 2.1 Example of data recording format on the waste acceptance (daily)

Date: ****/**/**　　　　Daily record No. ______

Weather: ______

Daily waste acceptance record

Time	Waste origin	Type of waste	Vehicle ID.	Quantity (ton)	Quantity (m3)	Acceptance (OK/Reject)	Inspection report No.

Table 2.2 Example of data recording format on the waste acceptance (Monthly)

Year: **** Month **

Monthly record No.

Monthly waste acceptance record

Date	Quantity		Volume		Number of reject	Remarks
	Daily (ton)	Cumulative (ton)	Daily (m3)	Cumulative (m3)		

Table 2.3 Example of acceptance inspection record

Date: ****/**/** ____________ Daily record No. ____________

Inspector: ____________

Report on acceptance inspection

Date and Time	****/**/** **:**	
Waste carrier		
ID of Waste carrier		
Waste origin		
Result of visual inspection	□ Caution You are cautioned because of the reason described below. If you receive similar caution again, delivery of waste by you will be rejected. □ Reject Your waste is not accepted in this landfill based on the reason described below.	
Reason	1	Presence of unacceptable waste ( )
	2	The characteristics of waste is different from the waste in contract
	3	Other
Proof of the reason (Photo, etc.)		

2.3. Waste filling operation

Waste filling operation including soil cover application is the most crucial one in landfill operation. By appropriate operation, various issues regarding the landfill site can be prevented, such as minimizing the issue of odor, vermin, insect, fire, waste dispersion, etc., reducing the quantity of leachate, and preventing non-controlled emission of landfill gas. Therefore, to confirm whether the site is properly operated or not, regarding waste filling work is most important.

2.3.1. Waste emplacement and compaction

After waste is unloaded at the working area, at first, the waste should be crushed and blended by heavy equipment in order to fill the waste efficiently and to extend the service life of the site. The waste is spread on the ground then crushed by heavy equipment by running over the waste at least five or six times. The spreading of waste should not be performed under strong wind condition, especially for the waste that is easily scattered. Even when the wind is mild, such waste should be humidified beforehand, or sprayed by using water before rolling compaction is done. The waste spread is pushed to the previous cell's slope by either following method; 1) pressing down or 2) pushing up. By repeating this operation, a cell is formed daily. At the end of the day, the cell is covered with a daily cover. The size of the cell is about 2~2.5m in height, and width and depth are decided depending on the amount of the waste every day. It is quite important to minimize the area where cell is created.
The extension of vertical landfill gas collection pipes is also necessary if vertical vents are installed. When landfill work is performed near the waste retaining structure, slope surface liner and landfill gas collection pipes, cares should be taken so as not to damage these equipment. The workers should be educated for this matter. In addition, when the landfill layer is shallow, special care must be paid on the movement of heavy equipment over the surface leak prevention layer, since it may damage the liner, and also the leachate collection and drainage system.

2.3.2. Implementation of cover material

Significant difference between open dump and sanitary landfill is the implementation of soil cover. By covering waste by soil daily, various environmental nuisances are minimized and a safe working environment can be created. Therefore, this operation is one of the most important operation among landfill work. If the daily cover is not applied properly, the similar situation with the open dump site is easily created.

2.3.2.1. Daily cover

Daily cover soil prevents the scattering of waste, emission of odor, access of birds, and multiplication of vermin. Besides, appearance of landfill is improved. Normally, the soil with high permeability is preferred for daily soil cover. Although rainwater is to infiltrate easily, vehicle motion can be improved even on rainy day and smooth release of gas becomes possible. Furthermore, diffusion of oxygen into the surface layer is promoted, which results in activating methane oxidation and expanding aerobic zone. On the other hand, fine soil with high clay content exaggerates working condition and triggers the formation of perching of leachate between the layers. In general, soil excavated on site is utilized for daily cover. But, construction and demolition waste such as crushed concrete can be also used.

Surface soil is very thin in this area. Bedrock such as marlstone, limestone, chalk, and chert appear relatively shallow zone. Therefore, crushed rock is the major candidate for cover soil here. The characteristics of them seems to be suitable for daily cover soil since relatively high permeability can be attained and they don't have higher cohesion like clay. In many countries, 15cm of depth for daily cover is recommended.

However, about 30 cm depth or more of daily soil cover is recommended if the waste contains high amount of organic matter.

Application of alternative cover material is also worth to consider. To use compost like material for cover material is effective to reduce the odor issue.

2.3.2.2. Intermediate cover

The landfill layer is formed by extending the daily cells to the horizontal direction. When the height of the sum of some layers reaches to the planned height (e.g. around 12m which is resulted from 5~6 layers of waste was set in Al Minya landfill)), the intermediate soil cover on the landfill layer is constructed. It is important to note that the surface runoff on the intermediate soil cover should be collected and drained by temporary runoff collection ditches. Compared with daily cover soil, rather low permeable soil is preferred for the intermediate cover. By this low permeability, rainfall infiltration can be significantly reduced. In general, about 30 cm or more in depth of intermediate cover is recommended. As for cover material, crushed stone should be made much finer.

2.3.2.3. Final Cover

When the landfill is reached to the height that is originally planned, the final cover is implemented to the surface of the layer for the landscaping and the control of leachate quantity.

Concrete objective of final cover are; reduction of leachate quantity during long-term post-closure phase, prevention of uncontrolled release of landfill gas, isolation of waste that is possible to cause odor and various nuisance, etc. Moreover, if certain after-use is planned, proper final cover that can contribute to the purpose of the after use should be designed.

If the design concept of landfill is containment-type and to completely contain the waste in the landfill is intended, the general structure of the final cover (from the lower to the upper layer) is as follows; the gas drainage layer, impermeable barrier layer, rain water drainage layer, and topsoil. Geomembrane is commonly used for impermeable barrier layer in order to restrict infiltration of rain water. Because gas migration through surface is to be restrained by the geomembrane, gas drainage layer is installed below the membrane in order to drain the gas efficiently. Beside, drainage layer above the liner is also work for drain the rain water infiltrating through top soil vertically. Top soil works to maintain plant growth and contribute the landscape.

When complete containment structure is not intended, only thick soil cover of which thickness is more than 50 cm is installed in some cases.

2.3.3. Survey of completed amount

Landfill operation should be progressed strictly based on the plan that has provided beforehand. Therefore, regular measurement of the thickness of the waste layer and cover soil layer according to the progress of landfill operation is necessary. In order to measure the thickness of the waste layer and height of the landfill, marking the elevation on the slope or geographical survey can be applied. To grasp the shape of the landfill three-dimensionally, not only the plane but also vertical information becomes important. Survey of the height is carried out by the level, the hand level, the transit, and GPS, etc. These surveys should be conducted regularly to understand completed amount at that time. And the completed amount should be recorded in detail.

2.3.4. Confirmation of slope stability

To prevent the risk of a slope collapse, the stability of slope constructed by filling the waste in landfill should be checked. Basically, the slope should be maintained at a gradient not greater than 1:3 (ratio of vertical height to horizontal distance). Along with the progress of the waste filling operation, deformation of slope may possibly occur due to the settlement of the waste. Thus, the survey on slope is regularly executed to confirm whether the gradient is within the range.
Besides, the slope might be eroded by the surface runoff. When erosion occurs, landfill waste may crop out and it results in the scattering of the waste and the plague of vermin. To prevent this, regular walk-over survey is necessary to find the location of erosion. If erosion is found, it must be promptly repaired by additional soil covering. The state of the slope is recorded, and managed regularly.

2.3.5. Monitoring of settlement

Severe subsidence may occur along with time elapsing, especially in the landfill where a lot of organic waste has been disposed of. The subsidence during active operation before the installation of the top cap is not significant for waste filling work. However, its impact becomes to be serious for the surface drainage system and gas collection system after the installation of the top cap. Therefore, subsidence should be monitored regularly. It can be done by the method explained in the section of survey of completed amount.

2.4. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Management of waste acceptance	Setting up waste acceptance criteria · Clear definition of prohibited waste · Refuse of waste with high moisture content · Clear protocol on asbestos · Measure for specific putrescible · Measure for bulky wastes					
	Waste inspection at acceptance · Enactment of visual inspection · Sampling and analysis of waste					
	Measure for the waste not comply with criteria · Existence of decisive procedure					
	Waste quantity measurement					
	Inspection/Periodical analysis · Execution of periodical composition analysis					
	Data recording and reporting					
Waste filling operation	Waste emplacement and compaction · Proper compaction work · Well planned cell creation · Minimization of working face · Care on the other facilities					
	Implementation of cover material · Daily cover · Intermediate cover · Final cover					
	Survey of completed amount · Conduct periodical survey					
	Confirmation of slope stability · Periodical walk-over survey and maintenance					
	Monitoring of settlement					
Overall comment						
Other observation / (Immediate) Action is Required on;						

Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

3. Leachate management

3.1. Introduction

At the sanitary landfill, of which bottom and slope is lined strictly and inflow from outside is satisfactorily controlled, leachate generation is determined mainly by climate condition (rainfall and evaporation), and moisture of waste.

Especially, if the landfill is located under arid/semi-arid climate, amount of leachate formation is less when compared with the landfill under wet climate, because evaporation exceeds rainfall. Besides, because the moisture that waste brings in becomes the main source of the leachate, the generation of the leachate is mainly limited for the period of active operation, in which the waste is disposed of. Moreover, characteristics of leachate become strong because of the condensation by evaporation and less dilution by rainwater.

In general, relatively a large amount of leachate is perennially generated from the landfill under wet climate because annual water budget is positive. By this, discharge of the leachate to outside is inevitable. And in order to fulfill the requirement on the discharge, quality and quantity of leachate is managed. In other words, exit is necessary for leachate that is continuously generated, and the landfill cannot help requesting the exit to available surface water. As long as the landfill belongs to this attributes, controlling the quality of leachate to below the level that never affects the environment is major premise, when it is discharged (For this, effluent standards is set by considering the dilution effect of the river water). Concretely, to minimize leakage into the underground, to minimize leachate generation, and to fulfill the effluent standard by the leachate treatment are set as the main management targets, in general.

When considering above mentioned regards, two management strategies can be applied to the leachate management in landfill under arid/semi-arid climate.

3.1.1. Control the leachate within the site and never allow the discharge of leachate

At first, careful examination should be done if the leachate management is possible within the site without discharge. The generation of leachate depends on various factors, such as topography, climate, characteristics of the waste disposed of (especially, moisture content), landfill structure, measure on promotion of evaporation, etc. In arid/semi-arid climate region, it may be common that there is no surface water body around the site. Thus, quality of effluent, which is discharged to outside environment, should be equivalent to the quality of rainwater/groundwater, since no dilution effect is expected by river water. In order to satisfy this requirement, extremely highly sophisticated leachate treatment process is necessary. Thus, strategy controlling leachate only inside the landfill and never allowing the discharge has advantage of cost and energy when comparing to the strategy allowing discharge.

If it becomes evident that the leachate is never generated based on the past operation record or the prediction by water balance calculation, leachate treatment will not be a major subject of the landfill management.

To the contrary, if the leachate is generated even just a little, evaporation should be promoted to effectuate the management strategy confining the leachate within the site. In this case, concrete measure is to rely on the evaporation pond or re-circulation to the surface of landfill body. However, promoting evaporation creates simultaneously odor issue because odorous substance vaporized together with the evaporation of water. Thus, there may be a case that leachate treatment becomes to be necessary to address this issue according to the circumstances of complaints from residents, etc. Besides, when the leachate re-circulation is performed, there may be a case in which elimination/conversion of substances, which hinder biodegradation process, is necessary in order to accelerate stabilization. Hence, although the discharge isn't intended, there is a case in which leachate treatment is helpful for landfill management. If the leachate treatment is conducted based on this concept, the advanced process that can produce high quality effluent is not necessary. That is, leachate treatment is designed for more concrete objective, such as reduction of the odorous substance (e.g. Ammonia (NH_3) and Hydrogen sulfide (H_2S)), conversion of ammonia to nitrate for smooth denitrification after re-circulation to landfill body. Thus, in this case, the leachate after treatment is sent back to the pond or landfill. Because leachate quality after treatment is not stringent for other constituents than the target substances, the treatment process can be made simple in comparison with the process described in the next section.

3.1.2. Permit the discharge of leachate and execute leachate treatment so as not to affect the surrounding environment.

When the amount of leachate exceeds the capacity of which the landfill can control it only inside, discharge of the leachate is obliged to be considered. However, since no river that has abundant water to dilute effluent is typical in arid/semi-arid region, especially strict standards is to be applied for the effluent. That is, quality equivalent to rainwater/groundwater is required to avoid any impact caused by the discharge. There are various configuration of the leachate treatment process, However, by choosing any process, effluent must satisfy the requirement of the standards, which are listed in section 3.4.

3.2. Leachate quantity

Despite the strategy of leachate management (i.e. strategy confining the leachate inside the site and not allowing discharge outside the site, or the other strategy which permitting the discharge of the treated leachate), to grasp the quantity of leachate is crucial. Quantity of the leachate can be predicted by using water balance model/past record of the site. Prediction of leachate in advance is quite helpful to manage leachate properly. As a matter of course, daily measurement of leachate quantity should be done and also the result can be used for the prediction of future leachate generation.

3.2.1. Prediction

Generally, it is quite important to forecast the amount of the leachate based on the climate data, moisture content of waste, etc. at the planning phase. There are various prediction tools for leachate generation (e.g. U.S.EPA's HELP model [10]). Besides, the generation of leachate can be also estimated by simple water balance model by using meteorological data. In the latter case, when describing most simply, the input is rainfall rates and the water squeezed from waste, and output is surface runoff, evaporation, and leachate. Thus, if the steady state is assumed (i.e. the amount water stored inside the landfill is assumed to be constant), the amount of leachate is calculated by subtracting output (evaporation and surface runoff) from input. Anyhow, what is important on this is whether the prediction of leachate quantity is conducted or not. Here, simple water balance model is briefly described.

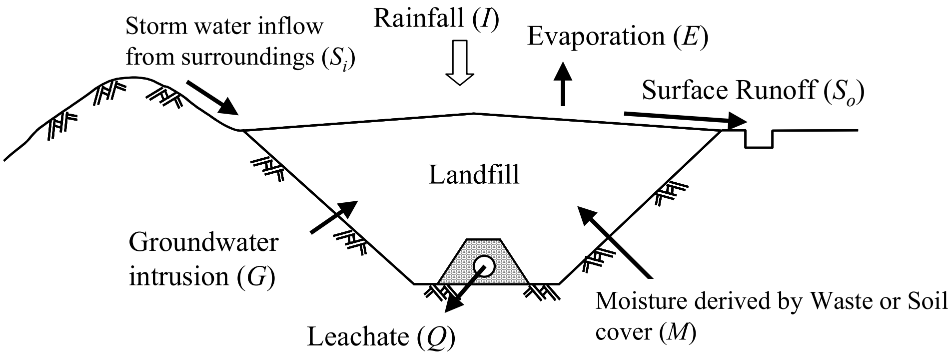


Figure 3.1 Elements considered in water balance model

Figure 3.1 shows elements which are taken into account in water balance model.

Here, I: Daily rainfall intensity [mm/d], E: Evaporation rate [mm/d], S_i: Storm water inflow from surroundings [m^3/d], G: Groundwater intrusion [m^3/d], M: Moisture derived by waste/soil [m^3/d], S_o: Surface runoff [m^3/d], Q: Leachate [m^3/d].

Rainfall intensity can be obtained from meteorological station near the site. If evaporation rate is recorded at the meteorological station, it can be used. But, in many cases, empirical equation (e.g., Thornthwaite equation, Hamon equation, etc.) or theoretical equations (e.g. Penman equation) are used to estimate evaporation. M is determined based on the analysis conducted for the waste actually accepted at the site. S_i and G are in general neglected. As for S_o, influence of it is small during operation period but it must be determined after cover soil is implemented.

When S_i and G are neglected; input water to landfill is;

$$Input: \frac{IA}{1000} + M$$

Here, A: is catchments area of rainfall in landfill [m^2].

And output is;

$$Onput: \frac{EA}{1000} + S_o + Q$$

Therefore, water balance in one day can be expressed as follows;

$$\Delta(W_R + W_S) = \left(\frac{IA}{1000} + M\right) - \left(\frac{EA}{1000} + S_O + Q\right)$$

Here, $\Delta(W_R+W_S)$ is the change of moisture inside. W_R is the moisture stored in the landfilled waste and W_S is the moisture stored in the cover soil.

If the moisture in landfill can be assumed to be steady state, leachate generation can be expressed as follows;

$$Q = \left(\frac{IA}{1000} + M\right) - \left(\frac{EA}{1000} + S_O\right)$$

Leachate quantity can be also estimated by the rational formula that is explained 1.3.3.

3.2.2. Measurement

Additionally, it is important to measure the amount of leachate generation and its amount in the entire landfill regularly after the landfill operation commences. In the typical landfill in arid/semi-arid region, water fractions related to leachate are the following nine.

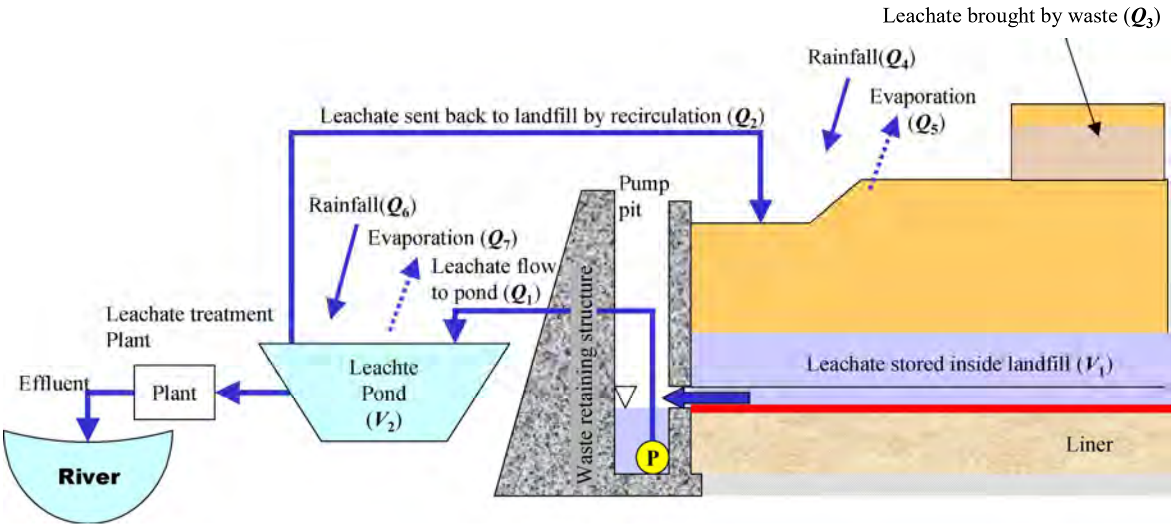


Figure 3.2 Water fractions related to leachate in landfill in arid/semi-arid region

1) Leachate stored inside landfill (V_1)
2) Leachate stored in leachate pond (V_2)
3) Leachate flowing into leachate pond (Q_1)
4) Leachate sent back to landfill from leachate pond by recirculation (Q_2)
5) Leachate brought by landfilled waste (moisture content) (Q_3)
6) Rainfall on the landfill surface (Q_4)
7) Evaporation from landfill surface (Q_5)
8) Rainfall on the leachate pond (Q_6)
9) Evaporation from leachate pond (Q_7).

For "2) leachate stored in the leachate pond (V_2)", "3) Leachate flowing into the leachate pond (Q_1)", and "4) leachate sent back to the landfill from the leachate pond by recirculation (Q_2)" can be measured. As for 2), volume of leachate can be determined by leachate level in the pond and surface area of the pond. So, measurement of leachate head in the pond is necessary. As for 3) and 4), flux of them need to be measured. If pump is used for their transport, flux can be calculated by the operating time of pump and its flow rate. If the leachate naturally flows into the pond, some flow meter should be installed. As for these three fractions, daily measurement is preferable.

For the following component, there is no officially defined method. So, they are estimated if possible.

Measurement of “1) leachate stored in the landfill” is difficult. So, only applicable method is the estimation by leachate head inside the landfill.

Similarly, “5) moisture derived by the waste” is estimated by the physical composition analysis which is regularly performed. Rainfall data (daily, monthly, etc.) can be obtained from nearby meteorological station. Evaporation can be also obtained sometimes from meteorological station, but if evaporation isn’t recorded, it can be estimated by various theoretical/empirical equations by using basic weather data. The amounts of both rain and evaporation can be calculated by multiplying them to the surface area of landfill/pond.

3.2.3. Recording

Result of measurement regarding the amount of leachate stored in landfill, leachate flux in and out of the leachate pond should be recorded.

3.2.4. Evaluation criteria

The evaluation is done in terms of the presence of successive execution of measurement of the leachate. Especially, to confine the leachate in the landfill and not to permit its discharge to outside, understanding of the amount of leachate becomes essential.

3.3. Leachate head

Since liner is installed to prevent leachate leakage, in the case of having any leakage this means that liner is not complete properly. Moreover, in case of the liner constructed by earthen material such as clay, leakage through the liner is dominated by the hydraulic head on the liner. Therefore, it is necessary to reduce the hydraulic head on the liner as much as possible. For example, U.S.EPA stipulates that leachate head on the liner should be controlled to less than 30cm [11]. In view of these, it is recommendable to observe the level of the leachate in some way. However, depending on the landfill structure and equipments, monitoring of leachate is hard to conduct. Actually, there is no obligation for monitoring leachate head in some countries such as Japan. Hence, this is a future perspective. However, what is important is to prevent leachate storage inside landfill as much as possible.

3.3.1. Measurement (future perspective)

Leachate head in leachate monitoring well or in vertical gas vents should be monitored by water-level meter regularly.

3.3.2. Recording (future perspective)

Record should be kept.

3.3.3. Evaluation (future perspective)

Leachate head is evaluated by comparing U.S.EPA standard. Namely, it should be controlled below 30cm.

3.4. Leachate quality

The purpose of the management and analysis of the leachate quality is classified into mainly the following two points:
1) To understand the condition of the landfill and to evaluate its impact on the surrounding environment in the case of discharging leachate to this environment.
2) To confirm whether the quality of effluent complies with the designated standards
The leachate contains various elements and high concentration of each element is natural. There is a mentality that ties the environmental impact directly to the leachate concentration. However, because the direct discharge of the leachate from the landfill to the environment hardly happens basically, therefore, the leachate quality should not be evaluated from the viewpoint of the environmental impact. That is, to compare directly the leachate quality with environmental condition has no meaning. Leachate should be evaluated from the viewpoint of the above-mentioned two points. And this is not the mandatory. This monitoring will be done if the landfill operator think its necessity.

3.4.1. Analysis of leachate to understand landfill condition (not mandatory)

3.4.1.1. <u>Objective</u>

Characteristics of leachate reflect the biodegradation process of organic matter contained in the waste and the leaching process of inorganic matter. These characteristics become the important keys to understand the status of the landfill reaching to the waste stabilization phase.

3.4.1.2. <u>Sampling and frequency</u>

Raw leachate should be sampled. It is obtained at the outlet of leachate collection pipe or inlet of the leachate pond. If the monitor wells are set up, to obtain sample from these wells is also useful. Sampling point should be fixed to certain point and should not be changed. Leachate in the leachate storage pond is not suitable because it is affected by exposure to the atmosphere and dilution by rain.
Frequency of sampling is as follows;

- This measurement is not obliged.
- Thus, the frequency should be determined by the landfill owner.
- Since the information is useful to recognize the condition of landfill, to understand the stabilization phase, and to be used as the basic data when leachate treatment is performed, the

periodical measurement is recommended.

3.4.1.3. Item for analysis

Items for analysis can be classified by simple analysis and detailed analysis

a) Simple analysis

This analysis is conducted on site by using simple apparatus. Daily analysis is recommended when conducting.

pH, temperature, ORP, EC

b) Detailed analysis

After leachate sample is collected, analysis is asked to the certain laboratory. This analysis should be performed every month or every three month when conducted.

pH, temperature, ORP, EC, BOD, COD, SS, TDS, T-N, NH_4^+-N, NO_3^--N, NO_2-N

Special knowledge or skill is necessary for sampling and sample storage. So, it is recommendable to ask certain laboratory to conduct whole procedure from sampling to analysis.

3.4.1.4. Result evaluation

The purpose of this analysis is to understand the condition in the landfill. So, there are no meanings to evaluate the high and low values. Though the meaning of each parameter is not explained here, roughly explaining, information regarding circumstance in landfill (aerobic or anaerobic), phase of biodegradation (acidogenesis, methonogenesis, stabilization, etc.), wash off of salts, and existence of inhibition factor for stabilization can be obtained from these parameters. By conducting these analyses continuously, their trend and fluctuation can be identified.

In addition, in some occasions when environmental deterioration occurs, to distinguish the influence of leachate from other sources is required, especially when there is a possibility of leachate discharge. For this purpose, in depth analysis on leachate characteristics provides useful information. There are various sources of pollution such as release of non-treated sewage or wastewater to the small stream ("wadi"), excessive use of fertilizer and uncontrolled use of pesticide on agricultural land, discharge of wastewater from stockbreeding farmer, etc. Various forms of environmental pollution are possible to occur and pollutants also vary. Therefore, in order to distinguish from other sources, thorough identification of leachate characteristics is necessary. Although there are numerous kinds of pollutants, for example, U.S. EPA designates major hazardous substances as indicated in Table 3.1.

Table 3.1 Hazardous substances for detection monitoring listed by U.S.EPA. [11]

Inorganic Constituents:	Organic Constituents:	
Antimony	Acetone	trans-1,3-Dichloropropene
Arsenic	Acrylonitrile	Ethylbenzene
Barium	Benzene	2-Hexanone; Methyl butyl ketone
Beryllium	Bromochloromethane	Methyl bromide; Bromomethane
Cadmium	Bromodichloromethane	Methyl chloride; Chloromethane

Chromium	Bromoform; Tribromomethane	Methylene bromide; Dibromomethane
Cobalt	Carbon disulfide	Methylene chloride; Dichloromethane
Copper	Carbon tetrachloride	Methyl ethyl ketone; MEK; 2-Butanone
Lead	Chlorobenzene	Methyl iodide; Idomethane
Nickel	Chloroethane; Ethyl chloride	4-Methyl-2-pentanone; Methyl isobutyl ketone
Selenium	Chloroform; Trichloromethane	Styrene
Silver	Dibromochloromethane; Chlorodibromomethane	1,1,1,2-Tetrachloroethane
Thallium	1,2-Dibromo-3-chloropropane; DBCP	1,1,2,2-Tetrachloroethane
Vanadium	1,2-Dibromoethane; Ethylene dibromide; EDB	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene
Zinc	o-Dichlorobenzene; 1,2-Dichlorobenzene	Toluene
	p-Dichlorobenzene; 1,4-Dichlorobenzene	1,1,1-Trichloroethane; Methylchloroform
	trans-1, 4-Dichloro-2-butene	1,1,2-Trichloroethane
	1,1-Dichlorethane; Ethylidene chloride	Trichloroethylene; Trichloroethene
	1,2-Dichlorethane; Ethylene dichloride	Trichlorofluoromethane; CFC-11
	1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	1,2,3-Trichloropropane
	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	Vinyl acetate
	trans-1, 2-Dichloroethylene; trans-1,2-Dichloroethene	Vinyl chloride
	1,2-Dichloropropane; Propylene dichloride	Xylenes
	cis-1,3-Dichloropropene	

3.4.2. Confirmation of the effluent quality based on the designated standards

3.4.2.1. Objective

If the leachate management strategy is determined to the confinement of leachate inside and never allowing its discharge, discharge of leachate (raw leachate) must not happen. In this case, the event of discharge is immediately regarded as the violation of the environment. Hence, auditing of environmental impact should be done based on the occurrence of discharge.

Meanwhile, in the landfill where leachate treatment is conducted and its effluent discharge is intended, effluent quality must comply with the designated standards.

At present in Palestine, standards for the leachate discharge to the environment isn't exist. Destination of the effluent is not only necessarily the river (or wadi), and sometimes, in arid/semi-arid climate, effluent of treated wastewater is used as irrigation water. Table 3.2, in the following page shows the effluent standards set by Palestinian National Authority Ministry of Environmental Affairs (2000) [9] for treated waste water.

Table 3.2 Maximum allowable condition on discharge for effluent of treated waste water [9].

Property (unit mg/L unless otherwise stated)	Irrigation of								Groundwater recharge by infiltration	Discharge to the sea 500 m far
	almond trees	olive trees	citrus trees	forest trees	artificial crops and grains	parks and gardens	green feed	dry feed		
BOD_5	45	45	45	60	60	40	45	60	40	60
COD	150	150	150	200	200	150	150	200	150	200
DO	>0.5	>0.5	>0.5	>0.5	>0.5	>0.5	>0.5	>0.5	>1	>1
TDS	1500	1500	1500	1500	1500	1200	1500	1500	1500	-
TSS	40	40	40	50	50	30	40	50	50	60
Color	free	free	Free	free	free	free	free	free	free	Free
pH	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Fat Oil &Grease	5	5	5	5	5	5	5	5	0	10
Phenol	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	1
MBAS Detergents	15	15	15	15	15	15	15	15	5	25
NO_3 (N)	50	50	50	50	50	50	50	50	15	25
NH_4 (N)	-	-	-	-	-	50	-	-	10	5
T.K.N (Organic nitrogen)	50	50	50	50	50	50	50	50	10	10
Cl	400	600	400	500	500	350	500	500	600	-
SO_4	500	500	500	500	500	500	500	500	1000	1000
Na	200	200	200	200	200	200	200	200	230	-
Mg	60	60	60	60	60	60	60	60	150	-
Ca	400	400	400	400	400	400	400	400	400	-
SAR(Sodium adsorption ratio)	9	9	9	9	9	10	9	9	9	-
PO_4 (P)	30	30	30	30	30	30	30	30	15	5
Al	5	5	5	5	5	5	5	5	1	5
As	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05
Cu	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Fe	5	5	5	5	5	5	5	5	2	2
Mn	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Ni	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pb	1	1	1	1	1	0.1	1	1	0.1	0.1
Se	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Cd	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zn	2	2	2	2	2	2	2	2	5	5
CN	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1
Cr	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.5
Hg	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Co	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	1
B	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	2
fecal coliform	1000	1000	1000	1000	1000	200	1000	1000	1000	50000
Pathogens	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
(Protozoa),((Cryptosporoidiom))Amoeba & Gardia (Cyst/L)	-	-	-	-	-	Free	-	-	Free	Free
Nematodes (Eggs/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

3.4.2.2. Sampling

Treated leachate before discharge should be obtained.

3.4.2.3. Item for analysis and frequency

Items for analysis are indicated in Table 3.2.
Frequency of analysis should be at least once in a year. However, representative parameters such as BOD, COD, DO, TDS, TSS, pH, NH_4 and TKN, fecal coliform should be analyzed more frequently. Recommendable frequency of testing these parameters is seasonally (i.e. once in four months).

3.4.2.4. Evaluation

If the leachate is intended to be utilized for irrigation purposes, its excess against these standards means the violation on the use. Hence, if the excess occurs, immediately discharge of the effluent should be stopped and prompt measures should be taken to satisfy the standards. Auditing should be done based on the condition of compliance with the standards.

As reference, Table 3.3 and 3.4 are indicated. Table 3.3 is the standards of Japan on the surface water and groundwater. They are environmental standards not effluent standards. Effluent standards were determined by taking into account the dilution effect after discharge to the river. In arid region such as Palestine, this dilution effect cannot be expected because the discharge point will be wadi. This means that effluent should have similar characteristics to environmental water (surface water and ground water). The meaning to show these standards is how the standards of environmental water is and the effluent standards in Palestine should be similar to them if the discharge is intended. Figure 3.3 shows this difference on the setting the standards of discharge.

Table 3.3 Standards for surface water and groundwater (in Japan as a reference) [1]

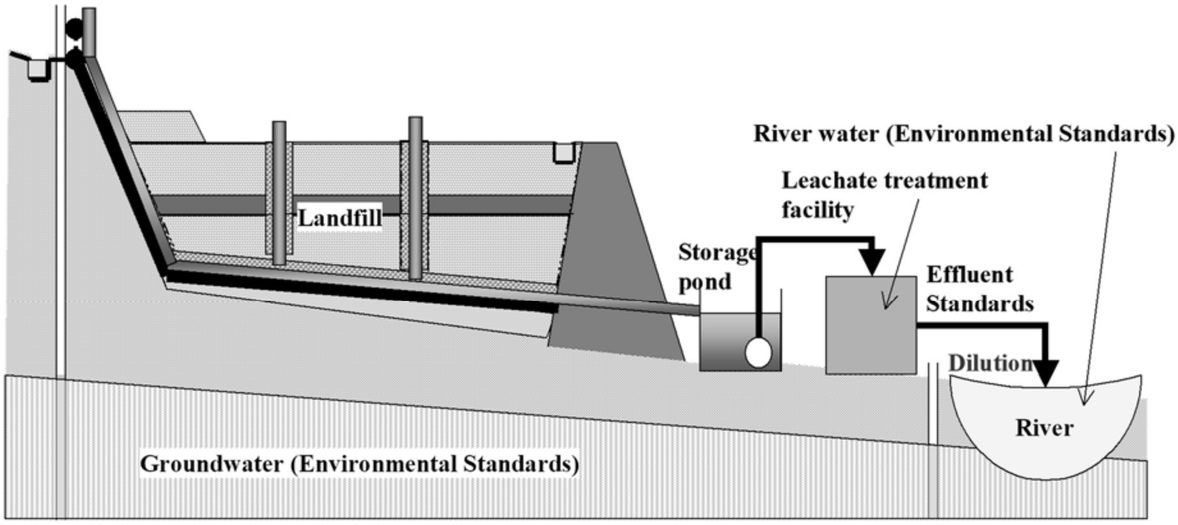
Items	Criterion (less than below value)
Cd & Cd compounds	0.003 mg/L
As & As compounds	0.01 mg/L
Cyanides	Not detected
Total Hg	0.0005 mg/L
Pb & Pb compounds	0.01 mg/L
Alkyl Hg	Not detected
Hexavalent chromium	0.05 mg/L
PCB	Not detected
Dichloromethane	0.02 mg/L
Tetrachlorocarbon	0.002 mg/L
1.2-dichloroethane	0.004 mg/L
1,1-dichloroethylene	0.02 mg/L
cis-1,2-dichloroethylene	0.04 mg/L
1,1,1-trichloroethane	1 mg/L
1,1,2-trichloroethane	0.006 mg/L

Trichloroethlene	0.03 mg/L
Tetrachloroethylene	0.01 mg/L
1,3-dichloropropene	0.002 mg/L
Thiram	0.006 mg/L
Simazine	0.003 mg/L
Thiobencarb	0.02 mg/L
Benzene	0.01 mg/L
Se & Se compounds	0.01 mg/L
nitrite, and nitrate	10 mg/L
B & B compounds	1 mg/L
F & F compounds	0.8 mg/L

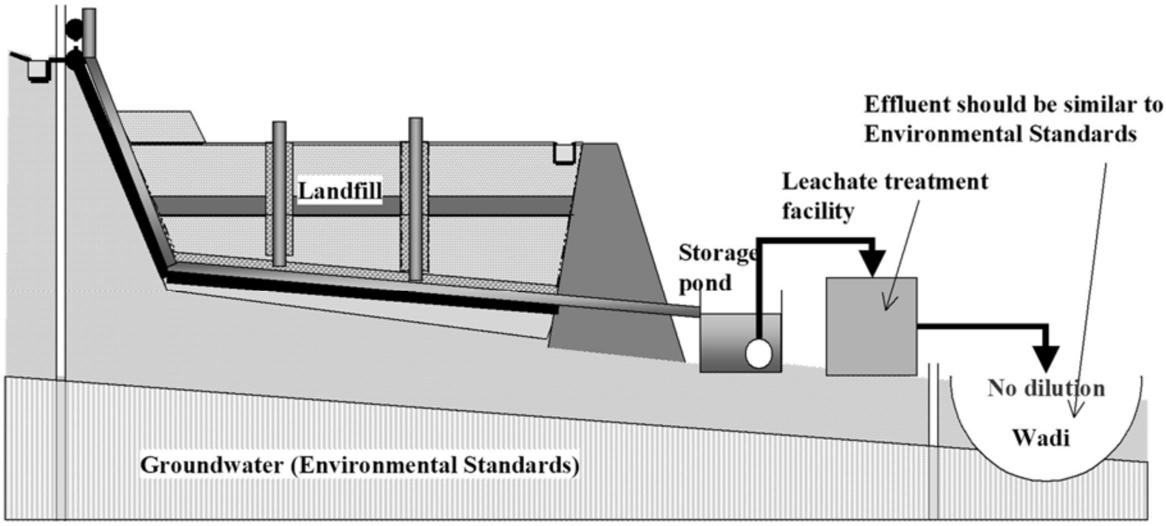
Table 3.4 shows requirements for MSW landfill in USA. In the regulation of USA it is described that the concentration values listed in Table 3.4 should not be exceeded in the uppermost aquifer at the relevant point of compliance.

Table 3.4 Standards for water quality at the point of compliance (in USA as a reference) [11]

Chemical	Maximum Contaminant Levels (MCLs) (mg/l)
Arsenic	0.05
Barium	1.0
Benzene	0.005
Cadmium	0.01
Carbon tetrachloride	0.005
Chromium (hexavalent)	0.05
2,4-Dichlorophenoxy acetic acid	0.1
1,4-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
Endrin	0.0002
Fluoride	4
Lindane	0.004
Lead	0.05
Mercury	0.002
Methoxychlor	0.1
Nitrate	10
Selenium	0.01
Silver	0.05
Toxaphene	0.005
1,1,1-Trichloromethane	0.2
Trichloroethylene	0.005
2,4,5-Trichlorophenoxy acetic acid	0.01
Vinyl Chloride	0.002



(a) Effluent standards can be set based on the environmental standards if dilution effect is expected after discharge.



(b) Effluent standards should be similar to the environmental standards when dilution is not expected after discharge.

Figure 3.3 Difference on the setting the standards of effluent

3.5. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Leachate quantity	Is the prediction of leachate quantity conducted or not. · Daily, weekly, monthly, yearly? · Is the methodology appropriate? · What sort of data is used for it?					
	Is measurement of leachate conducted? · Amount of leachate in the pond · Quantity of leachate flowing in the pond · Quantity of leachate re-circulated Are there satisfactory data on · Quantity of water getting in by rainfall · Quantity of water evaporating Estimation of leachate stored in the site					
	Are these measured data recorded properly?					
Leachate head	Is the leachate head on the liner measured? · Frequency · Methodology					
	Is the data on leachate head recorded?					
	Is the hydraulic head of the leachate on the liner less than 30cm					
Leachate quality	Is analysis of raw leachate conducted? · Frequency · Items of analysis ·					
	Does the direct discharge of raw leachate to outside occur? · Extent · Duration · Impact					
	If the leachate is discharged after treatment, Is the quality of effluent analyzed? · frequency · analyzed item					
	If the leachate is discharged after treatment, Doe the quality comply with the standards?					
Overall comment						

Other observation / (Immediate) Action is Required on;
Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

4. Landfill gas management

4.1. Introduction

Major component of landfill gas are methane and carbon dioxide, and it contains trace odorous substance and volatile organic compounds. As for the landfill gas, issues can be listed as follows;

1) Flammable and explosive methane may migrate through waste layer by pressure increase and then it may be emitted at certain location of the site. This may result in fire or explosion.
2) Landfill workers on site may be harmed by toxic gases contained in landfill gas. This issue is limited only to the location close to the dumping yard. It is thought to be quite rare that these gases move across the site boundary. So, it seems to be not necessary to manage these gases outside the site.
3) This is similar to the issue explained in 1). Landfill gas migrates through underground within site's premise and accumulates in the building or underground structure, then causes explosion or threaten worker's health.

A necessary management strategy to each event is shown as follows. The audit objective is to evaluate whether these management is executed.

4.2. Control of gas pressure

In anaerobic landfill, especially methane and carbon dioxide are generated actively. If no gas vents/gas collection system are installed and permeability of soil cover is low, there is no destination for landfill gas generated then it accumulates and causes pressure rise. By this elevated pressure, landfill gas may migrate by passing through various routes and may consequently be emitted to the atmosphere at the certain point at where pressure can be easily released. At such point, perhaps, concentration of methane may become high and it may reach the explosion limits. In order to avoid the risk of explosion, such uncontrolled gas release should be properly prevented.

Most effective measure for this event is to install gas vents/gas collection system. There are two kinds of gas vents/gas collection system; i.e., active and passive. The passive gas vent/gas collection system collects and releases landfill gas based on the pressure gradient. The landfill gas accumulated inside landfill tends to move through least resistance part of the waste layer. Hence, if the perforated pipe or trench filled with pebble is installed in such layer, gas flow occurs through the pipe/trench smoothly. The gas flowing through the pipe/trench is finally gathered at exit of the system and it is treated by flare. On the other hand, active gas collection utilizes vacuum device that is attached at the outside edge of collection system.
However, even if the gas vents/gas collection system are installed, landfill gas can be released fugitively from the surface as long as the permeability of soil cover is high enough and the efficiency of gas vents/gas collection system is not enough. In order to confirm whether they are not functioning, gas monitoring is necessary.

4.2.1. Methodology for confirmation

At first, installation of gas vents/gas collection system should be confirmed.
Then, in order to check the emission of landfill gas from the surface of the landfill, several methodologies/equipments can be used such as;

- Walk over survey with gas detection device (methane gas detector)
- the closed static chamber technique for the monitoring points on grid layout
- Sampling of gas and analysis by gas chromatography
- Measurement by laser methane detector
- Recently, it is reported that thermography can also be used to detect methane emission from the landfill surface by analyzing increase of temperature due to methane oxidation.

4.2.2. Evaluation

First evaluation can be done by confirming the installation of gas vents/gas collection system.
Then, detailed evaluation on the condition regarding gas emission control can be done by identifying methane gas release from the surface.
Although the installation of gas vents is recommended for controlling the migration of landfill gas, it is not obligatory.

4.3. Toxic gas for workers

Most important toxic gas contained in landfill gas is hydrogen sulfide. Toxicity of hydrogen sulfide is indicated in Table 4.1. Since hydrogen sulfide is heavier than atmospheric air, it tends to accumulate in the underground structure or lower area. It shows toxicity from very low concentration. And chance of exposure is high for on site workers. Therefore, workers should have enough knowledge about this gas, especially regarding its characteristics and dangerous area. Also, it is important to instruct workers to carry the portable gas sensor. Special attention must be paid at the dumping area because gas emission is active at there. The impact of toxic gas is instantaneous. So, all time monitoring should be done. It is not periodical monitoring.

Table 4.1 Toxicity of Hydrogen sulfide (H_2S)

Concentration (ppm)	Symptom
0.0005 - 0.025	Threshold of humans the sense of smell
0.06	Clearly the smell can be felt (rotten egg smell)
1–5	Strong unpleasant smell
5	Limit value set by Industrial Safety and Health Law in Japan
10	Threshold limit value (TLV) set by ACGIH
10 - 20	Threshold for eye irritation
50 - 100	Serious eye damage
150 - 250	Loss of olfactory sense
320 -530	Pulmonary edema with risk of death
530 1000	Strong central nervous system stimulation
over 1000	Immediate collapse with paralysis of respiration

4.3.1. Methodology

By using portable gas detector, gas concentration should be monitored all the time when workers stay closed to the dumping area of when they works in enclosed space.

4.3.2. Evaluation

The criteria to be managed as a working environment are shown in Table 4.2.

Table 4.2 Trigger level of dangerous/toxic gas for the working environment

	Gas components	Regulation value
Oxygen deficiency	O_2	More than 18%
Explosion risk	H_2	Less than 1.2%
	CH_4	Less than 1.5%
Toxic	H_2S	Less than 10 ppm
	CO	Less than 50 ppm

The evaluation is done with regard to the following;

- ✓ Is the monitoring of hydrogen sulfide or other toxic gas performed at the working face, regularly?
- ✓ Are the workers informed about the risk of hydrogen sulfide?
- ✓ Is the working face controlled so as to not accumulate toxic gases?
- ✓ Is the waste containing sulfate such as gypsum board excluded from the acceptable waste?

4.4. Explosive/Toxic gas control in the premises of the site

It is possible for the landfill gas to accumulate in the building and structure constructed in site's premise, since moving distance of landfill gas is short. Thus, periodical monitoring of inflammable/explosive gas (methane) and toxic gas must be conducted at the office building, warehouse, drainage ditch, culvert etc.

4.4.1. Methodology

- Target gases for measurement are methane and hydrogen sulfide.
- Periodical monitoring on these gases are necessary. Measurement can be done by using the portable gas sensor or gas detection tube.
- The monitoring should be conducted for the place where gas stagnates easily.

4.4.2. Evaluation

- At first, the fact on the execution of regular monitoring should be confirmed.
- The trigger level, which is the value for alert, is 1.5% for methane and 10ppm for hydrogen sulfide. Thus, the management condition is evaluated based on whether the concentration of these gases exceed trigger level or not.

4.4.3. Mitigation measure

- If the concentration of these gases exceeds the trigger level, immediate ventilation is necessary. Also, investigation of the cause is also important.
- In addition, if the route of the gas migration is made clear, equipment for ventilation should be installed for possible route such as ditch and culvert.

4.5. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Control of gas pressure	Installation of gas vents/gas collection system for landfill gas management					
	Condition of fugitive gas emission from the surface Well managed (less release)=satisfactory Un controlled=Unsatisfactory					
Toxic gas for workers	Is the monitoring of hydrogen sulfide or other toxic gas performed at the working face, regularly?					
	Are the workers informed about the risk of hydrogen sulfide?					
	Is the working face controlled so as to not accumulate toxic gases?					
	Is the waste containing sulfate such as gypsum board excluded from the acceptable waste?					
Explosive/Toxic gas control	Is the regular monitoring executed?					
	The level of methane at highest location.					
	The level of hydrogen sulfide at highest location					
Overall comment						
Other observation / (Immediate) Action is Required on;						
Site Operator's Comments:						
Samples Taken: Yes/No						
Photographs Taken: Yes/No						

5. Routine inspection and maintenance

5.1. Introduction

Appropriate functioning of each facility and equipment is essential for the total function of landfill. In order to secure their integrity, routine inspection and maintenance are indispensable. The items and frequency of routine inspection must be set depending on each facility and equipment. If any unusual situation occurs, appropriate measures must be taken according to the degree of the abnormality.
In this section, the routine inspections are described for the following facilities and equipment.

1) Waste retaining structure,
2) Leakage prevention system (lining system),
3) Leachate management system (including leachate collection and removal system, storage pond, recirculation system, and treatment facility)
4) Storm water collection and drainage
5) Gas collection system
6) Other facilities

5.2. Waste retaining structure

For the waste retaining structure, purposes for inspection are the followings;

- ✓ taking effective measures promptly for the damage caused by landfilling operation,
- ✓ immediately identifying damage (erosion, slides, etc.) of the structure, cracking and subsidence of the foundation.

Especially, inspection must be performed when abnormal natural disaster event occurred such as earthquakes and torrential rain. If any deterioration is confirmed, maintenance/repairing must be scheduled as soon as possible.
Inspection items and frequency are different by the structure. In general, these items and frequency are recommended as follows;

Concrete dam

ID	Inspection item	Frequency	Methodology
1	Seepage of leachate	daily	visually
2	Cracks and chipping of concrete	Daily	Visually
3	out of alignment	Daily	Visually
4	Corrosion of reinforcing	Daily	Visually
5	Buckling	Daily	Visually
6	Settlement	Monthly	Subsidence meter/Survey
7	Slippage	4 times per year	Survey

Earth fill dam

ID	Inspection item	Frequency	Methodology
1	Plant (incl. Weeds and grass) growth	Weekly	Visually
2	Accumulation/deposition of soil	Weekly	Visually
3	Seepage of leachate from slope	Weekly	Visually
4	Cracks	Weekly	Visually
5	Expansion of structure	Weekly	Visually
6	Settlement	Twice/year	Subsidence meter/Survey
7	Erosion of slope	Weekly	Visually
8	Slope failure	Weekly	Visually
9	Scouring	Weekly	Visually
10	Buckling of the slope	Weekly	Visually
11	Subsidence of foundation	Twice/year	Subsidence meter/Survey
12	Collapse of foundation	Weekly	Visually

5.3. Leakage prevention system (lining system)

Leakage prevention system (Lining system) is regarded as one of the most important system among the various systems in the landfill because it protects both surface and groundwater and conserves environment by preventing leachate leakage. It also prevents intrusion of groundwater from outside. Major cause of the deterioration of the system are; failure and collapse of foundation, natural deterioration effect (temperature, oxidization, freeze/thaw, etc.), physical stress, chemical deterioration, effects of the activity of fauna and flora, landfilling work, etc. Inspection is possible when the liner isn't covered by the waste. But, it becomes difficult after landfilling operation is commenced.
Recommended items for inspection and frequency are as follows;

ID	Inspection item	Frequency	Methodology
A	When the liner is exposed		
A-1	Deposition of waste and earth and sand on the liner	Daily	Visually
A-2	Crack and fracture	Daily	Visually
A-3	Holes and depression	Daily	Visually
A-4	Stripping, failure (on slope)	Daily	Visually
A-5	Deterioration	Daily	Visually
A-6	Buckling, swelling	Daily	Visually
A-7	Dissolution	Daily	Visually
B	After cover soil is implemented		
B-1	Propagation of crack and depression	Daily	Visually
B-2	Springing of groundwater, gas extravasation	Daily	Visually
B-3	Lifting of cover soil	Daily	Visually
B-4	Stripping, failure (on slope)	Daily	Visually
C	Under the waste		
C-1	Leachate quantity and quality	Refer to section 3.	Refer to section 3.
C-2	Groundwater quantity and quality in monitoring well	Refer to section 8.3.	Refer to section 8.3
C-3	Depression and failure of landfill surface	Daily	Visually

5.4. Leachate management system (including leachate collection and removal system,

storage pond, recirculation system, and treatment facility)

Leachate management system is comprised of leachate collection and removal system (LCRS), leachate storage pond, leachate treatment facility (LTF), etc. The required functions of them are; prompt collection and drainage of leachate from landfill to avoid leachate building up inside, transporting of leachate to each facility, and the treatment of the leachate. If any trouble such as blockage, clogging etc. occurs in LCRS, leakage is triggered from the retaining structure or landfill body due to the hydraulic pressure increase inside landfill by leachate storage. If any collapse and breakage of the pond structure happens, it leads to the leakage of leachate to the environment. And if any trouble happens in the LTF, it results in deterioration of the quality of effluent. Hence, inspection and maintenance of these facilities are crucial.
Major inspection items and frequency of these facilities are as follows;

ID	Inspection item	Frequency	Methodology
A	Leachate collection and removal system (incl. Re-circulation system)		
A-1	Crack/collapse/smash of the pipe	Weekly	Visually/Sewer Pipe Camera
A-2	Clogging/incrustation/scaling of the pipe	Weekly	Visually/Sewer Pipe Camera
A-3	Leakage at the joint part of the pipe network	Weekly	Visually/Sewer Pipe Camera
A-4	Wash out of protective sand/soil	Weekly	Visually (only before it covered)
A-5	Blocking in valve system	Weekly	Visually/Sewer Pipe Camera
B	Leachate storage pond		
B-1	Integrity of lining (hole, collapse, breakage, etc.)	Daily	Visually
B-2	Level of leachate (within controlled level)	Daily	Visually
B-3	Deposition in pond (amount of sediments)	Daily	Visually
B-4	Form/Bubble (abnormal forming)	Daily	Visually
C	Leachate treatment system (***if installed***)		
C-1	Proper operation mode (by checking operation parameters; temperature, pH, DO, MLSS, SVI, Turbidity, odor, etc.)	Daily	Checking of each parameter by measurement apparatus.
C-2	Quantity of leachate	Daily	Recorded data
C-3	Quality of treated leachate	Daily	Refer to section 3

5.5. Storm water collection and drainage

Storm water collection and drainage system collects and drain the storm water outside to avoid its inflow to the site and contributes to prevent increase of leachate quantity. If the system doesn't work properly, floodwater is possible to enter the landfill and creates serious condition regarding leachate management.
Generally, the following items and frequency are recommended for routine inspection;

ID	Inspection item	Frequency	Methodology
1	Collapse/damage/deterioration of each drainage ditch/culvert	Monthly	Walk over survey and visual inspection
2	Deposition of earth and soil in ditches	Monthly	Walk over survey and visual inspection
3	Clogging/blocking	Monthly	Walk over survey and visual inspection
4	Occurrence of leakage and spring water	Monthly	Walk over survey and visual inspection
5	Growth of plant/weed/grass	Monthly	Walk over survey and visual inspection

5.6. Gas collection system

The function of gas collection system is to collect landfill gas inside and reduce the pressure of the gas developed in waste layer. If the system loses its function by certain damage, the gas pressure increases and it leads to uncontrolled landfill gas release from various location. Hence, routine inspection and maintenance is significant. The followings are general inspection items and frequency.

ID	Inspection item	Frequency	Methodology
1	Collapse of gas vents/gas well/gas pipes	Weekly	Visually
2	Clogging of the vents/well/pipe	Weekly	Visually

5.7. Other facilities

As for other fundamental facilities, the following routine inspections are recommended.

ID	Inspection item	Frequency	Methodology
A	Weighing facility		
A-1	Function of weight bridge	Daily	Manual check of function
A-2	Data recording system	Daily	Manual check of function
A-3	Checking on mechanical part (Loosening of bolt, deformation of materials, etc.)	Daily	Manual check of function
A-4	Calibration of the weigh bridge	Twice / year	Calibration agency
B	Vehicle washing facility		
B-1	Function of washing facility	Daily	Manual check of function
B-2	Deposition of mud/soil	Daily	Manual check of function
B-3	Water supply	Daily	Manual check of function
C	Road		
C-1	Waste scattering	Weekly	Visually
C-2	Hole, depression, cracks	Weekly	Visually
C-3	Failure of road shoulder	Weekly	Visually
C-3	Dust	Weekly	Visually
D	Fence		
D-1	Breakage failure of fence	occasionally	Visually
D-2	Catching the waste on the fence	occasionally	Visually
E	Gate and notice board		
E-1	Normal function of the gate	occasionally	Manual check of function
E-2	Condition of the notice board	occasionally	Visually

5.8. Checklist

Items for confirmation	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Is the routine inspection (1-7) of the waste retaining structure (in case of concrete dam) conducted appropriately?					
Is the routine inspection (1-12) of the waste retaining structure (in case of earthfill dam) conducted appropriately?					
Is the routine inspection (A-1 to C-3) of the leakage prevention system (lining system) conducted appropriately?					
Is the routine inspection (A-1 to C-3) of the leachate management system conducted appropriately?					
Is the routine inspection (1 to 5) of the storm water collection and drainage system conducted appropriately?					
Is the routine inspection (1 to 2) of the gas collection system conducted appropriately?					
Is the routine inspection (A-1 to E-2) of the other remaining facilities conducted appropriately?					
Overall comment					
Other observation / (Immediate) Action is Required on;					
Site Operator's Comments:					
Samples Taken: Yes/No					
Photographs Taken: Yes/No					

6. Safety

In landfill, various accidents are possible to happen because of the characteristics of the landfilled waste. Thus, to prevent the accidents, appropriate facility maintenance, education of the workers, and work safety management should be implemented on a routine basis. Besides, to secure the safety of labors, various necessary safety equipments should be provided to them and also the facility should equip necessary units that are utilized at the emergency and accidents. The accidents that may happen at the landfill site are considered to be as follows;

- ✓ Fire by flammable gas
- ✓ Oxygen depletion on workers by inhalation of landfill gas
- ✓ Occupational hazard by dust during landfilling operation
- ✓ Traffic accident by vehicle and heavy equipment
- ✓ Fall accident because of work at a high place
- ✓ Facility breakdown and the discharge of waste by natural disaster
- ✓ Personal injury due to contact with the dangerous waste

6.1. Management of working environment

Working environment in landfill is not desirable circumstances because it is affected by weather condition and workers are exposed to various unfavorable factors (exhaust gas and landfill gas). Moreover, they are required to work at the dangerous place such as high place and the enclosed space in which oxygen depletion may occur. Thus, working environment has to be always kept under surveillance by staffs in the site. And all landfill workers must endeavor to care on health impact caused by the work and to prevent accident. Necessary measures are listed as follows;

- ✓ Recognition and compliance with law and regulation regarding the industrial health and safety
- ✓ Satisfactory supply of protective equipment and enforcement of the use of them (working clothes, helmet, dust mask, safety shoes, gloves, goggles, safety belts, etc.)
- ✓ Confirmation of flammable/toxic gas in working environment by detection device
- ✓ Setting up own rules on the working environment (limit value on gas concentration, etc.), and survey and control of them
- ✓ Installation of sanitation equipment for workers such as (eyewash, shower, emergency drug, etc.)
- ✓ Management of the various chemical agents used in the facility and instruction of care on them
- ✓ Training of first aid, lifesaving, and to establish an emergency response system.
- ✓ Regular health check

The following table shows general limit value on the working environment.

Incident/phenomena	Items should be controlled	Limit value
Oxygen depletion	Oxygen concentration	More than 18%
	H_2S concentration	Less than 10 ppm
Flammable gas	Hydrogen gas	Less than 1.2%
	Methane gas	Less than 1.5%
Toxic gas	CO gas	Less than 50 ppm
Odor	Ammonia	1~5ppm
	methyl mercaptan	0.002~0.01 ppm
	Hydrogen sulfide and other odor	0.02~0.2 ppm
Other	Vibration	55~65 db
	Noise	45~70 db

6.2. System and program for emergency response

In preparation for the emergency event or natural disaster, to prepare communication regime from normal times and to take proactive measures such as regular training are necessary. If the event of an accident or natural disaster occurs, responding to it must be done promptly. Also, it is always necessary to take measures to prevent recurrence of similar accidents.

Proactive measures;

To convey accurately and promptly the contents of the accidents/disasters that have occurred, a framework for communication should be put in place from normal times. Contact address includes the licensing authority, police, fire department, hospital, etc. Contact content are primarily, when, where, who, why (reason), what happened (the results). And the procedure of these contact contents should be prepared beforehand. In the event of an accident, an emergency lifesaving situation affecting a human life sometimes happens. To respond to the need for emergency treatment, in advance, the training of emergency measures must be implemented.

If event of an accident happens;

When the accident occurs, to report the situation promptly to relevant organizations is important. Also to perform quick appropriate measures is necessary. After the event, to draw up measures to prevent recurrence should be done based on in depth investigation of the cause.

6.3. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Management of working environment	Compliance with law and regulation related to the industrial health and safety					
	Supply protective equipments to the workers and enforcement of their use					
	Confirmation of dangerous gas at working area					
	Setting up the rules on the working environment					
	Installation of sanitation equipment					
	Instruction on hazards of the chemical agent used in the site					
	Training of first aid lifesaving, etc.					
	Regular health check of workers					
System for emergency response	Preparation of contact address list on the emergency event					
	Preparation of the procedure of contact contents					
	Training of workers for emergency response					
	Plans for prevent reoccurrence of the accident					

Overall comment
Other observation / (Immediate) Action is Required on;
Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

7. Littering and Vector

7.1. Littering

Municipal waste is generally collected by plastic bags and the bag is easily scattered after it is disposed of into landfill. Scattering occurs on not only plastic bags but also many other light objects, such as paper, container, plastic films etc. If they are scattered around site, they create bad impression to the site from resident and also they make resident unpleasant. Thus, it leads to the complaints from residents. Sometimes, scattering of the waste also causes the clogging of water course or drainage ditch outside landfill. Therefore, appropriate management for preventing the scattering of waste is indispensable.
The scattering of waste (also called "littering") depends on wind strength and direction, condition of waste filling operation. So, the countermeasure depends on these conditions. The main mitigation measure to minimize littering is the prompt covering of the waste after the waste is dumped. However, even though the placement of cover soil is conducted properly, sometimes light waste may be blown away from the tipping area in windy day. In such case, use of litter screen is recommendable. The screen is placed around the tipping area in order to trap the waste. The area of working face should be minimized as much as possible and the portable screen should be emplaced as it enclosing the area. In addition, daily inspection and cleaning of the site's perimeter should be executed by the special employee who is assigned especially for the littering.

Evaluation
There are no concrete numerical criteria for littering. Therefore, the condition of littering management cannot easily be evaluated numerically. Hence, this management should be done based on the best management practice concept. It means that no litter from the landfill reaches beyond the boundary of the premises.

7.2. Vector

Vector is including birds, flies, mosquitoes and other unfavorable insects, rodents and other animals. These birds, insects, and animals are attracted to the landfill because in waste landfill, there are foods for them and also there are many places at where they prefer to breed. They cause various problems. Most serious issue is they transfer various kinds of deceases to human and others. Other issues are noise, aesthetic impacts to site, interference of landfill work, nuisance, etc. Therefore, countermeasure to prevent their breeding and settlement in site should be taken.
Concrete measures for the vector are; appropriate implementation of daily cover soil; eliminating the water pools in the site; use of insecticide and pesticide; setting the traps; use of sound device to threaten birds and animals; physical barriers such as the prevention nets, etc. Beside, to ask professionals on pest control is

also effective measure.

Evaluation

With regard to vector, it is difficult to set concrete numerical criteria by which the condition of landfill management is assessed. Therefore, auditing of this matter should be done based on the status of implementation of various measures mentioned above and occurrence of resident's complaints.

7.3. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Littering	·Littering is properly controlled.					
	·Cover soil is promptly placed to prevent littering					
	Some measure (e.g. litter screen, etc.) is taken.					
	There is special employee for inspection and cleaning of the litter at the peripheral of the site.					
Vector	Are there serious vector issue happening?					
	There are a lot of birds out there.					
	Flies and mosquitoes are heavily infested.					
	Daily soil cover is placed properly.					
	Water pool in the site is eliminated.					
	Some measure to rid of the birds/animals is taken.					

Overall comment
Other observation / (Immediate) Action is Required on;
Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

8. Environmental monitoring

8.1. Introduction

Major purpose of the landfill environmental auditing is to confirm that there is no negative impact caused by the landfill operation. In this section, proper monitoring procedure, frequency, and evaluation regarding the followings are described.

- ✓ Landfill gas
- ✓ Leachate leakage (groundwater)
- ✓ Surface water
- ✓ Air
- ✓ Odor

8.2. Migration of landfill gas

8.2.1. Purpose

Subject in this section is methane. Other trace odorous substance is discussed in another section. Most important environmental impact regarding landfill gas is the migration of methane and resulting explosion/fire. Special care must be taken for anaerobic landfill because much methane is generated for a long term.

Methane emitted to the atmosphere diffuses rapidly and it is diluted greatly, so the problem is not so significant. Problematic event is the migration of the gas to outside environment passing through underground. Fundamental cause of this event is increase of the pressure inside landfill. Basically the bottom and slope of landfill is lined. However, if the liner is broke or clack is developed in the clay liner, gas migration becomes possible.

The base of the landfill in this region is comprised of mainly bedrock such as limestone, marlstone, etc. But it is reported that the fissure and fracture are developed in such bedrock. Therefore, gas migration through these fissure and fracture is highly possible. Since generation of methane continues for long time, enough monitoring is necessary.

8.2.2. Method and Frequency

- Recommendable monitoring method is to install several gas monitoring wells outside the lining system and conduct monitoring of their gas composition regularly.
- Measurement of methane gas only is enough.
- Frequency should be every three months.

8.2.3. Evaluation

- Trigger level is 1.5%.

・ Monitoring results should be recorded and kept for summarizing annual report.

8.3. Leachate leakage

8.3.1. Purpose

Sanitary landfill equips liner to prevent leachate leakage. So, basically, leachate leakage to underground is minimized as much as possible. However, in order to secure enough environmental safety, occurrence of groundwater pollution must be monitored. Especially, because groundwater is precious water resources, it must be conserved.

It is reported that there are two major aquifers in Palestine. Both aquifers are very deep and approximate depth of upper and lower aquifer is over 100m and 300m, respectively, although it depends on the area. Groundwater is recharged at the mountainous area at where the aquifer crops out. Based on the past report, both aquifers are karstified and have many fissure and fracture so that hydraulic conductivity is relatively high. Some studies suggest that infiltrated water can reach the water table within one year. Based on this information, it is highly possible that leachate eventually reaches to the groundwater, if it leaks from landfill. However, without in depth information regarding underground structure and groundwater flow regime, it is hard to know which underground path the leachate flows through, even if it leaks from the bottom of the landfill.

Besides, the results of water quality analysis on the groundwater obtained from various wells in Palestine indicate obvious deterioration of its quality by excessive use of fertilizer/pesticide, discharge of sewage and wastewater to wadi. This implies that groundwater has already affected by human activity even if the depth of it is very deep.

Generally, groundwater monitoring well is installed at the upstream and downstream vicinity of the landfill, assuming that the groundwater table exist at the depth of several tenth meter. This configuration is established from the intention to detect the influence of leachate as soon as possible.

It is not certain whether the detection of influence by leachate is possible or not, if the monitoring well is too deep like more than a hundred meter or the well is far apart from the landfill by horizontal direction. Especially, identification of leachate influence seems to be very difficult at where various human activities exist and wastewater is released into wadi.

8.3.2. Method and Frequency

At present, to propose optimum groundwater monitoring procedure, which can demonstrate influence of the leachate on groundwater, is not possible.

Therefore, it is necessary to continue to analyze the groundwater obtained from the wells that are existing in the vicinity of the landfill, as well as the means that has been done up to now. It is necessary to accumulate data, and to keep them as the precious information for the future analysis. It is recommendable to set up the wells both at upstream and at downstream of the groundwater flow, respectively, if installation of such additional wells in the vicinity of the site is possible.

As for the frequency of the sampling and the analysis of underground water, once or twice in a year are recommendable.
Items shown in Table 3.3 and 3.4 are suitable for analysis to distinguish the deterioration of groundwater..

8.3.3. Evaluation

When confirmation of no impact on groundwater is requested, Table 3.3 and Table 3.4 can be helpful. But, in many cases, it seems that upper aquifer has already affected by human activities.
The reference values on the deterioration of the groundwater are shown in Table 3.3 and Table 3.4. When the observed value exceeds these values, the groundwater is regarded as contaminated and it may be possible to influence human health.
However, because there is a variety of a pollutant source, it is necessary to identify the obvious source. And the auditing should be done based on whether the landfill is thought to be a source or not on.

8.4. Impact on surface water

8.4.1. Purpose

In Palestine, there is no perennial surface water (river). Here, there are temporary streams called "wadi", which is ephemeral and intermittently appears only during rainfall. A part of the water flowing into wadi evaporates, and the other part is infiltrates from its bed and recharges the groundwater. If the leachate after treatment is discharged into surface water (or wadi), its influence should be evaluated. On the other hand, even if there is no regular discharge because of no treatment facility, occurrence of accidental discharge should be confirmed.

8.4.2. Method and Frequency

- If water can be obtained when the stream is appearing in wadi, to sample water upstream and downstream is preferable. For this purpose, sampling point should be determined beforehand. If there is identifiable effluent from the site, water sample is taken from the point.
- Basically, sample should be analyzed in terms of chemicals listed in Table 3.2. However, if necessary, the items indicated in Table 3.3 and 3.4 may be analyzed.

Alternative methodology

- Sampling of the sediment of Wadi after the rainfall is thought to be a means to confirm the influence of the landfill. This is because it deemed that the history is preserved in the sediment even after the flow ceased.
- To distinguish from other emission sources and to identify the effect of the landfill only, it is necessary to take samples at two points upstream and downstream. Upstream sample must be such that is unaffected from landfills.
- In the analysis, air-dried sample is subjected to the leaching test (L/S=10 (mixing weight ratio of

distilled water and sample, Liquid to Solid ratio), shaking duration 6 hour at 200rpm under ambient temperature and pressure), then leaching liquid should be analyzed after filtrated by 0.45 um membrane filter.

・ As for the analysis, items listed in Table 8.1 are the candidate. If possible, TOC, T-N, Na, K, Mg, Ca, Cl, and oil (by n-hexane extraction) are thought to be helpful.

Table 8.1 Chemicals for analysis and its criteria on sediment analysis obtained at wadi

Chemicals	Criteria (less than below value)
Cd (Cadmium)	0.01 mg/L
As (Arsenic)	0.01 mg/L
CN (Cyanide)	Not detected
Total Hg (Total mercury)	0.0005 mg/L
Pb (Lead)	0.01 mg/L
Alkyl Hg (alkylmercuric compound)	Not detected
Hexavalent chromium	0.05 mg/L
PCB (Polychlorinated biphenyl)	Not detected
Dichloromethane	0.02 mg/L
Tetrachlorocarbon	0.002 mg/L
1.2-dichloroethane	0.004 mg/L
1,1-dichloroethylene	0.1 mg/L
cis-1,2-dichloroethylene	0.04 mg/L
1,1,1-trichloroethane	1 mg/L
1,1,2-trichloroethane	0.006 mg/L
Trichloroethlene	0.03 mg/L
Tetrachloroethylene	0.01 mg/L
1,3-dichloropropene	0.002 mg/L
Thiram	0.006 mg/L
Simazine	0.003 mg/L
Thiobencarb	0.02 mg/L
Benzene	0.01 mg/L
Se (Selenium)	0.01 mg/L
B (Boron)	1 mg/L
F (Fluorine)	0.8 mg/L

8.4.3. Evaluation

If water was analyzed, it can be evaluated by Table 3.2 (column "Groundwater recharge by infiltration" should be referred.)

If sediment is analyzed, the results can be evaluated by Table 8.1. In this case, comparison between upstream and downstream is more important to discuss the influence of landfill.

8.5. Air quality

8.5.1. Purpose

Particular air pollutants are not generated from landfill. Therefore, analysis of air sample obtained from landfill surface performed at present seems to be almost unnecessary. Moreover, even if the air pollutants are emitted from landfill, it rarely becomes a crucial problem, because they are promptly diluted by intense diffusion and mixing of air. If strict management is favored, the target substances for monitoring are volatile organic chemicals, CFC (chlorofluorocarbon), and a greenhouse gas, etc. However, the importance is not high.

8.5.2. Method and Frequency

Monitoring of specific air pollutants is not necessary at present.

8.5.3. Evaluation

Monitoring of specific air pollutants is not necessary at present.

8.6. Odor

8.6.1. Purpose

Various odor substances are emitted from landfill. These substances originate in waste disposed of and also they are generated from the reaction occurring in landfill. Most odors have offensive characteristics and affect life of residents if they diffuse from the landfill site. Sometimes it causes serious resident's complaints. Therefore, odor has to be managed in the landfill operation. And monitoring is crucial to achieve proper management of it.
The odor is mainly emitted from the working face and leachate pond. Major odorous substances in landfill are ammonia, hydrogen sulfide, methyl mercaptanm, dimethyl sulfide, and volatile fatty acid (Butyric acid and Valeric acid). The former four substances are generated from anaerobic biodegradation and VFA is generated by acid fermentation of waste, which occurs immediately after the waste is disposed of.

Concentration of these odorous substances should be controlled to the level below certain target value at the site's boundary. Odor can be expressed by odor intensity (Table 8.2). To mitigate odor issue, in general, maximum level of odor intensity at the boundary is lower than 2.5 or lower than 3.5. Which maximum value is favorable depends on the odorous substance and the site condition. So, maximum value should be determined by the site. But it must be set within the range between 2.5 and 3.5.

Table 8.2 Relation between odor intensity and human sense

Odor Intensity	Explanation
0	Odor Intensity
1	Smell that can barely be sensed
2	No smell
2.5	Weak smell that can be understood what it is.
3	(Middle between 2 and 3)
3.5	Odor easily sensed
4	(Middle between 3 and 4)
5	Strong smell
6	Very strong smell

8.6.2. Method and Frequency

Essentially, evaluation of odor should be done by the olfactory sense test method because odor strongly depends on human sense. In general, odor is the mixture of various odorous substances, and its intensity is magnified by mixing of the substance. Therefore, odor is reported to be not possible to evaluate properly by the instrumental determination of specific odor substance.

According to the official document published by UK Environmental Agency in 2011 [12], official method in EU is described "The standard method for measuring odor in Europe is Dynamic Dilution Olfactometry (BS EN 13725:2003). This involves diluting a grab sample in the laboratory to a point where each member of the panel can just begin to detect the odor. The result is the number of dilutions used when half of the panel can detect the odor. "

In case of Japan, similar methodology is applied. Olfactory sense method is designated as the official method. Several assessors sniff the diluted sample, which is obtained from grab sampling. And the dilution ratio that almost half assessors cannot detect the odor is provided as odor concentration. Thus, odor concentration of 1000 means the odor cannot be sensed when it is diluted 1000 times by odorless air. In other words, "odor concentration of 1 means the odor cannot be sensed even if it is sniffed directly. The sense of human doesn't linearly relate to the concentration of odorous substance. Rather, it is proportional to the logarithmic concentration. Hence, the odor concentration (dilution ratio) is converted into odor index, which is calculated by multiplying 10 to the logarithmic value of odor concentration. And this odor index is utilized for regulation. In Table 8.3, the relationship among odor intensity, odor concentration and odor index is indicated with regard to the regulatory value at site boundary.

The regulatory value (standards) of odor index has a range because the odor characteristics are different by odor substances and odor sources.

In general, odor index of 10-14 at the boundary of landfill as the regulatory value is common in Japan.

Table 8.3 Relationship among odor intensity, odor concentration and odor index

Odor Intensity	2.5	3.0	3.5
Odor concentration	10~32	16~63	25~126
Odor index	10~15	12~18	14~21

However, the olfactory sense test method requires many assessors who passed the authorized test and standard substance for such test is also necessary. The execution of olfactory sense test is relatively complicated procedure.

If it is difficult to conduct olfactory sense test, an alternative procedure is to use specific apparatus such as odor sensor. Various odor sensors are commercially available. They have their own gauge to indicate intensity of odor that is sensed but such gauge can be convertible to the odor index. Hence, the odor index can be measured much easily. However, the relationship between the gauge of the sensor and the odor index should be carefully calibrated. Similar method is to use a field dilution olfactometer which is also commercially available. In the guideline of UK Environmental agency introduced about this device that "This device can assist investigators in assessing the concentration of odors in ambient air. The investigator breathes filtered air through the device while they manually adjust the amount of unfiltered ambient air until the odor is just detectable. This results in a crude field measurement of odor concentration in dilutions to threshold. Some authorities use detection requiring more than 7x dilution to indicate unacceptable exposure”. Hence, if by using a field dilution olfactometer, 7 times dilution is regarded as the level of nuisance.

Odor substances are various and they are in general mixed. Hence, the instrumental measurement of odor is reported to be not satisfactory. And sometimes it cannot detect because the odor substance is trace even though human sense can perceive it.
However, major odor from landfill site can be categorized into two groups as described above. And their sources are also limited (i.e. leachate pond and working face). Therefore, if focusing on specific odor substance, measurement may become possible. In Table 8.4, relation between odor intensity and concentration of specific odorous substance is shown. By this table, limit value of each odorous substance at the boundary can be set.

Table 8.4 Relation between odor intensity and concentration of specific odorous substance

Odor Intensity	2.5	3	3.5
Odorous substance	Concentration corresponding to Odor index (ppm)		
Ammonia	1	2	5
Methyl mercaptan	0.002	0.004	0.01
Hydrogen sulfide	0.02	0.06	0.2
Dimethyl sulfide	0.01	0.05	0.2
Dimethyl disulfide	0.009	0.03	0.1
Trimethylamine	0.005	0.02	0.07
Propionic acid	0.03	0.07	0.2
Butyric acid	0.001	0.002	0.006
Valeric acid	0.0009	0.002	0.004
Isovaleric acid	0.001	0.004	0.01

Therefore, concrete methodology can be summarized as follows;

a. Olfactory sense test by using several assessors
b. Odor sensor
c. Field dilution olfactometer
d. Measurement by gas detection tube or another instrument

Measurement frequency

- Measurement at least weekly basis is recommendable. If complaints from residents are received, immediate measurement should be done.

8.6.3. Evaluation

Evaluation of odor should be done based on the Table 9.2 and 9.3. Limit value on maximum intensity should be determined by the site or competent authority from the range between 2.5 and 3.5. In general, when using olfactory sense test and odor sensor, odor index of 10-14 is recommendable for the limit value at the site's boundary.

Further recommendation for odor monitoring

In the guideline of UK Environmental agency (2011), monitoring procedures with the sniff monitoring report and the odor diary are also introduced. The sniff monitoring report is indicated in Table 8.5. It can be created by the observer walking over the site and recording the sniff felt by each location. Also, the odor diary is created by community member (residents), who is asked to record the condition of odor or to record by conducting walk over survey of the site. Example of odor diary is indicated in Table 8.6.

Table 8.5 Example of sniff monitoring report (created by modifying table (Odor report form) indicated in the guideline of UK Environmental agency (2011) [12]

Odor report form

Date					
Time of test					
Location of test e.g. street name etc					
Weather conditions (dry, rain, fog, snow etc):					
Temperature (very warm, warm, mild, cold, or degrees if known)					
Wind strength (none, light, steady, strong, gusting) Use Beaufort scale if known					
Wind direction (e.g. from NE)					
Intensity (see below)					
Duration (of test)					
Constant or intermittent in this period or persistence					
What does it smell like?					
Receptor sensitivity (see below)					
Is the source evident?					
Any other comments or observations					

Sketch a plan of where the tests were taken, the potential source(s).

Intensity 0 No odour 1 Very faint odour 2 Faint odour 3 Distinct odour 4 Strong odour 5 Very strong odour 6 Extremely strong odour Ref: German Standard VDI 3882, Part 14	Receptor sensitivity Low (e.g footpath, road) Medium (e.g. industrial or commercial workplaces) High (e.g. housing, pub/hotel etc)

Table 8.6 Example of odor diary (created by modifying form presented in the guideline of UK Environmental agency (2011) [12]

Name: Tel:	Address:		
Date of odour:			
Time of odour:			
Location of odour, if not at above address (indoors, outside):			
Weather conditions (dry, rain, fog, snow etc):			
Temperature (very warm, warm, mild, cold or degrees if known):			
Wind strength (none, light, steady, strong, gusting):			
Wind direction (eg from NE):			
What does it smell like? How unpleasant is it?			
Do you consider this smell offensive?			
Intensity – How strong was it? (see below 1-5):			
How long did go on for? (time):			
Was it constant or intermittent in this period:			
What do believe the source/cause to be?			
Any actions taken or other comments:			

Intensity

0 No odour	3 Distinct odour	5 Very strong odour
1 Very faint odour	4 Strong odour	6 Extremely strong odour
2 Faint odour		

8.7. Checklist

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Landfill gas	Is the monitoring of methane performed? · Frequency · Methodology · Data keeping					
	No abnormal methane concentration is reported.					
Leakage	Is groundwater monitoring performed? · Frequency · Methodology · Analyzed items					
	No abnormal concentration in groundwater is reported					
Surface water	Is the monitoring of surface water performed? · Frequency · Methodology · Analyzed items					
	Is the monitoring of wadi (sediment) performed? · Frequency · Methodology · Analyzed items					
	No abnormal concentration in surface water/effluent is reported					
	No abnormal condition on the sediment in wadi is identified					
Air	·"*Currently no monitoring item*"					
Odor	Are there complaints from residents? · The complaint is recorded? · Measures for them are taken?					
	Is the monitoring of odor conducted? · Frequency · Methodology					
	Is the monitoring data recorded?					
	Does any odor substance exceed the criteria at the boundary?					
	Or does odor index satisfy the criteria?					
Overall comment						

Other observation / (Immediate) Action is Required on;
Site Operator's Comments:
Samples Taken: Yes/No
Photographs Taken: Yes/No

Annex 9

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Annex-3

2017/03/14

Auditing report on Zahart Al Finjan landfill

Date of audit: March 15, 2017

Auditor: Yasumasa TOJO (JICA Expert), Eng. Yosrea Ramadan (Ministry of Local Government)

Person responded: Mr. Mohammad Al Sadi (Jenin JSC)

Purpose

In order to confirm the feasibility and appropriateness of the Guideline on the Environmental auditing of the landfill in Palestine created in 2017 under combined effort of MoLG (Ministry of Local government), LET (Local Expert) of several JSCs (Joint Service Council) in Palestine, and JICA (Japan International Cooperation Agency), auditing of the Zahart Al Finjan Landfll in Jenin district was conducted as a case study. Primal purpose is to confirm whether the items in each checklist added in each chapter is appropriate or not, and also to confirm that there isn't any estrangement between the requirement in the guideline and actual exercise conducted in the landfill site.

Methodology

The auditing was conducted as the form of the interview with face to face. The auditor asked each item in the checklist in the guideline and requested to the responder of the site to explain details on each items.

Results

Concrete results are summarized in the following tables of checklist. Comments from auditors and responder are also described.

Overall comment

1) Fundamental requirement of the landfill structure

   Most of the structures and equipments are designed and constructed so as to comply with the international standards. There are not notable issue regarding basic structure, at present.

   However, a serious issue regarding shortage of capacity of leachate ponds is arising. At the time of the design and planning, it was thought that even if there is just one pond, leachate can be managed satisfactory. Besides, it was expected that the quantity was thought to be able to be managed by promoting evaporation from pond and landfill surface through re-circulation.

   However, due to the unexpected amount of waste that drastically exceeds the planned value, the site cannot keep up the management of leachate with only one pond because of the moisture derived by the waste. Consequently, many emergent ponds were constructed in order to address the excess leachate generation. However, since some of these ponds are made in the temporary measure, adequate structure required for the leachate pond wasn't applied.

   Furthermore, the leachate which cannot be stored in these temporary ponds is overflowing from the site and is affecting the surrounding environment. If this condition is kept, these affected area by leachate will expand to much wider area. Thus, immediate measure is necessary to manage these leachate.

2) Landfill operation

As for the waste acceptance procedure, measurement of the waste mass, inspection of the load, correspondence to the unacceptable waste, etc are performed by satisfactory manner. Since composition analysis has been seldom conducted, periodical execution of it is recommendable.

In terms of waste filling operation, there are several problems. First, working area is too large. It should be made smaller if possible. Second, daily cover soil is insufficient. Every nuisance issues are caused by this work. Third, quality of cover soil seems to be not suitable. Soil material having more suitable quality (i.e. high moisture holding capacity, high adsorption capacity, finer particle size, etc.) to mitigate odor should be used.

However, all the problems are caused by the huge quantity of waste delivered daily. It becomes three times higher than the planned daily amount. The site seems to be reached to its limit to control the waste appropriately. The reason of insufficient daily cover soil is that the site can't keep up with its acquisition. Also, to get the suitable cover material, there seems to be financial constraints. If cover soil having suitable quality was acquired sufficiently and it is implemented properly, current nuisance problems would be drastically solved.

3) Leachate management

Estimation of leachate quantity was conducted by using meteorological data and site characteristics. Analysis of leachate quality is also done periodically.

However, as mentioned above, leachate quantity isn't controlled properly and discharge of it to the surrounding environment occurs especially in winter. Some countermeasure should be taken in order to get out of this situation. Site personnel understands the issue well and tries to tackle this difficult situation. Though possible means are; 1) to increase the capacity of the ponds, 2) to install liner to every pond, 3) to install some leachate treatment process and discharge it after treatment, all these measure require tremendous costs. This cost should be borne by waste generators.

4) Landfill gas management

Gas management system isn't installed yet. Its installation is planned after the installation of final cover. As consequence, fugitive gas release from the surface can be found elsewhere. Even if the gas management is regarded as future work, some measures for preventing gas explosion and pressure increase inside landfill cell should be better taken. Monitoring is one of the measure in them.

Beside, having a framework on gas detection at working place is highly recommendable, especially enclosed space.

5) Inspection and maintenance

Necessary inspections and maintenances on the structure and equipments are performed appropriately. At present, it seems there are no document regarding routine inspection and monitoring. Thus, preparation of the manual of them are recommendable.

6) Safety

Although necessary measures concerning safety are adopted with little problem, the detection system concerning gas is insufficient. I would like to recommend the introduction of a gas detection system to prevent accidents related to explosion and life of workers.

7) Littering and vector

The scattering of waste has occurred, it spreads to not only the inside of the premises and the fence but also out of the premises. This is due to insufficient covered soil. There is room for improvement.

As for the vector, vermin, and birds, insufficient soil covering allows also their proliferate. As for pests, it is dealt with by using insecticide in the summer, but it is necessary to tackle the cause of the occurrence.

8) Monitoring

Various efforts made for trying to grasp the impact to the environment from the site as much as possible can be inferred. Various monitoring for gas including odor, leachate, surface water, and groundwater has been conducted voluntarily. If it allows to comment, these monitoring should better be done on a regular basis.

As for the gas monitoring, toxic or explosive gas should be focused on. They can be monitored by simple handheld detector. Voluntary analysis of surface water in wadi in storm event can be highly evaluated. In order to monitor the odor, there is simple olfactory method which can be performed by site personnel. Adoption of such simple method is recommendable.

Summary

In this landfill, there are several serious problems occurring.

The first problem is that the amount of leachate exceeds the planned value, making it impossible to manage. The clear cause is that daily amount of waste carried in far exceeds the predicted value at the design stage, and the increase of the leachate quantity is caused by the moisture derived from the waste. Because of the large amount of waste, covering of it by soil becomes insufficient so that eventually it allows rainwater to infiltrate to the waste layer, especially in winter. This rainwater intrusion also contributes to the increase of leachate further. At the time of designing, it was estimated that only a single pond is needed and furthermore it was judged that the leachate can be managed by evaporation. This judgment in design unfortunately resulted in the current condition in which a part of leachate overflows the site.

By the desperate effort done by landfill personnel for dealing with leachate, a number of emergency ponds were constructed. As consequence, the impact has been kept to a minimum. But essentially, drastic remedial measures are still needed. For additional measure, it seems to necessary to add emergency ponds with leak proof, to construct a leachate treatment process intended to release the treated leachate to wadi, and to introduce a pump to enhance leachate recirculation.

The second problem also comes from the high amount of waste. Since waste of about 3 times the planned amount is carried in everyday, the landfill working face has to be widened, and sufficient covered soil can not be implemented for such wide working face properly. As a result, the problem of nuisance on the surface becomes extremely serious. Odor also comes from this situation. Thorough covering is the most fundamental exercise of sanitary landfill. Besides, limestone collected from the surrounding ground is used as covering material at present. But it can hardly expect the reduction effect of odor. Thus, it is desirable to adopt soil covering that is more likely to have a deodorizing effect. However, additional costs will also be incurred for the introduction of such alternative coverings.

If it is difficult to reduce the amount of waste to be delivered, financial support for the implementation of soil covering and leachate treatment should be provided sufficiently. At this landfill, unexpected situations different from the design stage are occurring, so it is natural that the site becomes to be struggling to respond it. Since the essential cause is overwhelming quantity of daily waste, generators (i.e. general public) should also be responsible together for this situation and should pay a reasonable cost.

1) Checklist (Fundamental requirement of landfill)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Basic infrastructure	Fence ·The height of the fence. ·Unclimbable structure ·Enclose the territory completely	✓				Height of the fence is 2m. It completely surrounds the site boundary. If the breakage is found, it is immediately repaired.
	Site notice board ·Installation ·Information provided	✓				
	Site access road ·Width of the road ·Pavement and dust condition ·Access sign	✓				The access road has enough width (10m). It is paved by asphalt. In summer, water spray is performed to prevent dust.
	Weighing system ·Installation of the weighbridge ·The staff's arrangement at acceptance	✓				Installed. Three staffs are allocated. Three shifts system is employed. All the data measured by the weigh bridge is recorded electronically.
	Road inside the landfill ·Construction ·Quality (strength, dust prevention)	✓				There are peripheral road and delivery way comprised of coarse pebbles inside the site. Enough strength for vehicle running is provided.
	Wheel washing facility ·Installation	✓				Installed.
	Office	✓				There are three-storied office buildings.
	Warehouse	✓				Exists.
	Stockyard for cover soil ·Quantity of the soil stocked	✓				Depending on the season, location of the stockyard changes. Current yard has 100m^2 of the area.
	Inspection yard and quarantine place ·Existence ·Location/Condition ·Capacity for temporary storage	✓				Inspection of the waste is conducted at the tipping face. This location was selected in terms of the easiness of inspection because all the waste carried in is dumped at the tipping yard.
Fundamental facility required for MSW landfill	Leakage prevention system (Liner) ·Installation ·In conformity to standards ·	✓				The liner comprised of clay and geomembrane was installed. The specification of the liner complies with the international standards.
	Waste retaining structure ·Installation ·Robustness (not collapse) ·No erosion and cracks ·	✓				There are some embankments inside landfill. They are already covered by waste.
	Leachate collection and removal system (LCRS) ·Installation ·	✓				Installed. There are several cells in this landfill. Leachate collection pipes are installed in each cell as passing through completely the cell.
	Gas collection/ventilation system ·Installation ·			✓		Not installed. According to the design and plan of this landfill, gas collection system would be to be installed after the implementation of the final cover.

	Storm water collection and drainage ·Upstream diversion ditch ·Peripheral drain ditch ·Drainage ditch on the closed cell ·Drainage ditch in unused section ·Storm-water reservoir	✓				There are several storm water drainage ditches. The primal one is located at the side of the access road. Besides, temporary ditches to remove rainwater are installed inside the site. <The problem is separation of the storm water from leachate is insufficient, especially, ditches inside the site. In these ditches, leachate mixed with storm water flow. Because of the current site structure and the progression of cell construction, complete diversion of storm water seems to be difficult. However, if the soil cover is installed more completely, their diversion may become possible.>
	Leachate Management facility					
	Leachate storage pond ·Capacity ·Bottom lining ·Installation of the fence		✓			There are several leachate ponds. Based on the design, only one pond was necessary. However, waste exceeding its designed quantity has been delivered to the site and its results in the generation of leachate that is far over the estimated value. Thus, the site needed to construct new leachate ponds one after another. Some ponds have impermeable sheet as its liner. However, there are some ponds that don't have sheets. This can be said for the fence around the pond, too. In winter, the capacity of the pond is still less. As consequences, uncontrolled discharge of the leachate (overflow of the leachate from the site) occurs.
	Leachate recirculation network(Not necessarily required depending on the site structure) ·Installation ·Functioning			✓		The site doesn't have the complete leachate recirculation system. Leachate recirculation is performed by using tanker truck. At some location (upper area of site), re-circulation is conducted by using pump and hosepipe from 2nd leachate pond. Since they are not complete system, this inquiry is inappropriate to this site.
	Leachate treatment facility(Not necessarily required here)			✓		Leachate treatment system isn't installed in this site, yet.
	Monitoring facility					
	Leachate monitoring well (borehole inside landfill)			✓		No leachate monitoring well is installed. One manhole is installed at the edge of the site. It was installed to inspect leachate leakage by collecting groundwater passing below the liner. Thus, since this manhole is useful to detect leachate leakage, periodical monitoring is recommendable.
	Landfill gas monitoring well/pipe (borehole inside landfill)			✓		No gas monitoring well is installed. Installation of the gas collection system is planned after final cover is implemented.
	Groundwater monitoring well			✓		There are no groundwater monitoring well specifically intended for this site. However, there is a domestic well at the vicinity of the site. The depth of the well is approximately 300m. Since the depth of the well is too deep, it seems to be inappropriate for monitoring of this site.

Overall comment

Overall, the fundamental structures required for the sanitary landfill are installed in this site. This is because the site was designed and constructed based on the international standards. Thus, in terms of basic structure, the site does not have any problem.

However, with regard to leachate management, the current condition is regarded as insufficient. The capacity of the pond is obviously short. As mentioned above, it is the design issue. In the design phase, current situation was not expected (i.e., in actual, daily amount of waste keeps exceeding the planned quantity). The moisture in waste is the significant source of the leachate. Thus, the increase of waste beyond estimation causes huge amount of leachate generation that naturally surpass the originally designed pond capacity. Thought the site personnel are trying to handle it and are making additional ponds to prevent the overflow of leachate from the site, it seems to reach the critical limit of their effort.

Essentially, the quantity of the leachate exceeds the capacity of which the landfill control, its discharge to the outside is inevitable. When considering the discharge, leachate treatment becomes mandatory. So, this landfill seems to enter the phase in which the installation of the leachate treatment facility is must.

Other observation / (Immediate) Action is Required on;

As mentioned above, leachate treatment must be considered as soon as possible. And discharge of only treated leachate should be allowed but not allowed for raw leachate.

Site Operator's Comments:

The operator also thinks that the issue of leachate is serious. Although they are tackling the issue by creating several ponds, there is the limit. They also think that this issue is caused by the design and significant change of the daily waste quantity that was not expected when the landfill was constructed. They are thinking that they want to treat the leachate in some efficient way and want to reduce the amount of the leachate stored in the site.
The problem becomes especially serious in winter because there is much rainfall during winter. In summer, the generation of leachate decreases and they can control it somehow.

Besides, the operator also commented on the gas collection system. They are going to install the energy recovery system from the landfill gas and its feasibility study was already performed. After two or three years, the landfill reaches to its full capacity so then , they will install the gas collection and recovery system along with the implementation of final cover.

Samples Taken: Yes/$\boxed{\text{No}}$

Photographs Taken: $\boxed{\text{Yes}}$/No


Gate

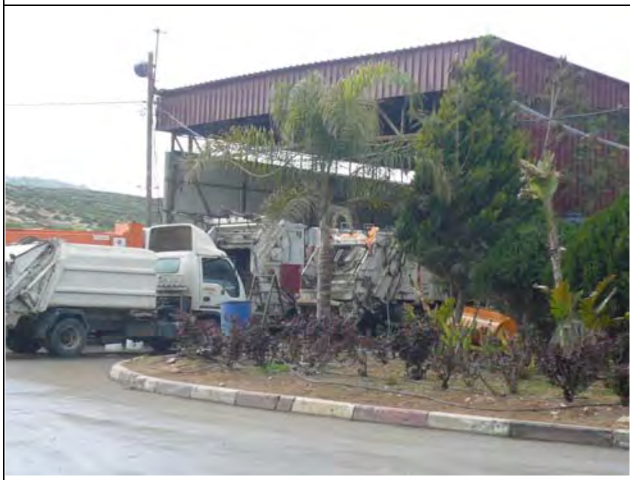

Office


Weighing system and staff


Vehicle washing


Fence

Site notice board


Warehouse


Leachate pond


Storm water drainage ditch


Leachate overflow to outside

2) Checklist (Management of landfill operation)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Management of waste acceptance	Setting up waste acceptance criteria · Clear definition of prohibited waste · Refuse of waste with high moisture content · Clear protocol on asbestos · Measure for bulky wastes	✓				Although there are not documented acceptance criteria, acceptable waste in this site is limited to the domestic waste generated from the area covered by Jenin JSC. In general, the waste from slaughter house, hazardous wastes (e.g. asbestos), and bulky waste isn't accepted in this site. The inspection is done at the tipping face in landfill where the waste carrying vehicles unload their waste. If it contains unacceptable waste, the disposal of the waste is refused and the carrier is ordered to bring it back to the source.
	Waste inspection at acceptance · Enactment of visual inspection · Sampling and analysis of waste	✓				Inspection is performed for every vehicle carrying in the waste. The procedure is visual inspection. Sampling and analysis are not performed since the acceptable waste is limited to the domestic waste (the characteristics are not so different.)
	Measure for the waste not comply with criteria · Existence of decisive procedure	✓				There are no clear criteria. But if the waste is regarded as not acceptable by visual inspection, it is rejected.
	Waste quantity measurement	✓				Done appropriately.
	Inspection/Periodical analysis · Execution of periodical composition analysis		✓			Occasionally, waste composition is analyzed. It was conducted in 1998, 2009, 2011, 2013, and 2017. Periodical analysis on waste composition is recommendable.
	Data recording and reporting	✓				All the data on waste quantity is appropriately recorded and it has been submitted to the regulatory authority (MoLG) for creation of waste statistics.
Waste filling operation	Waste emplacement and compaction · Proper compaction work · Well planned cell creation · Minimization of working face · Care on the other facilities		✓			The working face is quite large. And waste is exposed to atmosphere without cover. Though compaction is performed, it is difficult to judge whether the procedure is appropriate or not because daily amount of the waste is too much. Root of whole problem is too much waste delivery which exceeds the capacity of the site. As consequence, it causes the operation difficulty and results in large working face.

	Implementation of cover material ・ Daily cover ・ Intermediate cover ・ Final cover		✓			Daily cover is insufficient. The reason is the same with above (waste quantity beyond the designed amout). Due to the definite shortage of the soil, the waste is exposed at the surface in various places. If the daily quantity of waste was normal as designed, enough daily cover was implemented. The designated thickness of the daily cover soil in this site is 15cm. The site personnel told that in winter the implementation work of soil cover becomes difficult because of the rain. It affects trafficability of heavy equipment severely. The quality of the cover soil seems to have also problem. In this site, crashed lime stone is used as daily cover soil. However, this material does not have enough moisture holding capacity, adsorption capacity, and not suitable for microorganism to proliferate. Intermediate cover was implemented properly. Approximately, 30 cm of cover soil was installed at the time a layer of 2.5-3m was completed.
	Survey of completed amount ・ Conduct periodical survey	✓	✓			Depending on the progress of filling operation, the survey was performed. Up to now, three times of the survey was conducted within ten years. When conducting the survey, it is ordered to the professional land surveyor. Since the frequency of the survey is less, both satisfactory and unsatisfactory were checked.
	Confirmation of slope stability ・ Periodical walk-over survey and maintenance	✓				Yearly, the stability of slope is confirmed. Besides, erosion of the slope is also confirmed.
	Monitoring of settlement	✓				It is confirmed visually.

Overall comment

The procedure of waste acceptance seems to be not a problem. Though strict inspection is better for proper landfill management, real execution of it is known to be quite difficult. Thus, the procedure adopted in this site is acceptable.

As for the waste filling procedure, obviously there are serious problem. Namely, they are issues on the waste placement and implementation of daily cover soil. As mentioned earlier, the root of these problems is the quantity of the waste which exceeds planned value. The site's staffs have tried almost everything as much as possible up to now and still they are struggling.

These issues have to be considered by not only landfill operator but also by the generator of the wastes. Concretely, in order to manage these tremendous amount of waste, financial support must be indispensable to improve the current situation.

Other observation / (Immediate) Action is Required on;

Immediate action on the implementation of daily cover soil and on the selection of cover soil seems to be necessary.

Site Operator's Comments:

The operator commented that there are not significant issue on the operation.

Samples Taken: Yes/No

Photographs Taken: Yes/No

<table>
<tr><td>
Working face</td><td>
Cover soil</td></tr>
<tr><td>
Exposure of waste</td><td></td></tr>
</table>

3) Checklist (Leachate management)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Leachate quantity	Is the prediction of leachate quantity conducted or not. · Daily, weekly, monthly, yearly? · Is the methodology appropriate? · What sort of data is used for it?	✓				
	Is measurement of leachate conducted? · Amount of leachate in the pond · Quantity of leachate flowing in the pond · Quantity of leachate re-circulated Are there satisfactory data on · Quantity of water getting in by rainfall · Quantity of water evaporating Estimation of leachate stored in the site	✓				
	Are these measured data recorded properly?		✓			
Leachate head (optional)	Is the leachate head on the liner measured? · Frequency · Methodology					(This check item is optional)
	Is the data on leachate head recorded?					(This check item is optional)
	Is the hydraulic head of the leachate on the liner less than 30cm					(This check item is optional)
Leachate quality	Is analysis of raw leachate conducted? · Frequency · Items of analysis ·	✓				When necessary, leachate and other water samples are sampled and send to the laboratory. The items for analysis vary but cover almost important items.
	Does the direct discharge of raw leachate to outside occur? · Extent · Duration · Impact		✓			Direct discharge of leachate is happening. This is because the capacity of leachate ponds is short. Excess leachate overflows from the pond and flows into the nearby Wadi, especially at rainfall event. The leachate can be confirmed in Wadi even at almost several hundred meters away from the site. Since increase of leachate occurs in winter (in rainy season), the duration of discharge is thought to be limited within the period of rainfall event. Up to now, its impact never assessed. As shown in guideline, sediment of wadi should better be analyzed periodically to identify the range of its impact.
	If the leachate is discharged after treatment, Is the quality of effluent analyzed? · frequency · analyzed item			✓		In this landfill, there is no leachate treatment process.

	If the leachate is discharged after treatment, Doe the quality comply with the standards?			✓		In this landfill, there is no leachate treatment process.

Overall comment

The basic strategy of leachate management in this landfill was to evaporate it from the pond and by re-circulation. This strategy was planned because the estimated amount of leachate generation was less than what is now actually generated.
However, indeed the amount of leachate exceeds the controllable capacity prepared in the site, and overflow events seem to be occurred sometime up to now. The occurrence of it is clearly identified at downstream "wadi".
At present, it is undoubted evidence implying that this landfill must have leachate treatment facility because strategy relying on the evaporation cannot control the quantity of the generated leachate.
Besides, in order to halt the uncontrolled discharge of leachate as soon as possible, increase of the number of ponds that have lining system must be constructed.

Other observation / (Immediate) Action is Required on;

What is most important is to stop the uncontrolled discharge to outside the landfill as soon as possible.

Site Operator's Comments:

They are seeking optimum method to treat the leachate. At present, they are testing one method proposed by Israeli company in which chemical agents are used, by using main leachate pond. They expect the success of this. Besides, they heard that the investigation by consulting company on leachate management is under progress. Thus, they are expecting the results of the investigation, too.

Samples Taken: Yes/$\boxed{\text{No}}$

Photographs Taken: $\boxed{\text{Yes}}$/No


Leachate pond


Discharge of leachate


Leachate pond outside of the landfill

4) Checklist (Landfill gas management)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Control of gas pressure	Installation of gas vents/gas collection system for landfill gas management			✓		The landfill gas management is planned after entire cell construction is completed. Thus, during filling operation no gas wells are implemented.
	Condition of fugitive gas emission from the surface Well managed (less release)=satisfactory Un controlled=Unsatisfactory			✓		The same with above, the gas control will be done after the completion of entire cell construction and installation of top cap. Hence, at present, no measure is done for fugitive gas emission.
Toxic gas for workers	Is the monitoring of hydrogen sulfide or other toxic gas performed at the working face, regularly?		✓			The monitoring is not performed regularly. There is one mobile gas detector in site. Hence, if necessary, they can conduct monitoring.
	Are the workers informed about the risk of hydrogen sulfide?	✓				Not all the worker is informed. But some of them are informed about it.
	Is the working face controlled so as to not accumulate toxic gases?	✓				The working face in this landfill is in general flat. Hence, accumulation of toxic gas is not expected at the working face.
	Is the waste containing sulfate such as gypsum board excluded from the acceptable waste?	✓				Waste containing sulfate such as gypsum board is designated as an unacceptable waste.
Explosive/Toxic gas control	Is the regular monitoring executed?		✓			No.
	The level of methane at highest location. (ppm)					
	The level of hydrogen sulfide at highest location (ppm)					

Overall comment

In this landfill, gas collection and energy recovery from the gas is planned after the completion of entire cell. So, during the filling operation, no gas management is performed.

Based on the onsite survey by auditor, fugitive gas emissions from the landfill surface are identified at many places.

As the operator considering, to concentrate gas recovery after completion of cell construction is understandable. However, there are many landfill sites at where gas collection system is installed during operation phase. Especially, installation of horizontal gas trenches other than it directly located below the top cover is only possible during the filling operation.

In addition, to prevent the increase of gas pressure inside the landfill, it seems better to have gas bents. However, these are just auditors comments.

Other observation / (Immediate) Action is Required on;

None

Site Operator's Comments:

The gas collection and recovery system will be installed after the completion of entire cell. It isn't far future, and probably two or three years later, they will be installed. Already its feasibility study was completed. After the installation of it, every monitoring regarding gas will become possible.

Samples Taken: Yes/$\boxed{\text{No}}$

Photographs Taken: Yes/$\boxed{\text{No}}$

5) Checklist (Routine inspection and maintenance)

Items for confirmation	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Is the routine inspection (1-7) of the waste retaining structure (in case of concrete dam) conducted appropriately?			✓		This landfill doesn't have concrete dam.
Is the routine inspection (1-12) of the waste retaining structure (in case of earthfill dam) conducted appropriately?	✓				Inspection is performed routinely.
Is the routine inspection (A-1 to C-3) of the leakage prevention system (lining system) conducted appropriately?	✓				Inspection is performed routinely.
Is the routine inspection (A-1 to C-3) of the leachate management system conducted appropriately?	✓				Inspection is performed routinely.
Is the routine inspection (1 to 5) of the storm water collection and drainage system conducted appropriately?	✓				Inspection is performed routinely.
Is the routine inspection (1 to 2) of the gas collection system conducted appropriately?			✓		This landfill doesn't have gas collection system, yet.
Is the routine inspection (A-1 to E-2) of the other remaining facilities conducted appropriately?	✓				Inspection is performed routinely.
Overall comment It seems that routine inspections are performed appropriately. However, if commenting some, its procedure should be better to be documented clearly. For example, to create the routine inspection manual is recommendable.					
Other observation / (Immediate) Action is Required on; None					
Site Operator's Comments: None					
Samples Taken: Yes/$\boxed{\text{No}}$					
Photographs Taken: Yes/$\boxed{\text{No}}$					

Tables for check items (written again for checklist)

Waste retaining structure

Concrete dam

ID	Inspection item	Frequency	Methodology
1	Seepage of leachate	daily	visually
2	Cracks and chipping of concrete	Daily	Visually
3	out of alignment	Daily	Visually
4	Corrosion of reinforcing	Daily	Visually
5	Buckling	Daily	Visually
6	Settlement	Monthly	Subsidence meter/Survey
7	Slippage	4 times per year	Survey

Earth fill dam

ID	Inspection item	Frequency	Methodology
1	Plant (incl. Weeds and grass) growth	Weekly	Visually
2	Accumulation/deposition of soil	Weekly	Visually
3	Seepage of leachate from slope	Weekly	Visually
4	Cracks	Weekly	Visually
5	Expansion of structure	Weekly	Visually
6	Settlement	Twice/year	Subsidence meter/Survey
7	Erosion of slope	Weekly	Visually
8	Slope failure	Weekly	Visually
9	Scouring	Weekly	Visually
10	Buckling of the slope	Weekly	Visually
11	Subsidence of foundation	Twice/year	Subsidence meter/Survey
12	Collapse of foundation	Weekly	Visually

Leakage prevention system (lining system)

ID	Inspection item	Frequency	Methodology
A	When the liner is exposed		
A-1	Deposition of waste and earth and sand on the liner	Daily	Visually
A-2	Crack and fracture	Daily	Visually
A-3	Holes and depression	Daily	Visually
A-4	Stripping, failure (on slope)	Daily	Visually
A-5	Deterioration	Daily	Visually
A-6	Buckling, swelling	Daily	Visually
A-7	Dissolution	Daily	Visually
B	After cover soil is implemented		
B-1	Propagation of crack and depression	Daily	Visually
B-2	Springing of groundwater, gas extravasation	Daily	Visually
B-3	Lifting of cover soil	Daily	Visually
B-4	Stripping, failure (on slope)	Daily	Visually
C	other symptoms related to leachate leakage		
C-1	Leachate quantity and quality	Refer to section 3.	Refer to section 3.
C-2	Groundwater quantity and quality in monitoring well	Refer to section 8.3.	Refer to section 8.3
C-3	Depression and failure of landfill surface	Daily	Visually

Leachate management system (including leachate collection and removal system, storage pond, recirculation system, and treatment facility)

ID	Inspection item	Frequency	Methodology
A	Leachate collection and removal system (incl. Re-circulation system)		
A-1	Crack/collapse/smash of the pipe	Weekly	Visually/Sewer Pipe Camera
A-2	Clogging/incrustation/scaling of the pipe	Weekly	Visually/Sewer Pipe Camera
A-3	Leakage at the joint part of the pipe network	Weekly	Visually/Sewer Pipe Camera
A-4	Wash out of protective sand/soil	Weekly	Visually (only before it covered)

A-5	Blocking in valve system	Weekly	Visually/Sewer Pipe Camera
B	Leachate storage pond		
B-1	Integrity of lining (hole, collapse, breakage, etc.)	Daily	Visually
B-2	Level of leachate (within controlled level)	Daily (optional)	Visually (optional)
B-3	Deposition in pond (amount of sediments)	Daily	Visually
B-4	Form/Bubble (abnormal forming)	Daily	Visually
C	Leachate treatment system (***if installed***)		
C-1	Proper operation mode (by checking operation parameters; temperature, pH, DO, MLSS, SVI, Turbidity, odor, etc.)	Daily	Checking of each parameter by measurement apparatus.
C-2	Quantity of leachate	Daily	Recorded data
C-3	Quality of treated leachate	Daily	Refer to section 3

Storm water collection and drainage

ID	Inspection item	Frequency	Methodology
1	Collapse/damage/deterioration of each drainage ditch/culvert	Monthly	Walk over survey and visual inspection
2	Deposition of earth and soil in ditches	Monthly	Walk over survey and visual inspection
3	Clogging/blocking	Monthly	Walk over survey and visual inspection
4	Occurrence of leakage and spring water	Monthly	Walk over survey and visual inspection
5	Growth of plant/weed/grass	Monthly	Walk over survey and visual inspection

Gas collection system

ID	Inspection item	Frequency	Methodology
1	Collapse of gas vents/gas well/gas pipes	Weekly	Visually
2	Clogging of the vents/well/pipe	Weekly	Visually

Other facilities

ID	Inspection item	Frequency	Methodology
A	Weighing facility		
A-1	Function of weight bridge	Daily	Manual check of function
A-2	Data recording system	Daily	Manual check of function
A-3	Checking on mechanical part (Loosening of bolt, deformation of materials, etc.)	Daily	Manual check of function
A-4	Calibration of the weigh bridge	Twice / year	Calibration agency
B	Vehicle washing facility		
B-1	Function of washing facility	Daily	Manual check of function
B-2	Deposition of mud/soil	Daily	Manual check of function
B-3	Water supply	Daily	Manual check of function
C	Road		
C-1	Waste scattering	Weekly	Visually
C-2	Hole, depression, cracks	Weekly	Visually
C-3	Failure of road shoulder	Weekly	Visually
C-3	Dust	Weekly	Visually
D	Fence		
D-1	Breakage failure of fence	occasionally	Visually
D-2	Catching the waste on the fence	occasionally	Visually
E	Gate and notice board		
E-1	Normal function of the gate	occasionally	Manual check of function
E-2	Condition of the notice board	occasionally	Visually

6) Checklist (Safety)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Management of working environment	Compliance with law and regulation related to the industrial health and safety	✓				
	Supply protective equipments to the workers and enforcement of their use	✓				Depending on worker, sometimes it is difficult to order to wear safety clothes because of religious grounds.
	Confirmation of dangerous gas at working area		✓			Not performed.
	Setting up the rules on the working environment	✓				
	Installation of sanitation equipment	✓				Almost all necessary sanitary equipment for workers are provided.
	Instruction on hazards of the chemical agent used in the site			✓		Hazardous chemicals are not used in the site in general. Occasionally, in summer, some kinds of insecticide is used to clean up the insect. But it is done by only skilled professionals.
	Training of first aid lifesaving, etc.	✓				
	Regular health check of workers	✓				Labors are subjected to their health check, yearly.
System for emergency response	Preparation of contact address list on the emergency event	✓				
	Preparation of the procedure of contact contents		✓			This is not regarded as important, now.
	Training of workers for emergency response	✓				
	Plans for prevent reoccurrence of the accident	✓				It isn't documented clearly, but training for the emergency is conducted based on the experience and such experience is helpful to prevent reoccurrence.

Overall comment To protect labors and to prevent accidents, various measure are implemented. However, toxic gas monitoring seems to be better implemented in order to prevent lethal accident. In addition, response on emergency should be better to be documented.
Other observation / (Immediate) Action is Required on; None
Site Operator's Comments: None
Samples Taken: Yes/$\boxed{\text{No}}$
Photographs Taken: Yes/$\boxed{\text{No}}$

7) Checklist (Littering and Vector)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Littering	·Littering is properly controlled.	✓	✓			The operator answered that collection of litter around the site and cleaning of the perimeter fence is performed on regular basis. Also cleaning activity by workers is done. However, litter is easily found around the site. Thus, both satisfactory and unsatisfactory were marked. According to the answer of the operator, there are no complaints from the residents regarding the littering.
	·Cover soil is promptly placed to prevent littering		✓			At this site, inadequate daily soil cover is thought to be most significant problem. So, unsatisfactory is marked.
	Some measure (e.g. litter screen, etc.) is taken.			✓		Only perimeter fence works for preventing littering. There are no additional measures.
	There is special employee for inspection and cleaning of the litter at the peripheral of the site.			✓		Inspection and cleaning are done by site workers. Thus there is no special employee for this task.
Vector	Are there serious vector issue happening?	✓				There is serious vector issue actually in summer. However, by using insecticide the issue is mitigated.
	There are a lot of birds out there.		✓			Actually, the control of birds is difficult issue in any landfill site. If daily cover is implemented perfectly, the issue will be mitigated more or less.
	Flies and mosquitoes are heavily infested.	✓				Same as above. To prevent the heavy infestation, insecticide is used in summer.
	Daily soil cover is placed properly.		✓			The daily soil cover is insufficient. But this is because the quantity as mentioned earlier.
	Water pool in the site is eliminated.	✓				By constructing storm water ditches inside the site, formation of water pool is tried to be prevented as much as possible.
	Some measure to rid of the birds/animals is taken.		✓			Nothing specially.

Overall comment

Most effective measure for these nuisance issues (vector/vermin/birds/dogs) is an appropriate implementation of daily soil cover because it can block their access to the waste. So, strict execution of daily cover is highly recommendable in this site too. If all the waste, which is exposed to the atmosphere, can be covered completely by soil, all these issue will be solved.

Other observation / (Immediate) Action is Required on;

Though it is understandable that satisfactory implementation of daily cover is difficult, to make an effort to make the site closer to the condition with perfect covering is recommendable.

Site Operator's Comments:

None

Samples Taken: Yes/No

Photographs Taken: Yes/No

8) Checklist (Environmental monitoring)

Category	Status	Satisfactory	Unsatisfactory	Inapplicable	Not-checked	Comment
Landfill gas	Is the monitoring of methane performed? · Frequency · Methodology · Data keeping		✓			No measurement is done at present.
	No abnormal methane concentration is reported.			✓		No measurement.
Leakage	Is groundwater monitoring performed? · Frequency · Methodology · Analyzed items	✓				The groundwater monitoring is performed by PWA (Palestine Water Authority), on regular basis. Methodology and items are determined by PWA. Most of the items considered to be important are included. There are no original monitoring well owned by the site. So, its monitoring is not done.
	No abnormal concentration in groundwater is reported	✓				No abnormal concentration was reported from PWA.
Surface water	Is the monitoring of surface water performed? · Frequency · Methodology · Analyzed items	✓				In order to examine the impact of leachate discharge from the site, water in wadi (2 samples) were taken and analyzed. The result indicated these water is diluted by storm water and their concentration was less than the leachate.
	Is the monitoring of wadi (sediment) performed? · Frequency · Methodology · Analyzed items		✓			No monitoring was performed. (But this item is the proposal by the author of the guideline and is not in common in the general monitoring of the landfill.)
	No abnormal concentration in surface water/effluent is reported			✓		No analysis was performed.
	No abnormal condition on the sediment in wadi is identified			✓		No analysis was performed.
Air	·“*Currently no monitoring item*”					
Odor	Are there complaints from residents? · The complaint is recorded? · Measures for them are taken?	✓				There are complaints from residents. The complaints are recorded. And in order to respond immediately, residents are requested to contact to the landfill as soon as possible when they sense odor.
	Is the monitoring of odor conducted? · Frequency · Methodology		✓			As for the air collected at the landfill surface, occasionally, analyses were conducted. But they are not for odor.
	Is the monitoring data recorded?		✓			There is no data recorded.
	Does any odor substance exceed the criteria at the boundary?			✓		Since it is not measured, this inquiry is inappropriate.
	Or does odor index satisfy the criteria?			✓		Since it is not measured, this inquiry is inappropriate
Overall comment						

Gas: This monitoring should be done for safety aspect not the understanding of the methane emission from the site. Thus, simple gas detector should be installed at the office building or warehouse at where the gas migration from the site is doubtful. Groundwater: Since the PWA conduct monitoring the domestic well nearby and its depth is very deep, to detect leachate leakage is thought to be difficult from the results. For the detection of leachate leakage, manhole installed at the edge of the site is thought to be effective and its periodical monitoring is recommendable. Surface water: The site performed the analysis of the water taken by wadi when storm water event occurred by their own decision. This original monitoring can be highly evaluated. When there is a water in wadi, to conduct sampling and analyzing it is highly recommendable to confirm whether there is the evidence of discharge from the site. Wadi sediment: This monitoring was proposed in the guideline. However, this is not commonly done in many landfills. The reason why this was proposed is that there is no proper environmental target to identify discharge from the landfill under the condition of arid climate (like Palestine) at where perennial surface water doesn't exist. Hence, this is not mandatory. When it is necessary to probe the occurrence of the emission from the landfill, this investigation will be helpful. Odor: Since odor is regarded as serious issue in this landfill, some monitoring should be done. The air collected at the surface was performed in the past. However, it was the survey on air quality but not the odor survey. Hence, survey method especially on the odor should be selected and applied. The odor monitoring must be related to the human olfactory. If air sampling and chemical analysis are performed, specific odorous substances should be focused on. If complex procedure is difficult to implement, simple procedure, in which assessor walks over the site boundary and record what he feels, is also applicable.
Other observation / (Immediate) Action is Required on; None
Site Operator's Comments: None
Samples Taken: Yes/$\boxed{\text{No}}$
Photographs Taken: Yes/$\boxed{\text{No}}$

Annex 10

Home Composting Pilot Project- 4th Phase

Final Report

Prepared by : Eng. Abdelhamid Shami
Eng. Yosrea Ramadan

3/27/2018

1 Introduction

The home composting pilot project was implemented in four phases; the first and second phases studied the compost technology in two different seasons, in order to determine the best technology for home composting in Palestine. Then the third phase was started which include implementing the selected technology in large scale to study the impact of the home composting on waste reduction. Three JSCs have participated in the third phase, which are Ramallah JSC, Bethlehem JSC and NE&SE Jerusalem JSC. Each JSC has nominated one LGU to start the PP based on specific criteria, and they received the required number of barrels from the project. But not all delivered barrels to the LGUs had been distributed and used by the households; the LGUs couldn't find enough number of participants that matches the number of the received barrels. This refers to the lack of awareness and willingness to participate where no incentives or big direct benefits can be achieved from home composting (Waste reduction is indirect benefits for people). Since the aim of the third phase of the pilot project is to measure the impact of home composting on waste reduction, the number of the delivered barrels for each LGU was big in order to achieve significant and measurable impact on waste reduction, but the social aspect was not considered enough in determining the number of barrels that can be distributed.

The project team decided to extend the home composting pilot project to the fourth phase, and to reallocate the remaining number of barrels to new areas. The aim of this stage is to study the social aspect and to summarize the lessons that can be learnt from the pilot project for future policy intervention of home composting.

2 Purpose and Objectives of the Home Compositing Pilot Project- 4th phase:

This phase of composting project aims at continuously contribute in achieving the Ministry of local Government's vision in increasing the public awareness toward solid waste separation and reduction issues as clarified and confirmed in the National strategy of solid waste management (2017-2022). The specific objectives are:

1- Disseminate the idea of home composting in the targeted LGUs.
2- Studying the potential of applying home composting in rural areas.
3- Providing clear recommendations for MoLG about future strategies related to home composting.
4- To investigate the factors that negatively impact the home composting and leads to failure in achieving the aims of such practice.

3 Methodology

1. Project Agreements were signed between the responsible JSC and the targeted LGUs to assure the commitment of LGUs in following the project.
2. Providing the targeted LGUs with the required barrels that are used for home composting, the following table shows the targeted LGUs and the received number of barrels:

No.	JSC	LGU Names	No. of Barrels
1	Ramallah JSC	Selwad	35
2	Ramallah JSC	Beit Leqia JSC (Beit Leqia + Kharbatha)	30
3	Ramallah JSC	Kobar	8
4	Hebron JSC	Al Karmel	45
Total			**118**

3. Lunching workshops were conducted in each LGU; the workshops targeted the participating households in order to educate them about applying composting process in their houses.

Lunching Workshop at Selwad Municipality

Lunching Workshop at Kobar Village Council

4. The LGUs distributed the barrels to the households.
5. A weekly field visit was conducted for each targeted area by a field surveyor to follow the progress in home composting and give instructions to the participants.

Weekly field Visit to Beit Leqia

Weekly field Visit to Selwad

6. Some public awareness workshops were conducted during the project implementation; the workshops targeted the communities and some schools.

Public Awareness Workshop in Selwad

Public Awareness Workshop at Beit Leqia/ Girl School

7. A final workshop was conducted in each targeted area at the end of the project. The workshops targeted the participants, the community, and the LGU. The aim of the final workshop is to disseminate and promote the project idea between the communities and to get a feedback about the project from the participants.

Final Workshop in Beit Leqia

Final Workshop in Selwad

8. Reporting; this includes preparing a weekly report about the field visits and the progress of home composting in each area and preparing a final report.

4 Project Outline

The 4th phase was started in the beginning of November 2017 and lasted till the end of March 2018, as illustrated in the outline below:

No.	Activity	Oct, 2017		Nov, 2017		Dec, 2017		Jan, 2018		Feb, 2018		Mar, 2019	
1	Signing agreements between JSCs & LGUs												
2	Providing of barrels to LGUs												

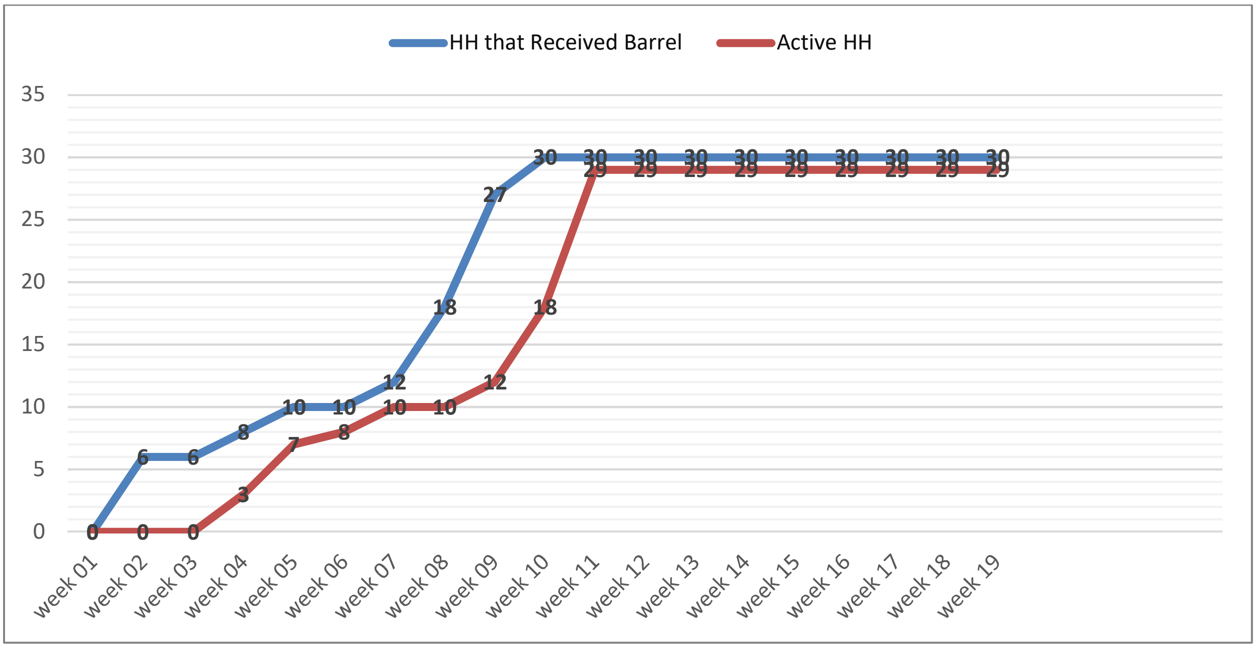
3	Lunching workshops												
4	Barrels distribution to participants												
5	Weekly field visits												
6	Public awareness workshops												
7	Final workshop												
8	Reporting												
8.1	Weekly reports												
8.2	Final Report												

5 Results

The results of the 4th phase in each targeted LGUs, can be summarized as following:

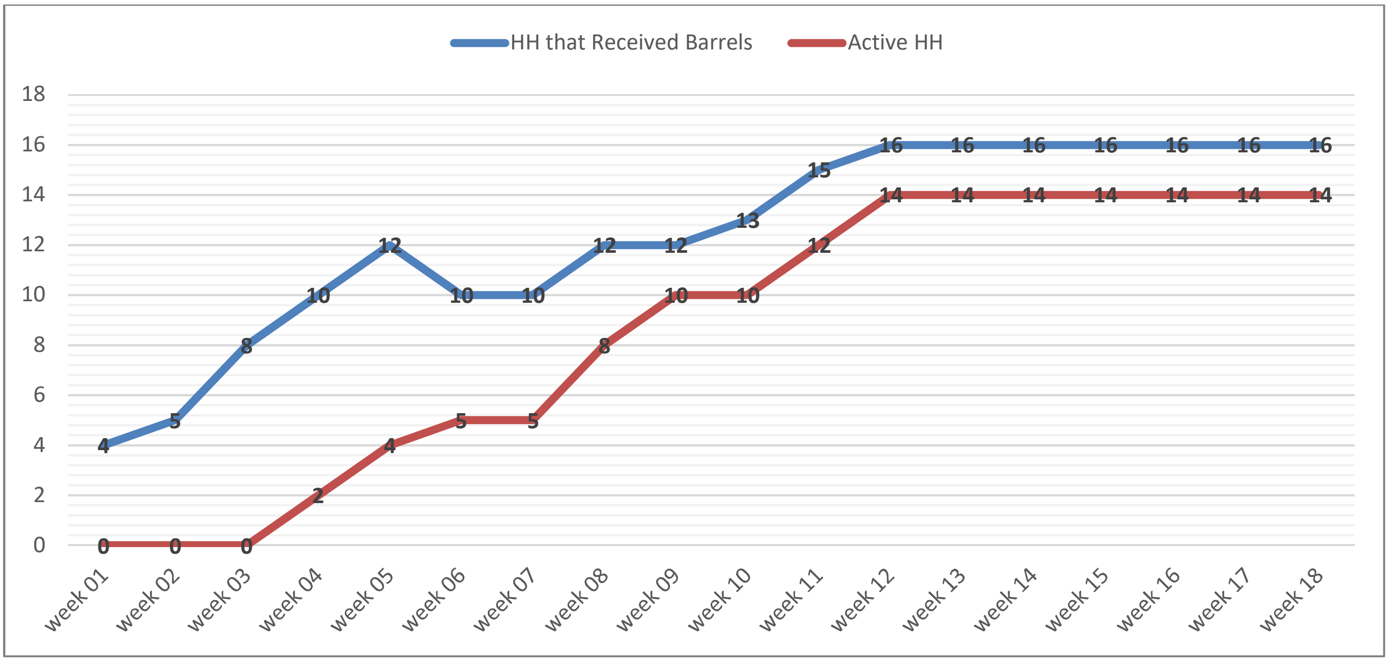
5.1 Selwad

- Selwad LGU received 35 barrels, two barrels were missed at the begging of the project, the remaining 33 barrels were distributed to 30 households (some households received more than one barrel) and the active households were 29.
- At the first period of the project, Selwad Municipality was not committed to follow up the project, and there was no assigned surveyor from the project to follow up the project; so most of the barrels were not distributed. Also when the municipality distributed some of the barrels to the households, they didn't give them enough information about the project, so many households returned the barrels to the municipality.
- After seven weeks, an active women association started to follow the project instead of the municipality, after that, the distribution of barrels going very well.
- At the beginning period of barrels operation, some problems were appeared, like odors, high moisture contents, existing of non-organic waste… etc. but after continuous following up of the project progressing and weekly field visits, the participants learned the process and overcame the appeared problems.
- By the end of the project period, 15 households filled their barrels with organic material and most of the participants operating their barrels in a good way.
- The following diagram shows the trends of project progress, which illustrate how the project proceed since the beginning, and what success percentage has been achieved, as no gab was noticed between the distributed barrels and the functioning one by the end of the project.



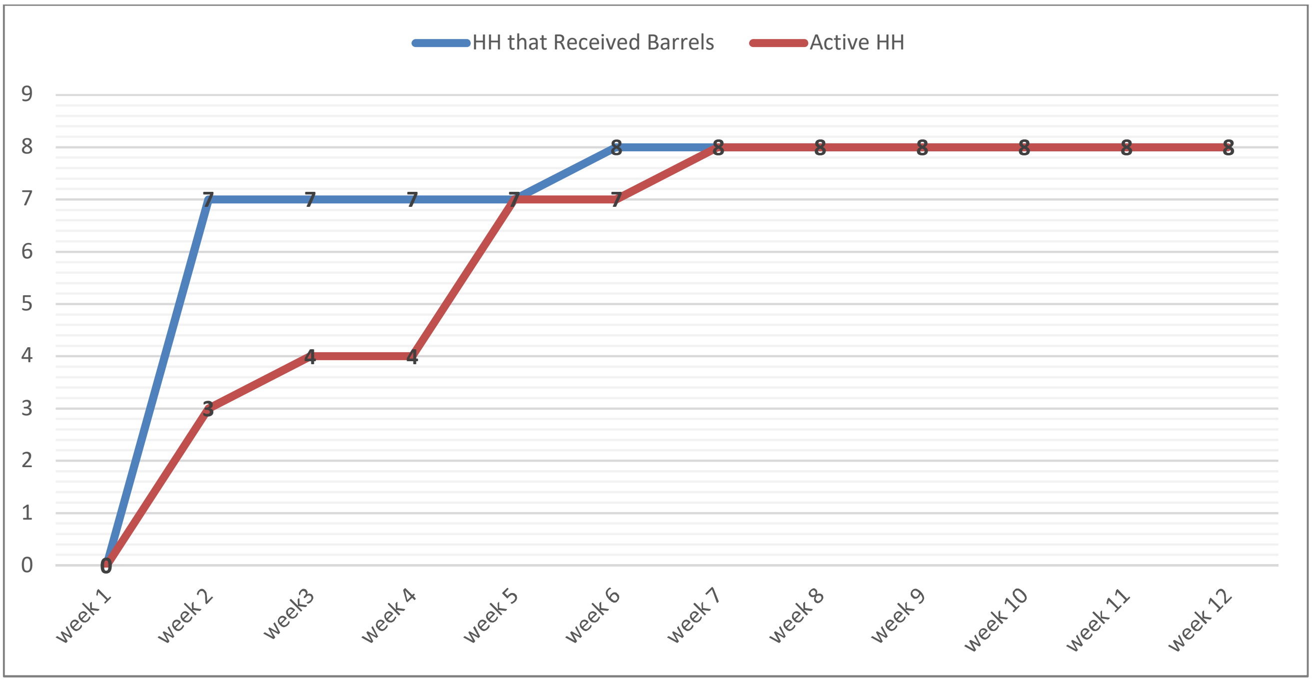
5.2 Beit Leqia

- Beit Leqia JSC received 30 barrels, 7 barrels were missed at the begging of the project, 4 barrels stayed at the LGU without distribution, the remaining 19 barrels were distributed to 16 households (some households received more than one barrel) and the active households were 14.
- After about 7 weeks of starting the project in Beit Leqia, the field surveyor who was assigned by the project started the following up of the project, so the number of functional barrels (Active households) starts to increase.
- At the beginning period of barrels operation, some problems were appeared, like odors, high moisture contents, existing of non-organic waste… etc. but after continuous following and weekly field visits, the participants learned the process and overcame the appeared problems.
- By the end of the project period, 8 households filled their barrels with organic material and most of the participants operating their barrels in a good way.
- Beit Leqia JSC, who is responsible for barrel distribution, couldn't distribute all of the barrels to households; they couldn't find enough number of participants who are willing to participate in the project. Some public awareness workshops were conducted in the area to promote the idea of home composting and to find new participants in the project but they couldn't find enough number.
- The following diagram shows the trends of project progress, which illustrated as well how the gap between the distributed and functioning barrels getting smaller after weekly follow up started by the field surveyor.



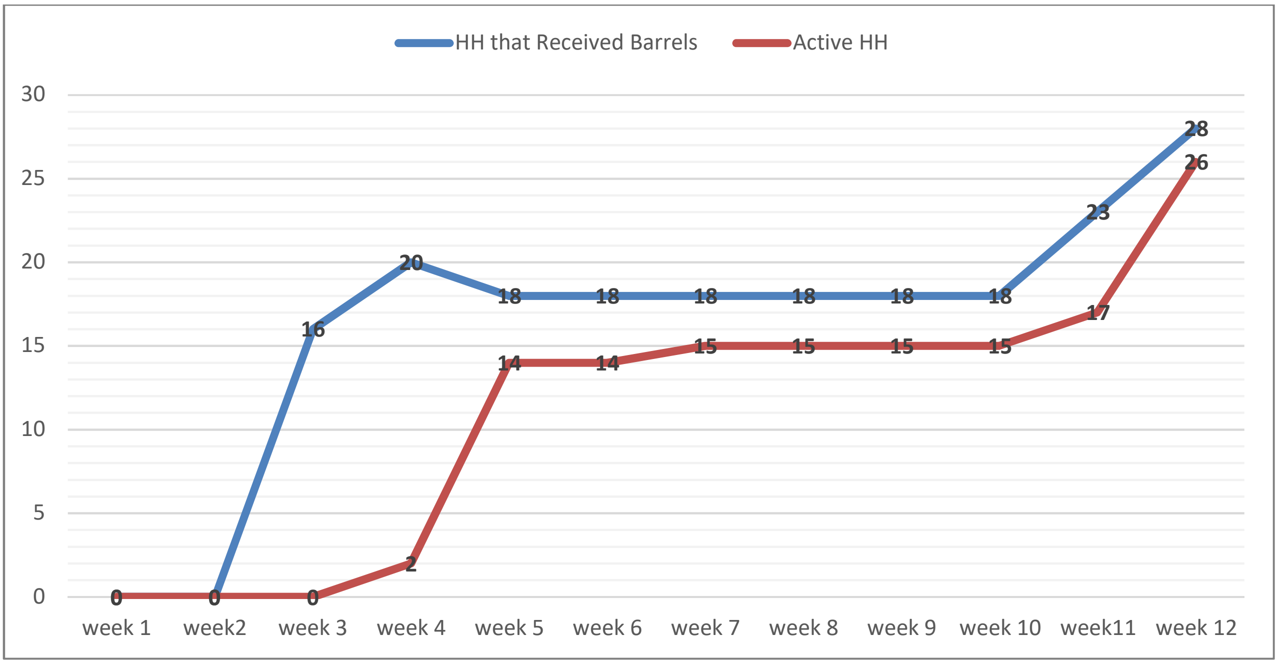
5.3 Kobar

- Kobar Village Council received 8 barrels, all of the barrels were distributed and all of the participants were active by the end of the project.
- At the beginning period of barrels operation, some problems were appeared, like odors, high moisture contents, existing of non-organic waste… etc. but after continuous following and weekly field visits, the participants learned the process and overcame the appeared problems.
- By the end of the project period, 3 households filled their barrels with organic material and most of the participants operating their barrels in a good way.
- The following diagram shows the trends of project progress, which illustrate gradual increasing of functional barrels which is resulted from continuous follow up.



5.4 Al Karmel

- Al karmel Municipality received 45 barrels, 35 barrels were distributed to 28 households (some households received more than one barrel) and the active households were 26.
- In the first four weeks of the project period, there were many unfunctional barrels, this is because the LGU was not active at that period and the lunching workshop was not enough to educate the people about home composting process. After continuous follow up for the households and the commitment of the LGU, the number of functional barrels starts to increase.
- At the beginning period of barrels operation, some problems were appeared, like odors, high moisture contents, existing of non-organic waste… etc. but after continuous following and weekly field visits, the participants learned the process and overcame the appeared problems.
- By the end of the project period, 7 households filled their barrels with organic material and most of the participants operating their barrels in a good way.
- Al Karmel Municipality, who is responsible for barrel distribution, decided to distribute the barrels in two stages; so they distributed half of the barrels at the beginning of the project, then the distributed number of barrels become stable for more than one month, after that the municipality started to promote the project to find new participants, so the distributed number of barrels started to increase.
- The following diagram shows the trends of project progress:



5.5 Results Summary

- Following is a summary table for the number of distributed barrels and participated households in each targeted area:

No.	LGU Names	No. of Received Barrels	Distributed No. (Barrels/ HH)	Functional No. (Barrels/ HH)	Remaining Barrels	Missed Barrels
1	Selwad	35	33/ 30	31/29	0	2
2	Beit Leqia JSC (Beit Leqia + Kharbatha)	30	19/ 16	15/ 14	4	7
3	Kobar	8	8/8	8/ 8	0	0
4	Al Karmel	45	35/ 28	27/ 26	10	0
	Total	118	95/ 81	81/ 77	14	9

- 80% of the received barrels were distributed, part of the remaining barrels were lost due to mismanagement from the LGU, part of them cannot be distributed and part of them still on going to be distributed. The problems that appeared in barrels distribution were:
  - Mismanagement from the LGU side in selecting the suitable household and providing enough information about the project.
  - People willingness to participate in the project and absence of incentives.
- 95% of the distributed barrels are active and compost is progressing very well. The reason for uninstalling some of the barrels refers to the laziness of some people; they liked the idea and got the barrel but after the nothing were done.
- According to the discussion with the participants in the project, the main benefit they achieved in the project was enhancing the cleanness level by reducing the disposed quantity in the public container and reducing the odors from the produced waste. Where the Production of compost is a minor benefit for them.

6 Conclusion and Recommendations

- Home composting projects need an intensive follow up by a specialized person especially at the beginning of the project, this is necessary until the household members getting the required experience for making the compost, after that following up still necessary but with lower efforts.
- The commitment of LGU in following up the project plays a main role in succeeding the project. This can be clearly concluded from Selwad and Al Karmel cases. The LGUs shall be aware about the importance of home composting and its impact on waste reduction which reflects on their waste collection fees; this will convince them to take their role strongly in such projects. So for future projects, targeting LGUs that paying high fees for solid waste management (with tariff system based on the generated tons) will increase the opportunity of project success.
- Since by the end of the project we had many functional barrels in the targeted areas, this indicates that there is a potential to disseminate the idea of home composting in the Palestinian rural areas.
- Since the number of barrels in each targeted area is very small compared to the total number of household, we cannot know exactly what will happen if the number of barrels is increased. But generally the idea of home composting takes time to be disseminated, and this happen gradually, but the number of participants in home composting can be increased until reaching a maximum limit "Saturation Point" (This is because the number of people who have gardens around their houses and have agricultural activities are limited). Since the number of barrels in each targeted area is very small, and the project period is very short, we couldn't determine the percentage of the saturation point. But based on a fact that Beit Leqia JSC couldn't distribute all of the barrels although they received small number of barrels, and based on the results of the 3rd phase of home composting PP, we can say that the maximum percentage that can be achieved for functional barrels (active households) is **10%**. In the 3rd phase of home composting PP, the highest percentage of active households that can be achieved was in Al Walajah village (it was 10% from the total number of household in the village), and this percentage was achieved after intensive follow up and conducting many public awareness

activities, after that no new participants can be found. The following table shows the percentage of active household to the total number of households in each targeted area:

No.	LGU	Population No. *"Based on PCBS projection for 2016"*	Estimated No. of Households *"Pops No./ 5"*	No. of Active Households	Percentage
4th Phase					
1	Selwad	7836	1567.2	29	1.9%
2	Beit Leqia+Kharbatha	16534	3306.8	14	0.4%
3	Kobar	4705	941	8	0.9%
4	Al Karmel	4940	988	26	2.6%
3rd Phase					
1	Al Walajah	2569	513.8	53	10.3%
2	Beit Uor	5595	1119	52	4.6%
3	Mukhmas	1692	338.4	19	5.6%

- Since the organic fraction consists about 50% of the total waste, and about 80% of the organic waste can be used in home composting, this means that the expected waste reduction from the households who are participating in home composting is 40%. Considering the previous point, that the maximum participation percentage that can be achieved is 10%, this means that a successful home composting project in any area will achieve only **<u>4%</u>** of waste reduction in the targeted area.
- According to PCBS 2016, 73.9% of the Palestinian people are living in urban areas, 9.5% in refugee camps and only 16.6% in rural areas. Since home composting project can be applied mainly in rural areas, this means that the expected waste reduction from applying home composting in the rural areas is only **<u>0.7%</u>** (From the total generated waste amount in Palestine).
- To Achieve 4% of waste reduction in the targeted LGU, intensive follow up and huge efforts shall be provided which is not feasible financially, especially if we consider the low cost of SWM in Palestine (Avg. 144 NIS/ton) (See Annex 1). But considering the environmental aspect and the current situation of overloaded sanitary landfill in Palestine, achieving 4% of waste reduction is a good target to work on it even if it is not feasible financially, but there should be some incentives and governmental support to encourage the LGUs to start implementing home composting projects, also some mandatory regulations shall be applied. **<u>Due to the weak capacity of most LGUs in Palestine, such project cannot be implemented without governmental or international support.</u>**
- Since there are no direct benefits from home composting to the people (Waste reduction is indirect benefits for people). More incentives for the participants should be considered, in order to keep them motivated to continue making compost. For example providing the participants with some agricultural tools, or buying the produced compost from the participants by small prices (this can be arranged in cooperation with agricultural association in the project area) or by reducing the waste collection fees for the participants.

- In any case, promoting the idea of home composting through public awareness campaign as a waste reduction method shall be kept for individual practice.
- Many people faced some difficulties in turning the waste inside the barrel, so the type of used barrel shall be changed, a special composter is recommended. Also each household shall be provided with two barrels instead of one, so they can use the second barrel when the first one is filled with waste.

Annex (1): Financial Feasibility of Home Composting

The following table was developed based on the following assumptions:

- Percentage of organic waste to the total waste: 50 %
- Percentage of used organic waste to the total organic waste: 80%
- Total Waste Reduction: 40%
- Maximum participating rate in home composting: 10%
- Total waste reduction in the area: 4%
- Avg. SWM cost: 144 NIS/ton "Data Book, 2016"
- Max. SWM cost: 248 NIS/ton "Data Book, 2016"
- Cost of One Surveyor: 30,000 NIS/ year "2000 NIS/month*12+ 6000 NIS / Sallary + Transportation"
- Each Surveyor can follow up 200 barrel

Annex 10

Pops No.	HH No.	Expected Waste Generation (t/y)	Expected Waste Reduction (t/y)	Revenues		Active HH	Required No. of Field Surveyors	Expenditures
				Expected Cost Reduction (Avg. 144 NIS/t)	Expected Cost Reduction (Max. 248 NIS/t)			Cost of Field Surveyors
2,000	400	533	21	3,070	5,286	40	1	30,000
4,000	800	1,066	43	6,139	10,573	80	1	30,000
6,000	1,200	1,599	64	9,209	15,859	120	1	30,000
8,000	1,600	2,132	85	12,278	21,145	160	1	30,000
10,000	2,000	2,665	107	15,348	26,432	200	1	30,000
12,000	2,400	3,197	128	18,417	31,718	240	2	60,000
14,000	2,800	3,730	149	21,487	37,005	280	2	60,000
16,000	3,200	4,263	171	24,556	42,291	320	2	60,000
18,000	3,600	4,796	192	27,626	47,577	360	2	60,000
20,000	4,000	5,329	213	30,695	52,864	400	2	60,000
22,000	4,400	5,862	234	33,765	58,150	440	3	90,000
24,000	4,800	6,395	256	36,834	63,436	480	3	90,000
26,000	5,200	6,928	277	39,904	68,723	520	3	90,000
28,000	5,600	7,461	298	42,973	74,009	560	3	90,000
30,000	6,000	7,994	320	46,043	79,296	600	3	90,000
32,000	6,400	8,526	341	49,112	84,582	640	4	120,000
34,000	6,800	9,059	362	52,182	89,868	680	4	120,000
36,000	7,200	9,592	384	55,251	95,155	720	4	120,000
38,000	7,600	10,125	405	58,321	100,441	760	4	120,000
40,000	8,000	10,658	426	61,390	105,727	800	4	120,000

HOME COMPOSTING PP – 4TH PHASE

17 July 2018

Eng. Abdelhamid Shami

Project Objectives

- Disseminate the idea of home composting in the targeted LGUs.
- Studying the potential of applying home composting in rural areas.
- To investigate the factors that negatively impact the home composting and leads to failure in achieving the aims of such practice.
- Providing clear recommendations for MoLG about future strategies related to home composting.

Methodology

3

- Providing the targeted LGUs with Composting Barrels as follows:

No.	JSC	LGU Names	No. of Barrels
1	Ramallah JSC	Selwad	35
2	Ramallah JSC	Beit Leqia JSC (Beit Leqia + Kharbatha)	30
3	Ramallah JSC	Kobar	8
4	Hebron JSC	Al Karmel	45
Total			118

Methodology

4

- Conducting of public awareness workshops.



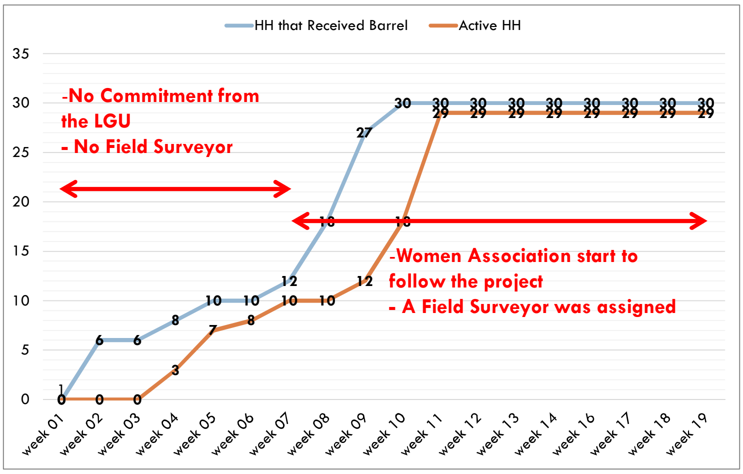
- Weekly follow up.


Results

5

- Trends of project progress:

Selwad

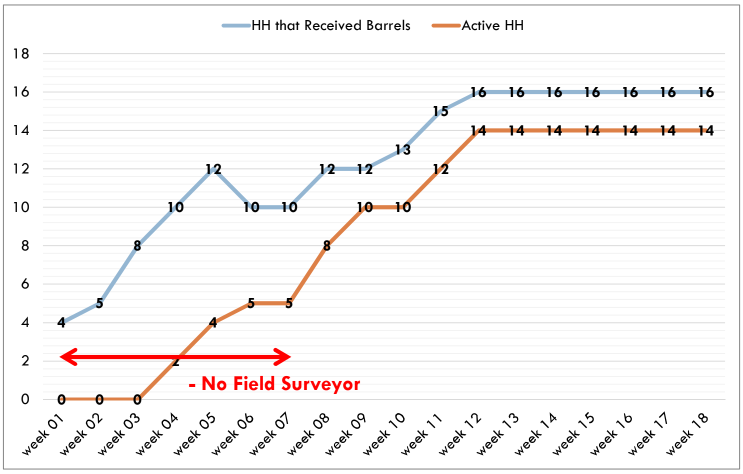


Results

6

- Trends of project progress:

Beit Leqia

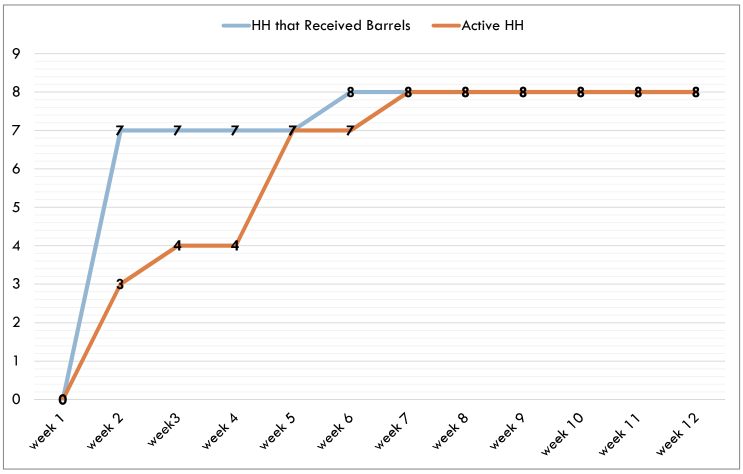


Results

7

- Trends of project progress:

Kobar

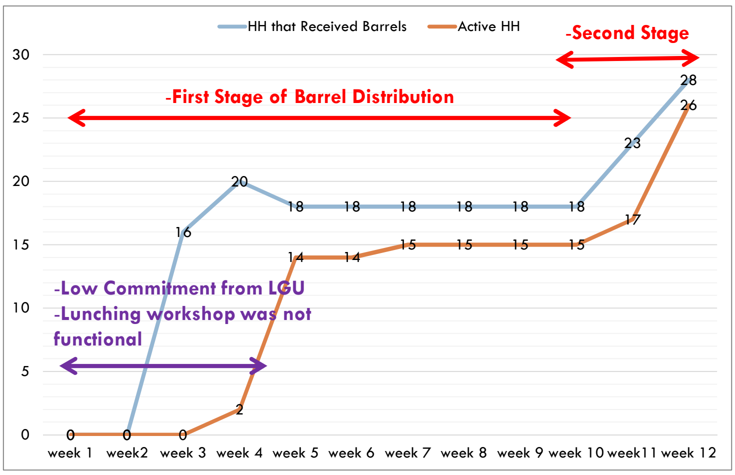


Results

8

- Trends of project progress:

Al Karmel



Results

9

- Summary table for the number of distributed barrels and participated households:

No.	LGU Names	No. of Received Barrels	Distributed No. (Barrels/ HH)	Functional No. (Barrels/ HH)	Remaining Barrels	Missed Barrels
1	Selwad	35	33/ 30	31/29	0	2
2	Beit Leqia JSC (Beit Leqia + Kharbatha)	30	19/ 16	15/ 14	4	7
3	Kobar	8	8/8	8/ 8	0	0
4	Al Karmel	45	35/ 28	27/ 26	10	0
	Total	**118**	**95/ 81**	**81/ 77**	**14**	**9**

Results

10

- **80%** of the received barrels were distributed. The problems that appeared in barrels distribution were:
  - Mismanagement from the LGU side in selecting the suitable household and providing enough information about the project.
  - People willingness to participate in the project and absence of incentives.
- **95%** of the distributed barrels are active and compost is progressing very well
  - The reason for uninstalling some of the barrels refers to the laziness of some people; they liked the idea and got the barrel but after the nothing were done.

Conclusion & Recommendations

11

- Home composting projects need an intensive follow up by a specialized person especially at the beginning of the project.
- The commitment of LGU in following up the project plays a main role in succeeding the project. This can be clearly concluded from Selwad and Al Karmel cases.
- Targeting of suitable LGUs will increase the opportunity of project success.

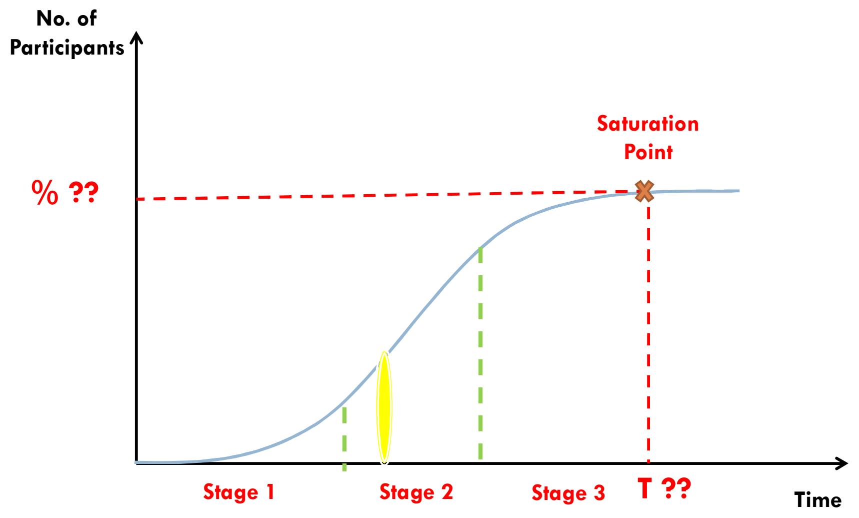
Conclusion & Recommendations

12

- Since by the end of the project we had many functional barrels in the targeted areas, **this indicates that there is a potential to disseminate the idea of home composting in the Palestinian rural areas**.
- But we should be careful: We are talking about too small percentages, but what will happen if these percentages increased??

No.	LGU	Population No. *"Based on PCBS projection for 2016"*	Estimated No. of Households *"Pops No./ 5"*	No. of Active Households	Percentage
1	Selwad	7836	1567.2	29	1.9%
2	Beit Leqia+Kharbatha	16534	3306.8	14	0.4%
3	Kobar	4705	941	8	0.9%
4	Al Karmel	4940	988	26	2.6%

Expected Home Composting Projects Trend



Conclusion & Recommendations

14

- But based on a fact that Beit Leqia JSC couldn't distribute all of the barrels although they received small number of barrels.
- Based on the results of the 3rd phase of home composting PP.

Maximum percentage that can be achieved for active households "Saturation Point" is 10%.

Conclusion & Recommendations

15

- Organic fraction: 50%
- About 80% of the organic waste can be used in home composting.
- Expected waste reduction from the households who are participating in home composting is 40%.
- The maximum participation percentage that can be achieved is 10%.

This means that a successful home composting project in any area will achieve only 4% of waste reduction.

Conclusion & Recommendations

16

- To Achieve 4% of waste reduction, intensive follow up and huge efforts shall be provided which is not feasible financially.
- Considering the environmental aspect and the current situation of overloaded sanitary landfill in Palestine, achieving 4% of waste reduction is a good target to work on it
- There should be some incentives and governmental support to encourage the LGUs to start implementing home composting projects, also some mandatory regulations shall be applied.
- **Due to the weak capacity of most LGUs in Palestine, such project cannot be implemented without governmental or international support.**

Financial Feasibility of Home Composting

17

Pops No.	HH No.	Expected Waste Generation (t/y)	Expected Waste Reduction (t/y)	Revenues: Expected Cost Reduction (Avg. 144 NIS/t)	Revenues: Expected Cost Reduction (Max. 248 NIS/t)	Active HH	Required No. of Field Surveyors	Expenditures: Cost of Field Surveyors
2,000	400	533	21	3,070	5,286	40	1	30,000
4,000	800	1,066	43	6,139	10,573	80	1	30,000
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8,000	1,600	2,132	85	12,278	21,145	160	1	30,000
10,000	2,000	2,665	107	15,348	26,432	200	1	30,000
12,000	2,400	3,197	128	18,417	31,718	240	2	60,000
14,000	2,800	3,730	149	21,487	37,005	280	2	60,000
16,000	3,200	4,263	171	24,556	42,291	320	2	60,000
18,000	3,600	4,796	192	27,626	47,577	360	2	60,000
20,000	4,000	5,329	213	30,695	52,864	400	2	60,000
22,000	4,400	5,862	234	33,765	58,150	440	3	90,000
24,000	4,800	6,395	256	36,834	63,436	480	3	90,000
26,000	5,200	6,928	277	39,904	68,723	520	3	90,000
28,000	5,600	7,461	298	42,973	74,009	560	3	90,000
30,000	6,000	7,994	320	46,043	79,296	600	3	90,000
32,000	6,400	8,526	341	49,112	84,582	640	4	120,000
34,000	6,800	9,059	362	52,182	89,868	680	4	120,000
36,000	7,200	9,592	384	55,251	95,155	720	4	120,000
38,000	7,600	10,125	405	58,321	100,441	760	4	120,000
40,000	8,000	10,658	426	61,390	105,727	800	4	120,000

Conclusion & Recommendations

18

- An intensive system shall be applied to increase the participation percentage.
- The type of barrel shall be changed.

Thank You

الوكالة اليابانية للتعاون الدولي

وزارة الحكم المحلي

Project for Technical Assistance in Solid Waste Management in Palestine - A Technical Cooperation between Ministry of Local Government Palestine and Japan International Cooperation Agency

Study on Construction and Demolition Waste in West Bank, Palestine

Final Report

Universal Group for Engineering and Consulting
Nablus, Palestine

August 2017

Project Information

Project Name	Study of Construction and Demolition Waste in West Bank, Palestine
Project No.	20161110
Client	Ministry of Local Government (MoLG)
Funded by	Japan International Cooperation Agency (JICA)
Consultant	Universal Group for Engineering and Consulting (UG)
Task Force on C&D Waste Management	• MoLG; • JSCs for Solid Waste Management; • EQA; • MoNE; • MoPWH; • Engineers Association; and • Palestinian Contractors Union.
Commencement Date	01 January 2017
Expected Completion Date	31 July 2017
Contractual Duration	8 months
Report Period	01 January - 31 August 2017
Report Summary	PART I: Introduction PART II: Quantification and Characterization of C&D Waste PART III: Current C&D Waste Handling and Practices PART IV: Environmental and Social Impacts PART V: Mapping of C&D Main Dumpsites PART VI: C&D Waste draft Guideline Part VII: C&D Waste Managing draft Bylaw PART VIII: CONCLUSIONS and RECOMMENDATIONS

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Abbreviations

3Rs	Reduce, Reuse, and Recycling of C&D waste
C&D	Construction and Demolition
C&DW	Construction and Demolition Waste
C&D waste	Construction and Demolition Waste
EA	Engineering Association
EQA	Environment Quality Authority
JICA	Japan International Cooperation Agency
JSC	Joint Service Council
LGU	Local Government Unit
MDLF	Municipal Development Lending Fund
MoHE	Ministry of High Education
MoLG	Ministry of Local Government
MoNE	Ministry of National Economy
MoPH	Ministry of Public Health
MoPWH	Ministry of Public Works and Housing
MoT	Ministry of Transportation
MSW	Municipal Solid Waste
NGO	Non-Government Organization
PCBS	Palestinian Central Bureau of Statistics
PCU	Palestinian Contractor Union
PVC	Poly Venyl Chloride
UG	Universal Group for Engineering and Consulting

PART I: Introduction

1. Background of Study

In the framework of the Palestinian National Strategy for Solid Waste Management, the Ministry of Local Government (MoLG) is implementing a project for technical assistance in solid waste management in Palestine, supported by Japan International Cooperation Agency (JICA), which will continue until the end of January 2018. One of the project items includes studying the current situation of construction and demolition (C&D) waste in Palestine. For this purpose, a preliminary study has been done in order to get an overview of C&D waste problems in Palestine. The study has been done in three stages:

1) Field survey on the connecting roads around Ramallah and Al Bireh city, in which different irregular dumps of solid waste including C&D waste of buildings.
2) A questionnaire distributed to Joint Service Councils (JSCs) of SWM in West Bank governorates.
3) A questionnaire distributed to local governmental units (LGUs) of West Bank governorates.

By which the C&D waste is the collective name of discharged debris resulting from construction, repair, demolition including (not limited to blocks, stones, digging residues, concrete, wood, carton, plastic, all kinds of metals, asphalt, etc.) in addition to fine particles generated from stone mills/crushers. The C&D wastes aggravating problem and the data available in Palestine about these kinds of wastes are limited regarding to types, quantities, and disposal ways.

Because of no clear evidence, it has not been determined how to deal with the accumulated C&D waste, and limited data about the negative impact on human and environment health, in addition to the lack of clear rules and regulation of dealing and administrating these wastes. So MoLG is planning to have a complete wide study on the reality of C&D waste in West Bank of Palestine.

According to the results of the above-mentioned preliminary study, MoLG-JICA Project recognized urgent needs of a detailed study on C&D waste for preparing draft guideline and draft bylaw. The Project created tender documents and conducted the consultant selection through the competitive bidding in 2016.

Universal Group for Engineering and Consulting has been contacted to conduct a basic study on C&D waste in West Bank, Palestine. The general purpose of the study is to estimate generated quantity and type of the C&D waste and to know current practices of handling these wastes. The study is also to prepare a draft Guideline, for appropriate C&D waste management, and a draft Bylaw in order to clarify the best administrative practices and how to prevent or reduce the environmental and social negative effects to the minimum level.

2. Construction and Demolition Wastes (C&D)

2.1 Description of C&D waste

In literature, C&D waste has many definitions. For example, Arslan et al. (2012) defined C&D waste as "a mixture of inert and non-inert materials arising from construction, excavation, renovation, refurbishment, demolition, roadwork and other construction-related activities." Inert materials can be comprised of whether soft inert materials such as soil, earth, and slurry or hard inert materials of rocks and broken concrete. Non-inert materials have also included wastes of metals, timber, plastics, and packaging.

According to the Department of Sustainability, Environment, Water, Population, and Communities (2011), the definition of C&D waste is "Waste produced by demolition and building activities, including road and rail construction and maintenance and excavation of land associated with construction activities."

The Regional Waste Reduction Coordinators of Nova Scotia (2013) named the C&D waste as "construction and demolition debris" and defined it as "The materials which are normally used in the construction of buildings, structures, roadways, walls and other landscaping material, and includes, but is not limited to, soil, asphalt, brick, mortar, drywall, plaster, cellulose, fiberglass fibers, lumber, wood, asphalt shingles and metals"

Based on the above definitions mentioned in the literature, the following definition can be adopted for the purpose of this study. Construction and Demolition Waste (C&D waste) is defined as any substance, matter or thing that is generated from construction, demolition, remodeling, and repairing of individual residences, commercial buildings, and other structures' works and abandoned. This matter might be processed or stockpiled before being abandoned.

The composition of such materials is variable, but may include rocks, stones, bricks, broken glass, soil, concrete waste, used packaging such as plastic and paper bags, cardboard, scrap iron such as concrete bars, reinforcing steel pieces, asphalt, electrical wire waste, wood from framework waste or pallets, and others. However, the waste generated will be predominantly building rubble consisting of waste cement, wood off-cuts, and scrap metal. Some of this waste can be re-used directly (e.g. wood off-cuts used as firewood), recycled (e.g. scrap metal) or re-used after processing (e.g. concrete scraps and waste cement); but the remaining unusable waste would be disposed of at a permitted waste disposal facility.

All C&D waste types are wholly inert, namely, public fill, should not be disposed of to landfill, but should be taken to pre-planned filling areas, which usually form part of reclamation schemes. C&D waste delivered to a public fill reception facility for disposal must contain entirely of inert material.

C&D waste is considered as part of the general solid waste generated from different activities in the community. In some countries, Solid Waste Management (SWM) is responsible for controlling collection, transportation and disposing of all sources and types of solid waste generated; municipal, industrial, etc. including the C&D waste. In other countries, C&D waste is managed away from other types of solid wastes. In Palestine, C&D waste collection and transportation are the responsibility of the one who generates it. The Local Governmental Units (LGUs) are responsible for monitoring the cleanliness of the generation sites and around, and directing the C&D waste producers (contractors) to the preplanned areas where the waste is to be stockpiled or dumped. However, waste management will be the producer's (contractor) responsibility to ensure that all generated wastes during the construction and demolition works are handled, stored and disposed of in accordance with good waste management practices, and as to the Palestinian Environmental Law, 1997and regulations.

Generally, the main achievements of any successful waste management of all sources and types are to:

(a) provide appropriate and efficient collection of solid wastes;
(b) provide successful source separation and storage;
(c) provide effective and economic transport of collected wastes to disposal facilities;
(d) provide environmentally safe, technically practical and low-cost disposal; and
(e) strengthen and ensure cost-effective operation and maintenance of the solid waste system.

Solid waste management includes a large number of activities that should be properly managed in order to achieve all previous goals at the maximum level of positive environmental impacts and at the minimum level of negative impacts. Solid waste management process begins with the first collection of the waste and continues to the last disposal process. Improper management of solid waste causes health and safety hazards to inhabitants

2.2 Problem statement of C&D

Huge amounts of Construction and Demolition (C&D) wastes are generated in all governorates in the West Bank. Most of these amounts are not dumped in official dumpsites but on roadsides and on privately owned land. Many problems had appeared due to such practices relevant to C&D waste handling and management. Some of which are the unpleasant scene of the city, the obstruction of traffic stream on roads, and the negative impacts of C&D waste on various environmental elements.

To solve the problems caused by the C&D waste, it is of great importance to secure the necessary information about quantities and types of the C&D wastes. Unfortunately, accurate estimation of such quantities is not available in any Palestinian institution or literature. The composition of C&D waste in generation sites as well as dumpsites is not characterized and proportioned. Negative impacts of C&D wastes on the Palestinian environment and on human health are not studied. Proper regulations and laws for handling of C&D wastes are not legally discussed nor adopted. These are the questions that this consultancy assignment is keen to answer.

Therefore, Universal Group for Engineering and Consulting (UG) was contracted by the Ministry of Local Government (MoLG) and granted by Japan International Cooperation Agency (JICA) to study different aspects of C&D wastes in the West Bank and to recommend effective solutions for the problems caused by mishandling and mismanagement of the C&D wastes.

The study area includes all the governorates of the West Bank, Palestine. The survey has covered all the 12 governorates of the West Bank, the site visits were conducted to a selected main generation sites of C&D waste in the West Bank governorates.

3. Project Objectives

3.1 Main objectives

The main objectives of this study are:

(i) to estimate generated quantities of C&D Waste in generation sites of the C&D Waste in West Bank, Palestine
(ii) to estimate types and composition of generated C&D Waste at the level of West Bank, Palestine
(iii) to know current practices of C&D waste handling, and;
(iv) to prepare a draft guideline and a draft bylaw for C&D waste management in order to clarify the best administrative practices and how to prevent or reduce the environmental and social negative effects to the minimum level.

3.2 Practical study targets

The practical targets of the study are mentioned below:

1) Categorize the C&D waste types based on the situation in West Bank, Palestine.
2) Determine and analyze the percentage of these C&D waste types observed in West Bank, Palestine.
3) Develop a method to estimate the produced quantities of C&D wastes in Palestine depending on the results of the site visits and other sources. The estimation has been based on scientific statistical methods. This will help in estimating annual C&D waste generation rate.
4) Complete description of all current practices of Collection, Transfer – Disposal of C&D waste with determining the locations of (public & private) transfer stations (if existed) and prepare a map clarifying these locations and the resulting environmental effects.
5) Assessment of the environmental effects of the C&D waste.
6) Assessment of the methods applied for the recycling or reuse and usefulness

4. Literature Review

Literature review is an important tool commonly used when start implementing a project. It is one of the main sources of collected data. Therefore, it is necessary to review as many publications as available to achieve the objectives of the project in a proper way.

The consultancy team was keen to use literature review of previous studies related to C&D waste studies implemented in the Palestinian areas, the regional areas and in the world as a whole. During that, the team had concentrated on the high-value studies which used the most updated scientific methods.

The team had selected a group of publications which researched the following topics:

- Questioning LGUs in Palestine about the C&D waste issues
- Quantification methods of generated C&D waste
- Characterization of the types of the C&D generated waste
- Different practices of collecting, transporting and disposing of generated C&D waste
- Reducing, reusing and recycling methods of generated C&D waste
- Effective C&D waste management adopted
- Different guideline manuals for the C&D waste management

- Socio-Economic impacts of generated C&D waste

Once the project team had been mobilized to start his work on the project, it began to classify selected publications for review as shown in **Table 1**. The team reviewed all these publications and found them to be very helpful and useful in achieving the objectives of the study.

Table 1: Literature Review

Title and Author	Summary
Report on Questionnaire Survey on Public Awareness on Construction and Demolition Waste at LGUs Level Nisreen Hammad Ministry of Local Government, Palestine November 18, 2015	The purpose of this survey is to get the present state of awareness on the C&D waste problem at LGU's level in Palestine. The questionnaire was distributed through a total of 142 Local Governmental Units (LGUs). According to the questionnaire, LGUs had estimated types and quantities of C&D generated in their service regions. LGUs have no accurate data about the C&D waste. It was concluded from the questionnaire that LGUs do not care about this type of waste because they consider it nonhazardous on the environment or humans, and hence they didn't have accurate records about the total amounts of C&D wastes generated. From the results of the survey, it was found that only 11 out of 142 LGUs that have designated dumpsite or land for C&D waste, whereas the rest of LGUs declared that C&D waste is being disposed of in the surrounding of construction sites, surrounding of demolition site, land owned by private entities, land owned by public entities and in wadies in the area. All LGUs pointed out that new laws and regulations are necessary to be enacted in order to control C&D waste handling.
Workers' safety in the construction industry in the southern West Bank of Palestine. Al-Sari, M., Al-Khatib, I.A. (2012)	There are few data about safety in the construction industry in Palestine. The main aim of the study was to assess worker's experiences and perceptions of safety at construction sites in Hebron and Bethlehem governorates of the West Bank. A structured questionnaire was completed through direct interviews with 349 construction workers. Of the respondents, 34.6% had experienced work-related accidents, 13.0% and 65.6% indicated that their workplace did not have a first-aid kit or trained first-aid specialist respectively, 35.8% reported that their work sites did not have safety tools and 83.7% had not received safety training. Workers perceived that awareness and training were the most frequent factor affecting workers' safety, with the foreman position having the greatest impact on the workers' safety. Greater enforcement of the current Palestinian safety laws is needed.
A Methodology for Quantifying the Volume of Construction Waste Peter A. Yost et al September 1, 1996	Estimates for construction waste generation are often based on per capita multipliers in much the same way as municipal solid waste estimates. This has lead to estimation rates with more than 10-fold variation and little confidence in the resulting estimates. A methodology is offered in this paper that bases construction waste estimates on the financial value of building permits for a variety of types of construction projects. In this way, estimates reflect actual construction activity more closely and are based on a detailed and widely available database from the Census Bureau.

Title and Author	Summary
Reducing building waste at construction sites in Hong Kong C. S. Poon et al 13 May 2010	The building industry is using a considerable amount of resources, but if the life cycle of the material on the site is closely examined, it is generally known that there is a relatively large portion of the materials being wasted because of poor material control on building sites. The problem of material wastage is not an isolated issue on construction sites. It is also an environmental concern. Hong Kong is running out of both reclamation sites and landfill space for the disposal of construction & demolition (C&D) waste. Many resources can be conserved and the amount of C&D waste required to be disposed of should be greatly reduced if better management of materials is practiced on building sites. This paper reports on a recent study conducted in Hong Kong relating to material control on construction sites with high rise multi-storey buildings.
Management of construction waste in public housing projects in Hong Kong Chi Sun Poon et al 21 Oct 2010	Waste management in the building industry in Hong Kong has become a major environmental issue in recent years. Of particular concern is the increasing amount of construction and demolition (C&D) waste being dumped at landfill sites. Greater consideration must be given to waste generation and management at the planning stage of a building development to reduce wastage levels. The causes and quantities of building construction waste generated on public housing building sites in Hong Kong have been analyzed. The major causes of wastes were improper preparation and handling, misuse, and incorrect processing. In general, little on-site waste sorting was carried out. Appropriate planning including the preparation of a detailed waste management plan is essential for effective waste minimization.
A study on the attitudes and behavioral influence of construction waste management in Palestine Majed I Al-Sari et al October 4, 2011	As a step towards comprehending what drives the management of construction waste in the occupied Palestinian territory, this paper quantifies construction waste generation and examines how the local contractors' waste management attitudes and behavior are influenced. Collection of data was based on a survey, carried out in the southern part of the West Bank between April and May 2010. The survey targeted contractors who specialized in the construction of buildings. The results showed that during the construction of buildings, 17 to 81 kg of construction waste are generated per square meter of building floor. Although the area of a building is the key factor determining 74.8% of the variation of construction waste generation, the employment of labor-intensive techniques in the study area means that human factors such as the contractor's attitude and behavior towards waste management exert a key influence on waste generation.

Title and Author	Summary
Quantifying construction and demolition waste: An analytical review Zezhou Wua et al September 2014	Quantifying construction and demolition (C&D) waste generation is regarded as a prerequisite for the implementation of successful waste management. In literature, various methods have been employed to quantify the C&D waste generation at both regional and project levels. However, an integrated review that systemically describes and analyses all the existing methods has yet to be conducted. To bridge this research gap, an analytical review is conducted. Fifty-seven papers are retrieved based on a set of rigorous procedures. The characteristics of the selected papers are classified according to the following criteria - waste generation activity, estimation level, and quantification methodology. Six categories of existing C&D waste quantification methodologies are identified, including site visit method, waste generation rate method, lifetime analysis method, classification system accumulation method, variables modeling method and other particular methods.
Assessment of different construction and demolition waste management approaches Manal S. Abdelhamid	The waste generated from construction and demolition sites is considered one of the most irritating problems in Egypt. In the last 10 years, some effort has been made toward solving this problem, the most outstanding is the newly issued Egyptian rating system “Green Pyramids Rating System”. It emphasizes on waste management and particularly “site provision and environment” which contributes to 75% of the management category score. However, the traditional practice which is limited to dumping all the generated waste is still dominating. The absence of sustainable practices in the construction sector in Egypt led to the lack of financial and environmental data. From a strategic perspective, the research aims at developing a detailed procedure to evaluate two construction and demolition waste management approaches by means of Decision Matrix technique. A detailed study is introduced for the two approaches; for each approach, a flow chart is developed to demonstrate its lifecycle, as well as the cost break down structure and the different stakeholders’ roles. A penetration discussion of the pros and cons of each approach was developed accordingly and came out with sixteen influencing attributes for both approaches. The previous steps paved the ground to construct a Decision Matrix to decide on one of the approaches from a strategic environmentally oriented perspective.
Strategies for successful construction and demolition waste recycling operations	Establishing a successful construction/demolition (C&D) waste recycling operation in the USA is a challenge today, especially because secondary materials markets have not yet matured. Increasingly, municipal solid waste (MSW) landfill operations refuse to accept C&D waste. The experiences of regional C&D recyclers indicate that successful recycling operations require a minimum of 0.8 ha of clear space for processing equipment, incoming waste stockpiles, recycled materials, and maneuvering room for mobile equipment and operations. At present, operators of these facilities make a profit almost

Title and Author	Summary
Chun-Li Peng et al 21 Oct 2010	solely on tipping fees, with the recycling operation functioning mainly to maintain materials throughput. Different categories of C&D recycling machinery and waste processing strategies are presented. Strategies for converting C&D landfills into successful C&D recycling operations are also examined. C&D waste recycling economics are presented to demonstrate the essential ingredients for successful operations.
Country Report on the Solid Waste Management in Occupied Palestinian Territories GIZ April 2014	The report concludes that the major obstacles in improving solid waste management are highly political. One of the important issues facing Palestinians in waste management is dealing with illegal import of waste. Illegally imported waste includes municipal waste, construction and demolition waste, E-waste and other hazardous waste. Quantification of illegal waste imports is not possible at the time. Another important problem facing Palestinian in waste management is obtaining approvals for disposal facilities. Most of the environmental facilities such as waste treatment and disposal facilities can be located only in “Area C” as classified by OSLO Agreement. The process of approval requires the Israeli approval for constructing these facilities in “Area C”, where Israelis have both civil and security control on that area. The approval of environmental facilities takes years (if approved), resulting in significant delays in improving waste management.
Best practice measures assessment for construction and demolition waste management in building constructions Paola Villoria Saeza et al June 2013	Currently, the construction and demolition (C&D) waste collection system in Spain is managed in a decentralized manner by each sub-contracted company. This lack of comprehensive strategy for C&D waste management causes a confusing and sometimes individual attitude regarding the different measures for C&D waste. Therefore effective waste management should be enforced. Construction stakeholders have a wide range of best practices in C&D waste management that can be implemented, so they need to be assessed for their effectiveness. The aim of this research study is to assist construction stakeholders in making a decision on C&D waste management. This paper carries out a survey conducted among the construction agents in order to evaluate the effectiveness of 20 best practice measures regarding C&D waste management, identifying the most suitable types of building constructions to implement these practices and also the advantages and drawbacks of their performance in a building construction project. Results of this study show that among the highly effective best practices are:

Title and Author	Summary
	the use of industrialized systems and the contract of suppliers managing the waste. In addition, distributing small containers in the work areas is also another high valued practice, although only 36% of respondents usually implement this measure in their works.
Pilot-based assessment of the economics of recycling construction demolition waste Issam M Srour et al March 4, 2013	The significant amount of waste generated from construction demolition has become a chronic problem in many developing countries. Using data obtained from demolition contractors and various other sources, this paper proposes a framework for the proper handling of construction demolition waste (CDW) to serve as a decision support tool in countries suffering from the lack of national CDW management guidelines. The framework is then demonstrated through a case study in the city of Beirut, Lebanon, and a sensitivity analysis is carried out to examine the economic feasibility of developing a recycling facility. The analysis showed that in order for a facility to be feasible, a gate fee should be charged in the presence of a market for recycled aggregates. The results confirm the significance of instigating and implementing legislation to control illegal dumping, constructing, and managing engineered landfills, and establishing markets for recycled CDW.
Revised Technology Transfer for Recycling of Building Material Waste, Gaza Support to the Marble and Stone Industry in the West Bank UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION Vienna, 2011	The intended beneficiaries were the Palestinian population (particularly workers and young entrepreneurs), the Government authorities and institutions dealing with industrial and infrastructure development, private sector associations, entrepreneurial groups and financing institutions addressing building activities. The immediate objective was to transfer know-how and technology to produce aggregates and/or value-added building materials from debris. Two recycling facilities were planned, to be owned and managed by local public and/or private partners. Waste materials would be transported to and crushed in the facilities and transformed into semi-finished and finished products. International and national experts would ensure proper technical and know-how inputs into the preparatory activities. The International Centre for Science and High Technology (ICS HT) in Trieste, Italy was to provide additional funding and training of local management and technicians. It was assumed that the local authorities would be able to secure the availability of land and utilities for the facilities.
Construction and Demolition Waste Manual	The basic goal of this document is to assist design and construction professionals to prevent construction waste and to divert from landfills the C&D waste that is generated. Reducing construction and demolition (C&D) waste requires commitment and attention by all parties key to the building's construction. Significant waste prevention and diversion from landfills requires

Title and Author	Summary
City of New York, Department of Design and Construction DDC May 2003	that we view materials as resources to be conserved. Opportunities for reducing the C&D waste focus on three approaches, typically expressed as Reduce–Reuse–Recycle. Reducing waste, the first approach, yields the greatest environmental benefits. Using less material costs less, reduces pollution from its manufacture and transportation, saves energy and water, and keeps material out of landfills. Waste reduction should be the top priority in your waste management plans. Reusing, the second approach extends the life of existing materials and decreases the new resources needed. The reuse or salvage of building components, common in historic renovations, is being extended to non-decorative elements such as doors and light fixtures as well. And as a long-term approach, designing buildings to easily accommodate evolving use and technology is an excellent strategy to prevent future waste. Recycling, the third approach again conserves resources and diverts materials from landfills. Demolition and renovation projects, which account for approximately two-thirds of DDC's work, present numerous opportunities for recycling. The most sustainable form of recycling converts wastes into new products, such as scrap to new steel or asphalt into new paving. Additionally, finding alternative uses for waste is a form of recycling. Inert waste, such as concrete and brick, can be crushed and used as an alternative daily cover for municipal landfills, substituting for dirt, or wood can be burned as boiler fuel.

5. Building and construction industry in Palestine

5.1 General

Construction industry sector has been always considered as one of the most important sectors in the world economy for its broad and the intense overlap with other sectors of industry. It affects the economic development in the country as it is a major generator of jobs and is an important component of Gross Domestic Product (GDP) in addition to its added-value. It is considered as the second largest industry in the world, with a contribution of 13% of the world GDP of developed countries in 2013.

The construction sector has a significant impact on the Palestinian economy and it became one of the key economic sectors and the main force that motivates the national economy. It has played a crucial role in extending job opportunities for Palestinian labor force throughout Palestinian cities and towns. In 1994, the construction sector has witnessed noticeable expansion and became the leading industry sector in attracting new investments and offering new job opportunities (PCU, 2008). In West Bank construction sector completed approximately 5 million m² in 2014 and it contributed about 8% of the GDP with gross value added totaling US$547.3 million in 2014 (PCBS).

A survey by the PCBS indicated that the value of constructing new buildings and additions in the Palestine rose by 23.2% in 2010. The results of the survey indicated that the value of constructing new buildings and additions in 2010 was US$657 million, with $299 million spent on new constructions and $358 million spent on additions of vertical or horizontal construction. Unfinished construction accounted for $374 million and finished construction for $283 million (Wafa, 2011).

5.2 Building materials used in Palestine

The building material is any material used for a construction purpose. Building materials can be generally categorized into two sources, natural and synthetic. Natural building materials are those that are unprocessed or minimally processed by industry, such as lumber or glass. Synthetic materials are made in industrial settings after many human manipulations, such as plastics and petroleum based paints. Both have their use. In general, stone is used as a basic structural component in the buildings, while plain concrete is used to fill the space in between, acting as a type of concrete and insulation.

In general, the main materials used in construction in Palestine are concrete, stone, hollow concrete blocks, steel, aluminum, wood and other complementary materials. These kinds of building materials can be used individually or together with each other to form the structure of buildings. By the second half of the 20th-century steel started to be used as a structural element for walls and different steel sections and bars were found as building materials. This changed the techniques of construction building system from a bearing wall system into a skeleton system (the columns). The cement displaced the lime, and with steel, it started to be not only the binding material but also a structural element especially with steel.

The stone cutting industry in the West Bank is the largest construction industry. Concrete blocks used in the construction of the walls and ceiling slabs of the buildings are locally produced from local materials.

1- Stones

Building stone is obtained by taking rocks from the earth and reducing it to the required shapes and sizes for the construction of residential houses and public buildings.

The vast majority of these quarries are concentrated in the Hebron area, which is also known for using the most modern and sophisticated machinery for extracting stone and for producing stone that has minimal defects, a good color, and a uniform texture.

2- Cement

The cement industry is considered as one of the strategic industries, the cement represents a great importance in the projects of the construction, reconstruction and development on both levels as the specific levels and the general ones. This industry in Palestine has a special importance at this time in particular where the Palestinian society passes in the construction stage and increasing population which increases the demand for cement.

The Palestinian market gets all its needs from cement by means of the import. The imported quantity spreads according to the source as follows: Israel 80% ،Jordan 9% ، Europe 6%، Egypt 5% *(Source: Palestinian National Information Center)*.

3- Concrete

Concrete is widely used in all types of construction. It is used in all types of construction; from residential houses to multi-storey office buildings and shopping complexes. Concrete is made by mixing: Cement, water, coarse and fine aggregates, admixtures, etc.

6. Data Collection

6.1 General

Collection of data had served in assessing the current situation of the C&D waste in the target governorates. The generated quantities of C&D waste had been estimated and the composition of this type of waste had been characterized, as well. Data had been also included the generation sites of the C&D waste and the current practices of disposing of the waste and recycling and usefulness ways of the generated waste.

Secondary data collection

Various resources of data had been utilized such as published studies and reports about C&D in Palestine

As a first step of the implementation of the project, baseline data, population, economic activities and employment data had been collected from the targeted governorates.

Baseline assessment of the existing C&D waste handling practices in addition to available relevant laws and legislations had been also collected.

<u>Primary data collection</u>

Data collection by this method had been conducted via different ways of collection such as site visits, questionnaires, and interviews. Primary data was perceived as a valuable source of original knowledge for the Consultant and all the project team members; since it allowed for deep understanding of the C&D waste problem and about the perception of the problem to local stakeholders. In addition to interviews with academics specialized in construction engineering.

The project team had concentrated on quantitative and qualitative data collection as the main objective of the project is to estimate amounts and composition of C&D waste in West Bank.

Quantitative and qualitative types of data collection aimed at assisting the team in gathering an in-depth understanding and evaluation of the current situation related to C&D waste management, as well as identification of the role of public and private sectors in controlling these wastes.

To make collecting data an easy process, the project team had developed a survey data sheet to be filled, on the spot, by the data collectors during their visits to C&D waste generation sites. A survey data sheet form is attached in **Annex III**. Site visits had targeted C&D waste producers from the private sector such as contracting companies and the public sector such as official bodies implementing projects under their direct supervision such as MoPWH and MoHE. Site visits had also targeted dumpsites, to estimate the composition of C&D waste dumped off, and LGUs to obtain available useful data such as permissions of buildings, demolishing and areas of licensed building under construction. C&D waste characterization from different construction locations had been implemented.

6.2 Field visits

Site visits had been conducted to generation sites in almost all governorates in the West Bank. Data collection had been carried out through visiting generation sites in the main cities in these governorates as well as the dumpsites there. During each of these visits, data collectors had filled the data sheet, on the spot. This survey was only descriptive and dealt with qualitative issues of C&D waste; such as the current situation of handling C&D waste as well as the current behavior and practices in this regard.

For dumpsites, it was important to describe the location, area, types of C&D waste, the majority of C&D waste, recycling processes (if present), Palestinian trucks emptying, etc.

The data collection team had visited Jenin Municipality and conducted a meeting with the Municipality Engineer in charge of C&D waste management. The team also conducted another meeting with the Head of Deir Sharaf Village Council. Furthermore, the engineer responsible for the management of C&D waste in Nablus Municipality was interviewed and valuable information had been obtained as an output of the interview. These meetings and visits had clarified many issues about:

(a) Public construction and demolition sites, supervised by the MoHE, MoPWH and other relevant agencies;
(b) C&D waste dumpsites existed (private, public, random landfill/ dumpsites).
(c) The need for a detailed comprehensive survey study

Dumpsites in the selected cities had been visited and general information about these dumpsites had been collected; such as location, distance from the city, area, recycling inside the dumpsite, etc. Furthermore, estimations of the composition of C&D waste had been carried out.

The data collected through site visits of generation sites and dumpsites was used together with the data obtained from meetings with LGUs, Contractors Union records, MoPWH, MLDF and PCBS; such as areas of licensed buildings, lengths of roads constructed or rehabilitated, permissions of building, demolishing, fines imposed on contractors and truck drivers, etc., were used in the process of determining the amounts and composition of C&D waste.

6.3 Interviews and meetings

I. Interview with the Palestinian Contractor Union

- The viewpoint of the Head of the Palestinian Contractor Union towards C&D waste handling was as follows:
- Quantities of C&D wastes have no accurate statistical estimation in any region in Palestine. However, he declared that during building; each 1 m2 of building surface requires 0.8-1.0 m3 of concrete and the generated waste is estimated at 3%. He added; each 1 m2 of building surface requires 80-100 kg of iron bars with a waste percentage of 5%.
- In Gaza Strip, recycling of C&D wastes is a common practice due to the unfair siege imposed by the Israeli and Egyptian governments. Therefore, almost all

components of C&D waste are being recycled. On the contrary, recycling of C&D waste in the West Bank is more selective and restricted to certain materials where the most attractive material is the steel bars.

- Random dumping of C&D wastes could be attributed to the absence of public dumpsites and the high cost of transportation to remote dumpsites. However, there is a need for strict regulations to control C&D waste
- In many cases, municipalities direct contractors to deliver C&D waste to future roads or places that need to be leveled and sometimes the waste is sold as a cheap agricultural soil.

II. Interview with a contractor

The consultancy team had met the senior engineer at Brothers Contracting Company, Nablus. The engineer had focused on some important points such as:

a. On-site recycling is restricted to agricultural soil and to rocks used for terraces building or crushed in a stone crusher.

b. During streets rehabilitation, removed layer of asphalt is piled and residents in the region can load from these piles for free and reuse this type of asphalt in paving their house entrances.

c. Suggestions presented by the engineer: (a) allocating enough number of dumpsites, by LGUs, in each governorate (b) enforcement of relevant laws and regulations (c) cooperation between contractors and the Palestinian Contractor Union (d) establishing a center within the LGU vicinity with a database of expected generated C&D wastes in order to offer that waste for those who need such wastes for road leveling or as soil for house gardens.

III. Meetings with engineers responsible for C&D management in LGUs

a) An important meeting was conducted with the engineer responsible for C&D waste in Nablus Municipality. He summarized the situation as follows:

b) There are not enough official dumpsites for this type of waste

c) There are no previous studies on C&D waste regarding quantification or characterization

d) The main reason for dumping C&D waste at the roadsides is the remote distance of the designated dumpsite located at Badan street

e) Enacting new laws and legislations is very important for C&D waste management

IV. Meetings and interviews with engineers and workers during site visits

Some important data was extracted from the interviews conducted with engineers and foremen during site visits:

a. A foreman in one of the generation sites (a building under construction) was interviewed. He declared that they do not reuse or recycle any of the generated C&D wastes on site.

b. The foreman himself estimated that a floor of about 400 m^2 generates around 10-15 ton of C&D waste (25-37 kg/m^2) and 2 bricks out of 60 ones (3.3%) used in building, become part of C&D wastes. The foreman denied the existence of any official dumpsites in that region and hence C&D wastes are of course, randomly, disposed of.

c. Another foreman of a workshop installing tiles said that wastes generated are tiles and fine aggregates. Damaged tiles are reused for filling purposes while the surplus of fine aggregates could be used in other places of the building. He estimated the wasted tiles as 0.5-1 m^2 out of 10 m^2 (5-10%) of tiles installed.

d. An engineer was interviewed in another workshop said that he could not accurately estimate the quantity of C&D waste generated in his workshop but he can say that a floor of 200 m^2 generates about 10 ton of wastes (50 kg/m^2). He added that about 40 truck-full of waste was generated from a demolished house.

V. Meeting with top officials of the Environmental Quality Authority EQA

A meeting was conducted at the office of the Vice President of EQA. Many engineers attended that meeting and participated in the discussions. These discussions focused mainly on laws and legislations needed to control the management of C&D waste all over the Palestinian Territory. They proposed that legal suggestions be addressed in this project to be studied together with the MoLG.

6.4 LGUs survey

A questionnaire consisted of 22 questions was designed and sent by fax to 60 LGUs. It was intended to be a successful tool for data collection about C&D waste issues. Unfortunately, only one or two of the LGUs responded and sent back the questionnaire. It was clear from the telephone contacts with some LGUs that most of them do not have any of the required data which can be exploited in this study. Therefore, it was suggested to perform a pilot survey for about 10 communities to assess the value of the available data of LGUs.

To conduct the survey, ten LGUs in Ramallah/Al-Bireh Governorate had been targeted for the survey purposes. Selection of this governorate was based on its location in the middle of the West Bank and its large population which is about 700 thousand people. The questionnaires were filled by an MSc. graduated student, who has considerable experience in the field of surveys and statistics. The respondents were the engineers or persons in charge of the C&D waste at the LGU. To ensure accuracy, respondents were questioned face to face. The targeted communities for this questionnaire were:

(i) large communities: Ramallah, Al-Bireh, and Beituniya;

(ii) medium communities of about 5,000 - 10,000 inhabitants: Birzeit, Beit Leqia, and Deir Abu Masha'al; and

(iii) Small communities of less than 5,000 inhabitants: Kober, Surda, Abu Qash and Aboud.

The questionnaires were entered in the computer and statistically analyzed using the SPSS statistical analysis program. Conclusions extracted after the statistical analysis of the survey are summarized as follows:

1) 33.3% of the questioned LGUs can estimate the total amount of C&D waste generated in their service area, while 66.7% cannot.

2) None of the LGUs can estimate the recycled or reused portion of C&D waste.

3) 33.3% of the LGUs reported that they have a dumpsite dedicated for C&D waste and that they have only one dumpsite; whereas 66.7% do not have such dumpsites. It is worth mentioning that Ramallah, Al-Bireh, and Beituniya cities, which constitute the three largest communities in the Ramallah/Al-Bireh governorate, are currently preparing a special dump site for excavation materials that are generated from construction. They are considering reusing these C&D wastes.

4) 11.1% of the questioned LGUs indicated that the waste dump sites in their community receive C&D wastes from other neighboring towns and cities.

5) 33.3% of the LGUs believe that the dumpsites of C&D waste are sufficient to accommodate the C&D wastes in their area. These communities are clusters that are small to medium communities.

6) All LGUs that have a landfill have indicated that C&D wastes are not recycled inside the dumpsites.

7) 77.8 % of the LGUs do not have any procedures (regulations, requirements or bylaws) for the management of C&D waste, while 22.2% of the LGUs which are considered large communities have some procedures. These include signed pledges as not to affect or dump on private lands. Sometimes, the municipal inspectors monitor the excavation and construction works in their region.

8) There are several suggestions by LGUs regarding the management of C&D waste which can be summarized as follows:

(i) the need for a general policy to determine how and where to dispose of large quantities of excavation materials;

(ii) the need to have dumps ready to receive the huge amounts of excavation materials;

(iii) the need for enforcement of laws including fining those who violate laws.

(iv) the necessity of obligating the building owner and the contractor to pay the insurance amount to ensure that the neighboring land owners are not affected. Furthermore, it is necessary to keep monitoring the excavation works by the municipal inspectors.

9) LGUs, in general, indicated that one of the most important reasons behind the illegal disposal of the C&D wastes would be:

a) the absence of a clear management and regulation system for C&D wastes;

b) inadequate dumpsites in the region;

c) saving transportation time and shorten distances;

d) saving the cost of waste transport; and

e) lack of awareness among those who are handling C&D wastes.

10) Most of the LGUs indicated that they are not aware of significant negative impacts due to C&D waste in their service areas. As to some of the LGUs negative impacts of C&D wastes could be:

(i) narrowing or closure of roads;

(ii) affecting privately owned lands;

(iii) closing of areas that are potential for LGU expansion and development;

(iv) obstruction of agriculture activities;

(v) changing the course of valleys (impact on surface water);

(vi) closing the rainwater drainage systems and culverts; and

(vii) contaminating the surrounding environment.

11) 33.3% of the questioned LGUs indicated that there were no protests from residents against the existence of C&D wastes either due to the nearby allocated dumps or because of the random nearby dumps. In the meantime, 66.7% of the LGUs indicated that there were protests from residents of the area against the presence of C&D random landfills and against dumping of wastes in the privately owned lands.

12) LGUs do not have the capacity to identify sources of C&D wastes and to determine the proportions of this type of waste.

13) 77.8% of the LGUs indicated that they do not have any recycling activities or reuse of C&D waste in their service areas.

14) LGUs stated suggestions on the recycling and reuse of C&D waste which can be summarized as follows:

(a) recycling should be carried out away from the boundaries of the LGUs;

(b) using the excavation materials in leveling new roads;

(c) employment of experienced staff in this field;

(d) recycling works to be under the supervision of an official body such as EQA or MoNE;

(e) establishment certain factories to re-grind the waste and reuse it in construction works; and

(f) cooperate with the private sector in recycling businesses and conducting feasibility studies in this regard.

15) None of the LGUs has undertaken a survey or study about the C&D waste in their service areas.

16) The following are suggestions from the questioned LGUs regarding the management of C&D waste in Palestine:

(i) activating the role of LGUs in monitoring C&D waste dumping;

(ii) adoption of legislations and laws that are logical and in line with reality;

(iii) conduct a diagnostic study of the current status;

(iv) cooperation with the private sector and strengthening the social partnership between the institutions and the LGUs with regard to recycling;

(v) adoption of official legal C&D landfills; and

(vi) create clear instructions and policies with respect to C&D waste handling and impose fees on building workshops and on trucks transporting C&D wastes.

Based on the analysis of the pilot questionnaire, it was concluded that expanding the questionnaire to cover more LGUs in the West Bank governorates is not expected to add any more desired data. According to the pilot questionnaire, only one-third of the questioned LGUs claimed that they could estimate the total amounts of C&D waste generated in their service areas, whereas two-thirds could not estimate such amounts. Furthermore, none of the LGUs had the capacity to identify sources of C&D waste and to determine the composition and proportions of this type of waste.

In addition, none of the LGUs could estimate the recycled or reused portion of C&D waste and none of them had undertaken any survey or study about the C&D waste.

On the other hand, the rest of data collected from the questioned LGUs would not differ such as:

a) no recycling or reuse activities inside the dumpsite;

b) few LGUs have dumpsites dedicated to C&D waste and another few said that dumpsites are sufficient to accommodate C&D waste in their areas;

c) very few LGUs allow other LGUs to dump C&D waste in dumpsites within their service area;

d) most LGUs do not have any regulations, requirements or laws for the management of C&D waste;

e) all LGUs declared that no significant negative impacts of C&D waste were observed in their regions;

f) most LGUs said that protests against C&D dumping concentrated on random dumping in roadsides and in privately owned lands;

g) LGUs presented many reasons for random dumping of C&D wastes;

h) Suggestions commonly raised, from LGUs regarding C&D waste management, were about recycling activities and legislations to be enacted and adopted.

PART II: Quantification and Characterization of C&D waste

1. C&D waste Characterization and Quantification

The main objectives of the project are (i) to estimate the generated quantities of C&D waste in generation sites of the C&D waste in West Bank, Palestine and (ii) to estimate types and composition of generated C&D waste, as well. These estimations include the categorization of C&D waste types based on the situation in West Bank and to develop a method to estimate the produced quantities of C&D wastes in Palestine depending on the results of the site visits and other sources. The estimation was based on scientific methods which helped in estimating annual C&D waste generation rate.

The consultancy team tried to get such estimations from the different LGUs in the West Bank through distributing questionnaires to these LGUs and through conducting several meetings with engineers responsible for C&D waste management in some LGUs. Unfortunately, it was found that LGUs, in general, don't have the desired data regarding the amounts of C&D waste generated nor the percentages of the composition of this type of waste. This was clear from results concluded from the survey carried out by the MoLG where it was found that most LGUs do not consider these wastes as a harmful agent for the environment and they do not have any data about the quantities of C&D wastes. Any values of generated C&D waste quantities got from LGUs are random figures and not based on accurate estimations.

Because of the above-mentioned reasons and the need to use scientific methods for C&D waste quantifications, the team had carried out an experiment which is described below in details.

It is worth mentioning that the heterogeneous nature of C&D solid waste, determination of the composition is not an easy task. For this reason, more generalized field procedures based on common sense and random sampling techniques have been evolved for determining composition.

Procedures of the experimental sampling:

14 samples were chosen to represent the districts in the West Bank:

- 3 samples were obtained from a newly constructed house in Nablus city,

- 2 samples were obtained from Al-Badan C&D dumping site receiving C&D wastes from Nablus city and the surrounding villages,
- 3 samples from Al Ezaryeh C&D dumping site in Jerusalem district,
- 3 samples from Dura C&D dumping site in Hebron district, and
- 3 samples from Ramallah C&D dumping site.

The location of the 5 C&D characterization sites is shown in **Figure 1**.

Figure 1: Location of the 5 C&D characterization site

Figure 2: Pictures for C&D waste experimental sampling for characterization

A galvanized sampling tank was filled with C&D waste, capacity 0.5 m^3. The tank contents were then emptied on the ground. Each sample was sorted into the components: Concrete, bricks, stones, metal, plastic, wood, gypsum, asphalt, tiles, paper & cardboard, and other materials. Twelve dustbins, each with capacity of 80L, were used for the separation of the C&D solid waste components. An electronic scale was used to weigh the dustbins at the different sampling locations. The percentage of the C&D waste components and the total sample weight were calculated. The following pictures have been snapped during the experiment clearing the steps. Pictures for C&D waste experimental sampling for characterization are shown below.

2. C&D Waste Composition

Figure 3 to 11 show the gross average, maximum and minimum of C&D waste components by weight of all tested samples, tested sample at the house, and the tested samples at the dumpsites. From the 9 figures, it can be noticed that the principal components on a weight basis are concrete and bricks. **Table 2** to **4** summarize all presented results.

Concrete, bricks, and stone fractions are the ones with the highest percentage. Conversely, the gypsum and tiles fractions present the lowest percentages, while metal, plastic, and wood remain relatively low if compared to the higher ratios. Note that metal low percentage, probably as a result of an increase in the amount of metals now collected selectively from dumpsites. Concrete waste ranges from 7.40% to 88.70% with an average value of 41.60%, while bricks waste ranges from 3.80% to 37.70% with an average value of 22.30%. All detailed samples' results are shown in Annex IV.

The average values of C&D waste components by weight of all tested samples will be used for the estimate of the total generation rate of the C&D waste components at the level of the West Bank districts.

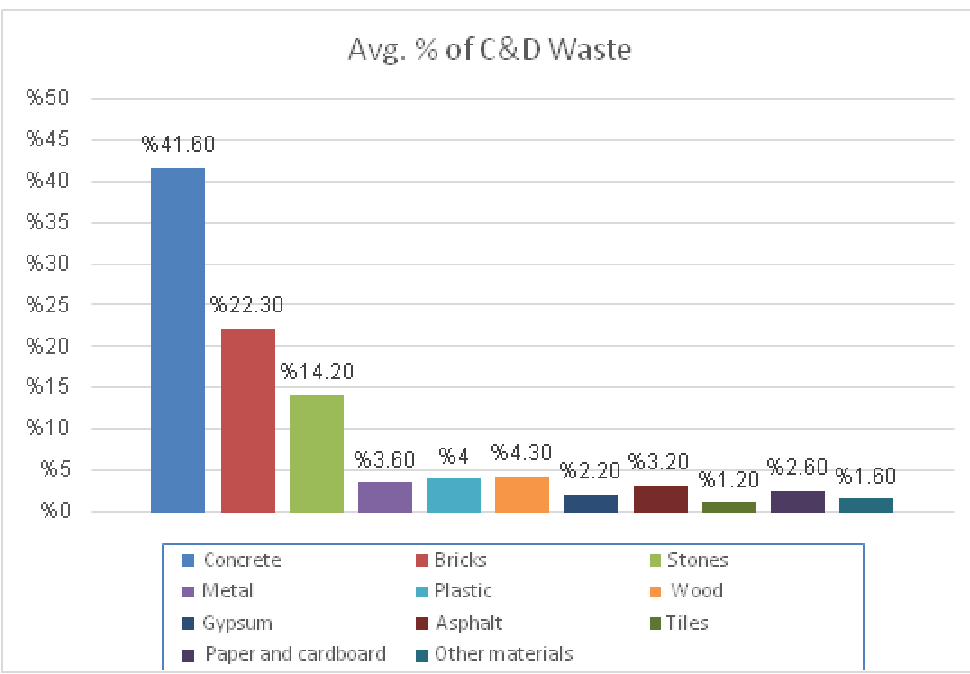


Figure 3: Gross average of C&D waste components by weight of all tested samples

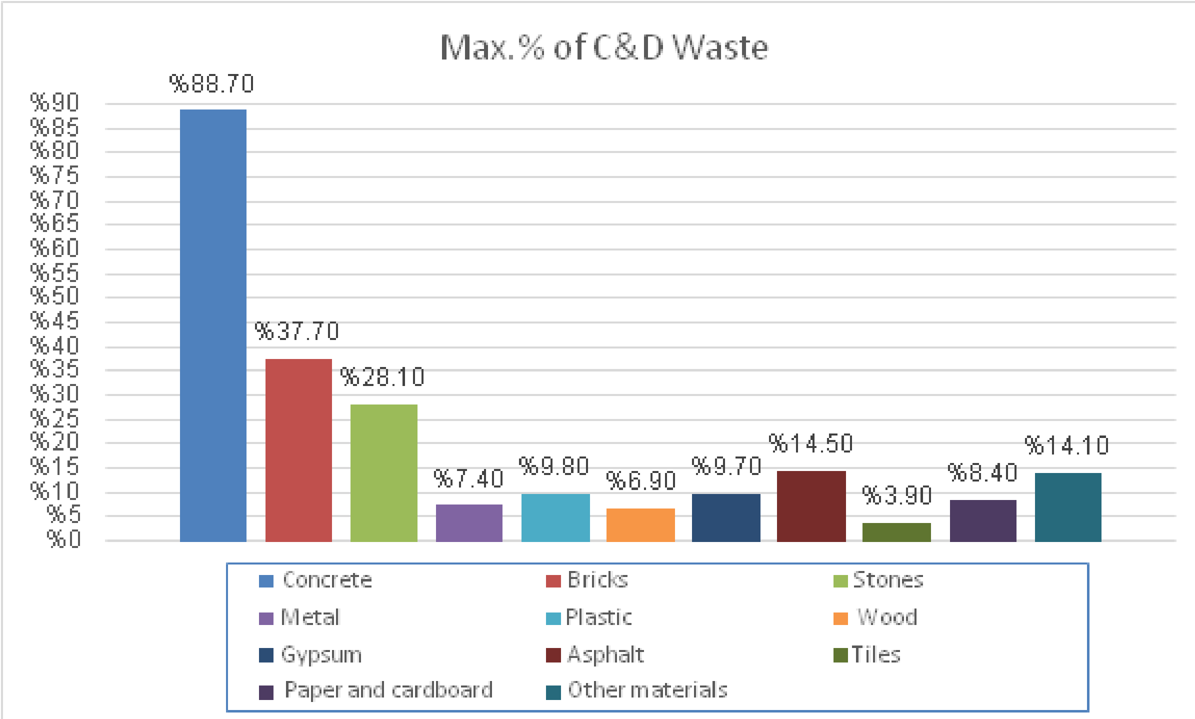


Figure 4: Gross maximum of C&D waste components by weight of all tested samples

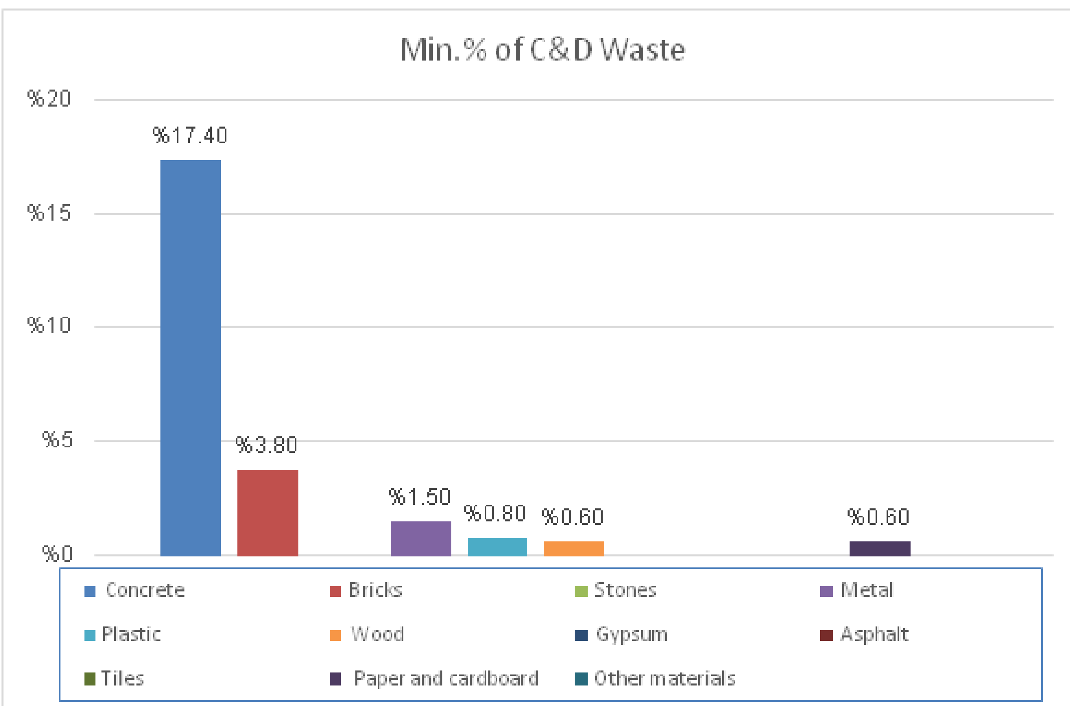


Figure 5: Gross minimum of C&D waste components by weight of all tested samples

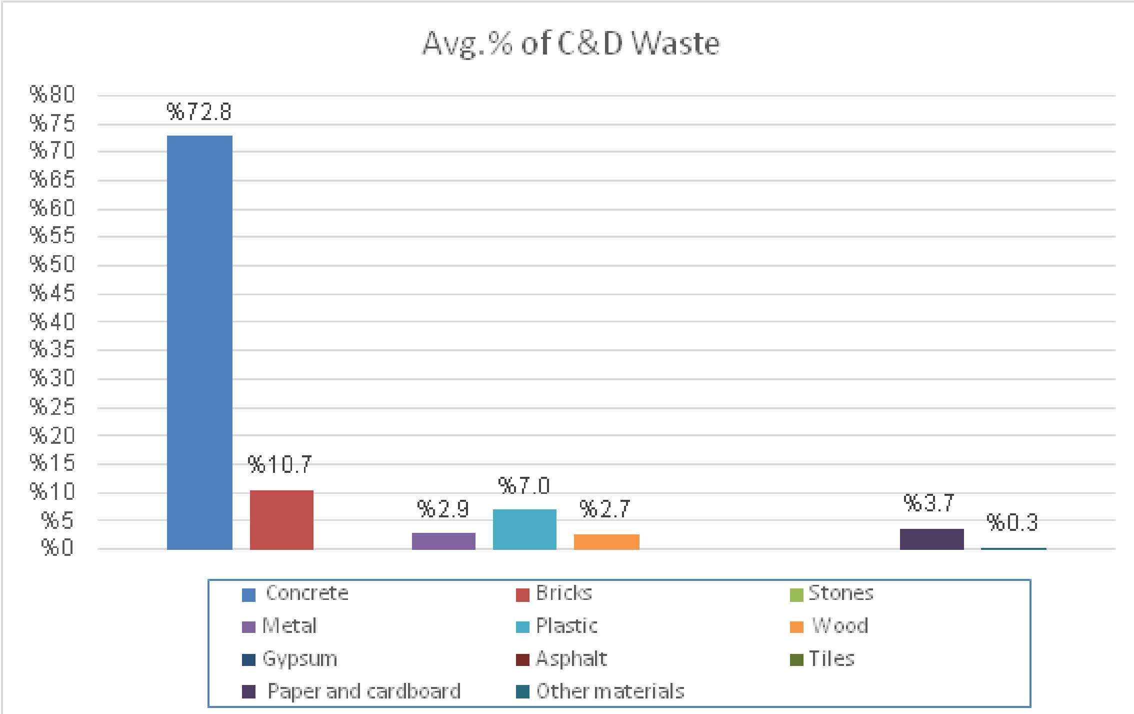


Figure 6: Gross average of C&D waste components by weight of the house sample

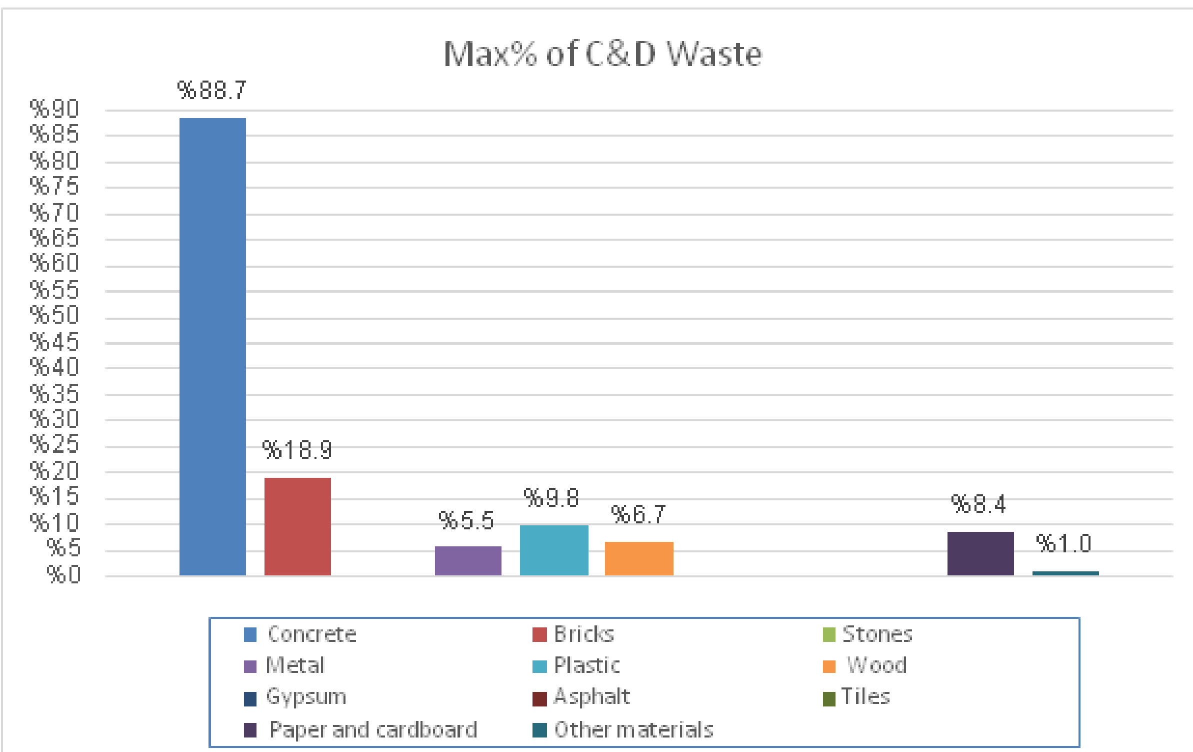


Figure 7: Gross maximum of C&D waste components by weight of the house sample

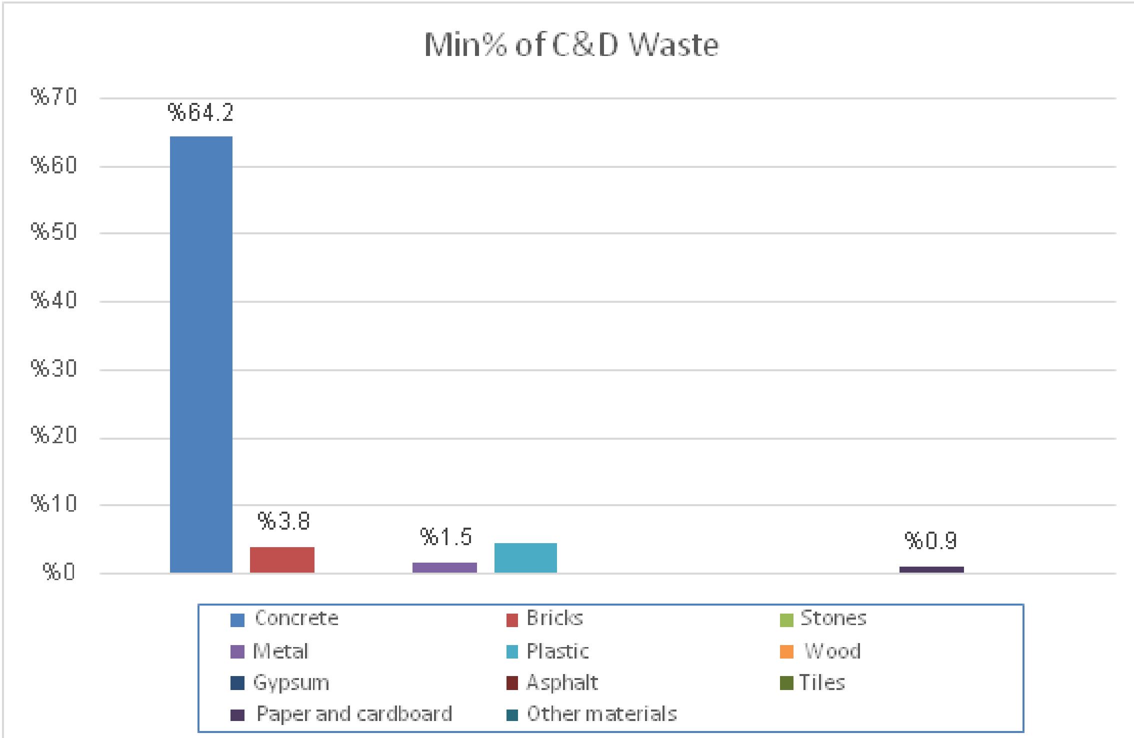


Figure 8: Gross minimum of C&D waste components by weight of the house sample

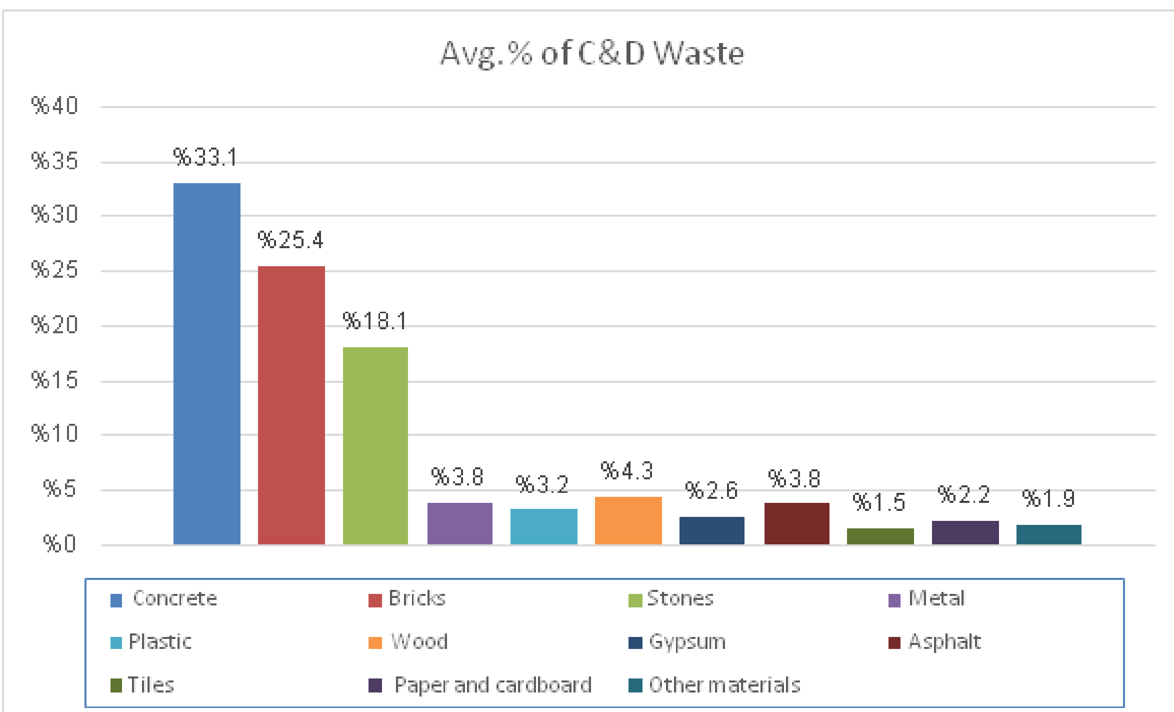


Figure 9: Gross average of C&D waste components by weight of the 4 dumpsites samples

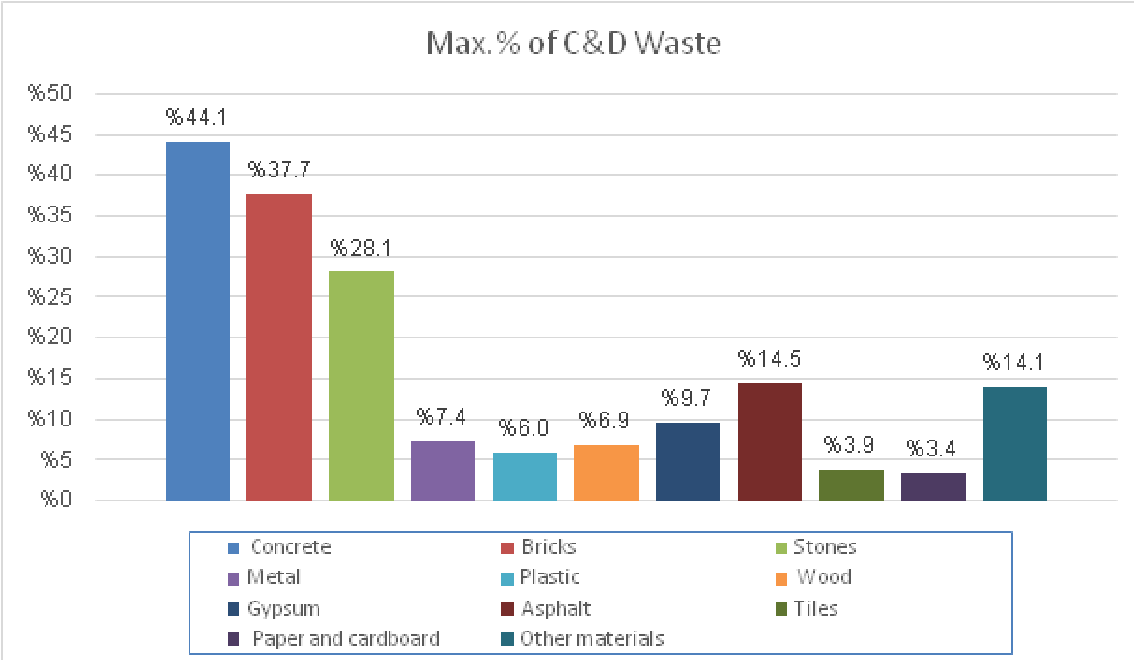


Figure 10: Gross maximum of C&D waste components by weight of the 4 dumpsites samples

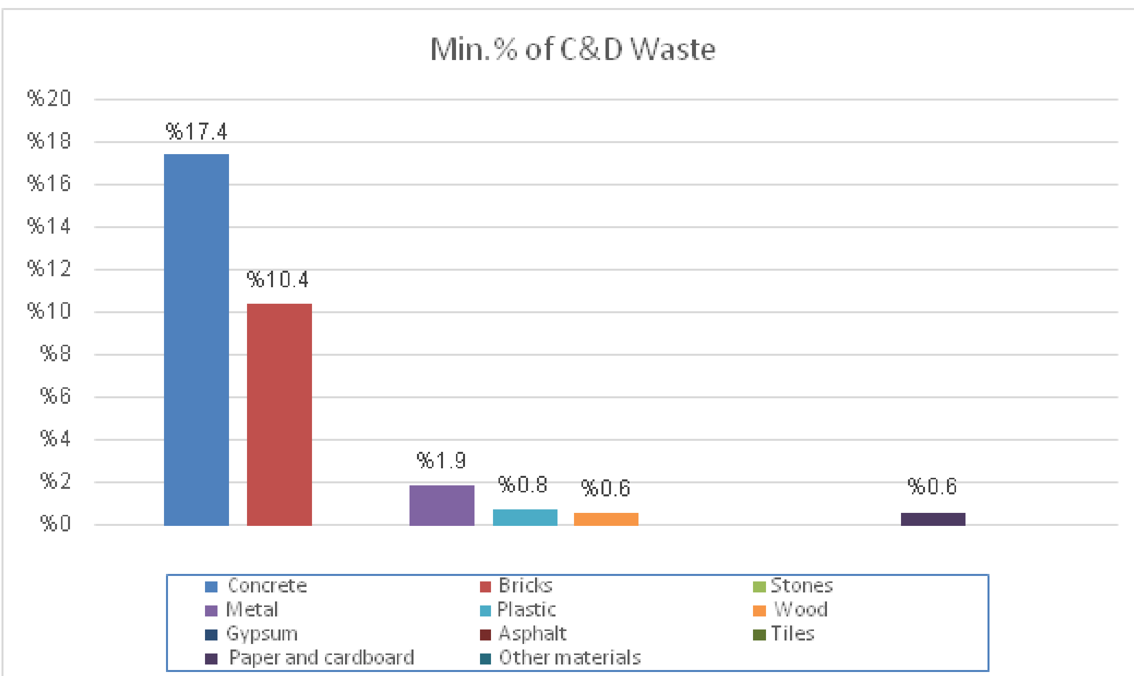


Figure 11: Gross minimum of C&D waste components by weight of the 4 dumpsites samples

Table 2: Gross average, maximum and minimum of C&D waste components by weight of all tested samples

Component	Avg.	Max	Min
Concrete	41.40%	88.70%	17.40%
Bricks	22.10%	37.70%	3.80%
Stones	14.20%	28.10%	0%
Metal	3.50%	7.40%	1.50%
Plastic	4%	9.80%	0.80%
Wood	4.30%	6.90%	0.60%
Gypsum	2.10%	9.70%	0%
Asphalt	3.10%	14.50%	0%
Tiles	1.20%	3.90%	0%
Paper and cardboard	2.60%	8.40%	0.60%
Other materials	1.60%	14.10%	0%

Table 3: Gross average, maximum and minimum of C&D waste components by weight of the house tested samples

Component	Avg.	Max	Min
Concrete	72.8%	88.7%	64.2%
Bricks	10.7%	18.9%	3.8%
Stones	0.0%	0.0%	0.0%
Metal	2.9%	5.5%	1.5%
Plastic	7.0%	9.8%	4.3%
Wood	2.7%	6.7%	0.0%
Gypsum	0.0%	0.0%	0.0%
Asphalt	0.0%	0.0%	0.0%
Tiles	0.0%	0.0%	0.0%
Paper and cardboard	3.7%	8.4%	0.9%
Other materials	0.3%	1.0%	0.0%

Table 4: Gross average, maximum and minimum of C&D waste components by weight of the four dumpsites tested samples

Component	Avg.	Max	Min
Concrete	33.1%	44.1%	17.4%
Bricks	25.4%	37.7%	10.4%
Stones	18.1%	28.1%	0.0%
Metal	3.8%	7.4%	1.9%
Plastic	3.2%	6.0%	0.8%
Wood	4.3%	6.9%	0.6%
Gypsum	2.6%	9.7%	0.0%
Asphalt	3.8%	14.5%	0.0%
Tiles	1.5%	3.9%	0.0%
Paper and cardboard	2.2%	3.4%	0.6%
Other materials	1.9%	14.1%	0.0%

3. C&D Waste Quantification

3.1 C&D waste estimation in dumpsites in the West Bank Governorates

The estimation of the C&D waste in dumpsites in the West Bank governorates depends mainly on the comprehensive survey conducted in Bethlehem governorate in 2014 (Al-Khatib et al., 2015). In that study, an estimate has been made for the quantity of C&D waste that is available at each dumping site existing in Bethlehem governorate. Surveying using GPS was applied for each site to estimate its area and volume. The volume has been converted to weight by multiplying it by the C&D waste density in the dumpsite which is 1800 kg/m^3.

In order to estimate the accumulated C&D waste in the dumpsites in the other governorates in the West Bank, the estimated weight in Bethlehem governorate in 2014 was divided by both the population and licensed area of Bethlehem governorate in 2014. The result was multiplied by both the population and licensed areas of each governorate to obtain the total weight of the C&D waste in the dumpsites in the governorates based both on population and on licensed areas in the West Bank. The results are summarized in **Table 5** and are presented in **Figure 12**. As can be noticed from Figure28, the estimated C&D waste in dumpsites based on licensed area bases is much higher than that based on population in Nablus and Ramallah/Al-Bireh governorates. This is expected as there is an accelerated growth of urban construction in these two governorates. In Jerusalem, the licenses for construction are very limited due to occupation restrictions. This explains why the estimation based on licensed area is much lower than that based on population estimation. In the other governorates, the differences between the two methods of the estimate are not high as those of the previous ones.

Table 5: C&D waste in dumpsites in the West Bank governorates

Governorate	**Population 2014**	**Licensed Area (1000 m^2)**	**Wastes (ton) Based on Population**	**Wastes (ton) Based on Licensed Area**
Jenin	319,035	319	2,558,811	2,030,557
Tubas	108,041	108	527,896	687,647
Tulkarm	238,429	238	1,506,923	1,517,525
Nablus	874,884	875	3,140,899	5,568,359
Qalqiliya	113,558	114	910,767	722,761
Salfit	157,140	157	583,124	1,000,146
Ramallah /Al-Bireh	1,032,762	1,033	2,852,299	6,573,203
Jericho and Al Aghwar	88,411	88	427,883	562,708
Jerusalem	140,512	141	3,469,798	894,314
Bethlehem	278,759	279	1,774,213	1,774,213
Hebron	628,874	629	5,767,658	4,002,584
West Bank	**3,980,405**	**3,980**	**23,520,270**	**25,334,016**

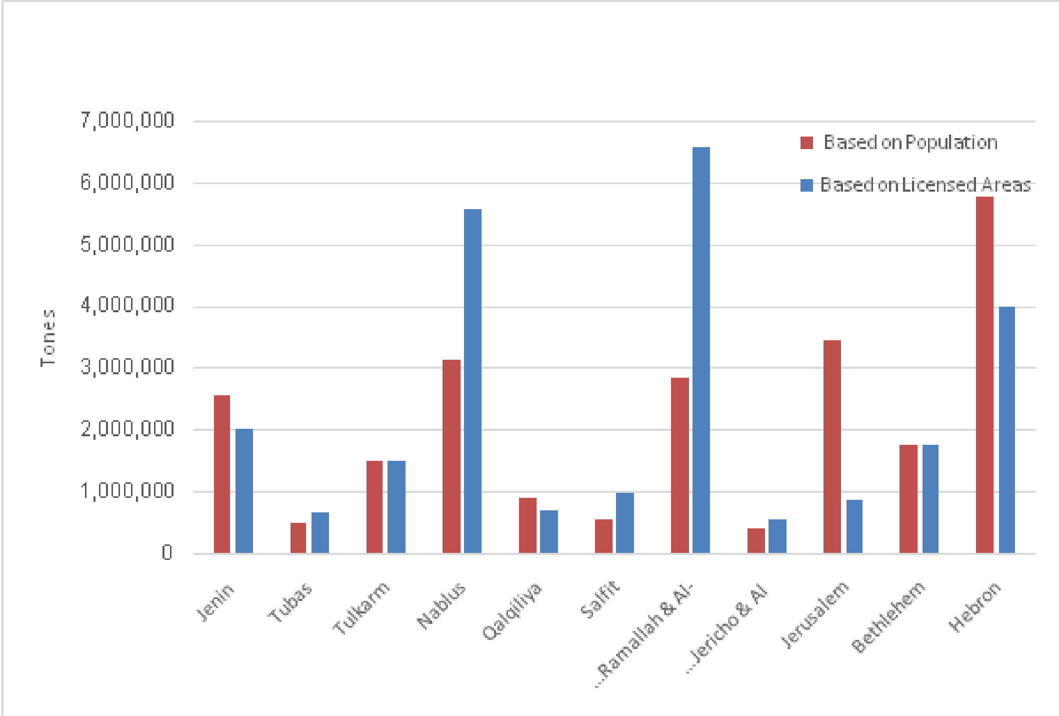


Figure 12: C&D waste in dumpsites in the West Bank governorates

3.2 Annual generation rate of C&D waste

All generated construction waste from a house in Nablus city was collected and weighed. The per meter square generated waste was estimated by dividing total generated waste from the house by the total built area of the house and was found to be 50 kg/m^2. This generation rate range is comparable with a previous study results conducted by Al-Sari et al. (2012) in Palestine, who quantified the waste generation based on the data provided by the 83 contractors and found that the quantity of waste generated during the construction of buildings ranged between 17 and 81 kg/m^2 of building floor. This generation rate range is comparable to the 20 to 50 kg/m^2 estimated by Lauritzen (1994), to the 21.4 and 45 kg/m^2 assumed by Kofoworola and Gheewala (2009) and Kartam et al. (2004) respectively, and the 75 kg/m^2 calculated on the basis of the assumptions made by Fatta et al. (2003) is also within this range.

The annual licensed area for the years 2011-2016 has been obtained from the Palestinian Central Bureau of Statistics as shown in Figure 29. The C&W quantities are estimated for the years 2011-2016 by multiplying 85% of the annual licensed area (m^2) by 50 kg/m^2. It is worth mentioning that huge efforts were paid to obtain the actual percentage of the built areas out of the licensed ones, but no actual data was found. The 85% factor was agreed upon after many consultations with different experts from the construction companies, municipalities, and engineers association.

Table 6 and **Figure 13** show the estimated construction waste in the West Bank for the years 2011-2016, while **Figure 14** to **Figure 15** show the estimated generated construction waste in the West Bank governorates for the years 2014 and 2015 respectively.

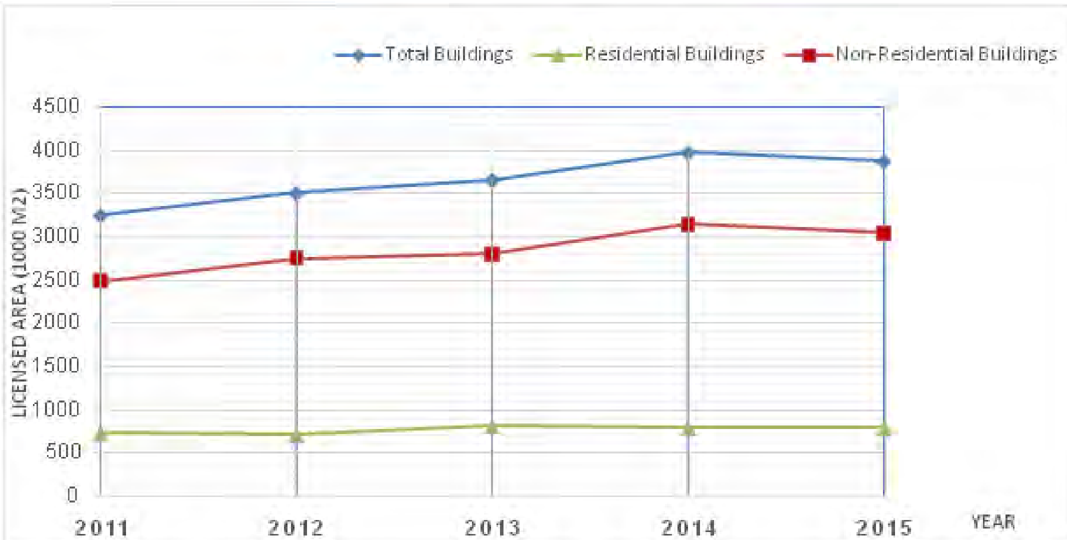


Figure 13: Licensed Areas (1000 m^2) in the West Bank during the period 2011–2015

In general, an upward trend can be observed in the amount of C&D waste generated in the West Bank for the 2011-2016 periods. However, the amount of C&D waste material generated was the highest in 2012 and 2016. This mainly is due to political situation and incentives provided by the LGUs for the buildings' owners to license the existing unlicensed buildings.

Table 6: Estimated construction wastes (tons) in the West Bank time series (2011-2016)

Year	Licensed Area (1000 m^2)	Percent of Built Area (%)	Actual Built Area (1000 m^2)	Wastes per 100 m^2 (Tons)	Total Wastes (Tons)
2011	3,253	85	2,765	5	138,237
2012	4,392	85	3,734	5	186,677
2013	3,661	85	3,112	5	155,614
2014	3,980	85	3,383	5	169,165
2015	3,817	85	3,244	5	162,225
2016	4,918	85	4,180	5	208,996

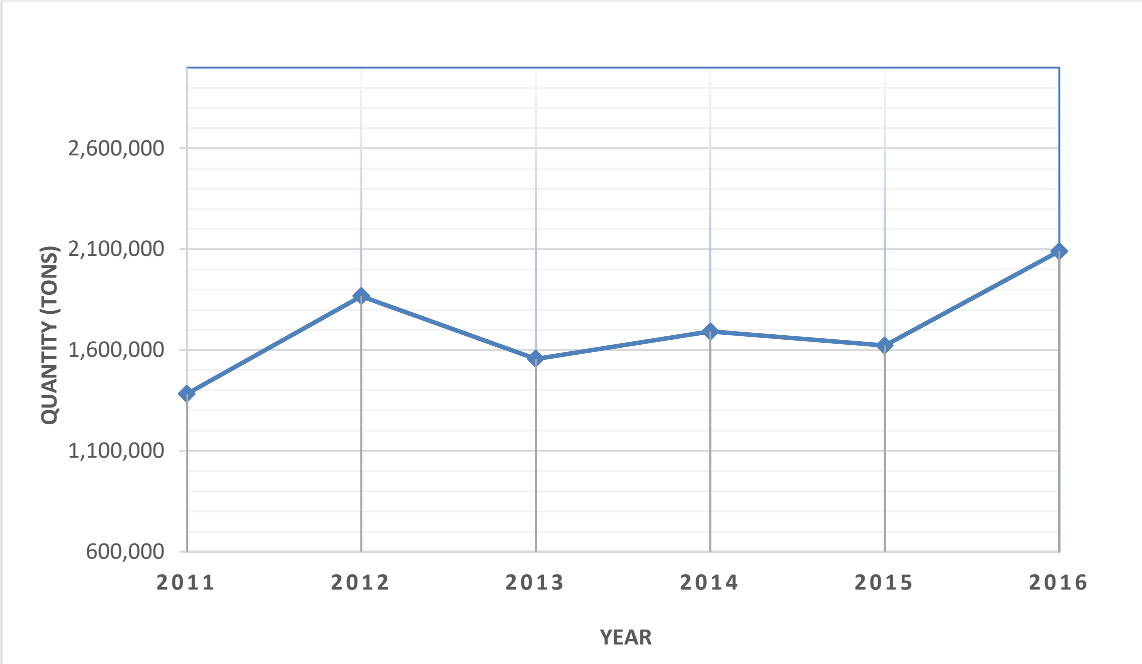


Figure 14: Generated construction waste in the West Bank (2011–2016)

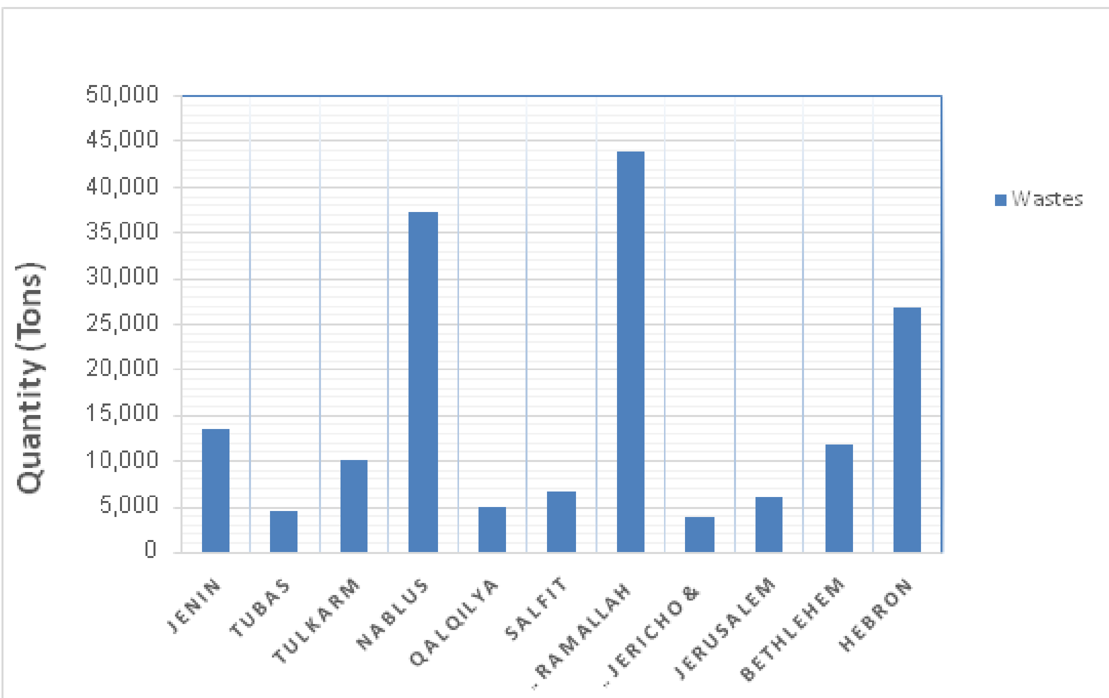


Figure 15: Generated construction wastes in the West Bank by governorate in 2014

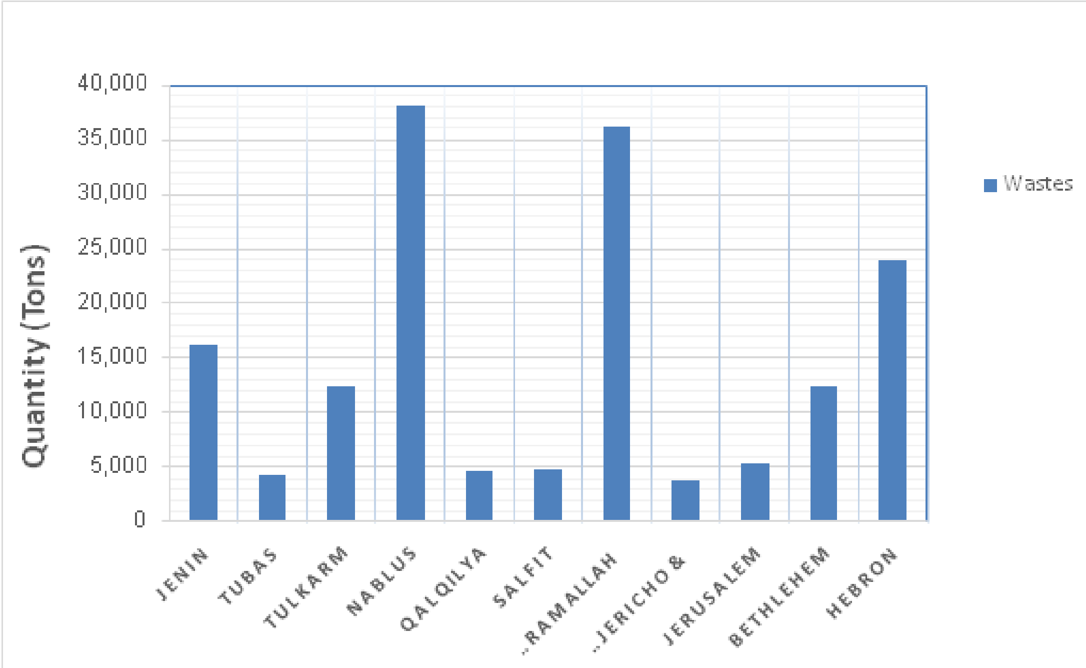


Figure 16: Generated construction wastes in the West Bank by governorate in 2015

Another point worth noting is the significant difference between the amount of C&D waste generated in Nablus and Ramallah & Al-Bireh districts compared to Hebron district. While the population of Hebron district is much higher than the population of Ramallah & Al-Bireh and Nablus districts, the generated C&D waste in Hebron district is lower. Ramallah & Al-Bireh district compared to Hebron district. While the population of Hebron district is much higher than that of Nablus and Ramallah & Al-Bireh districts. The reason can be due to the extensive presence of government institutions in Ramallah and Al-Bireh, and thus the presence of jobs in the private and public sectors, and consequently the increase of residential and non-residential buildings.

The above leads to a marked increase in built-up areas. The focus of the official bodies in Ramallah and Al-Bireh also helps to control the buildings and thus increase the percentage of the licensee. The reason for the increase in licensed built-up areas in the Nablus governorate from Hebron is also due to the residents' commitment to licensing prior to construction in Nablus governorate. In the Hebron governorate, the percentage of licensed buildings is lower due to the complex political conditions in the governorate.

Based on the results presented about the average percentage C&D waste components by weight of all tested samples and the data presented about the estimated construction wastes (tons) in the West Bank time series, the C&D waste components by weight in the West Bank has been estimated for the years 2011-2016 and presented in Error! Reference source not found..

Table 7: C&D wastes components by weight in the West Bank by year (ton).

Component	Average Percent	2011	2012	2013	2014	2015	2016
Concrete	41.40%	57,230	77,284	64,424	70,034	67,161	86,524
Bricks	22.10%	30,550	41,256	34,391	37,386	35,852	46,188
Stones	14.20%	19,630	26,508	22,097	24,021	23,036	29,677
Metal	3.50%	4,838	65,34	5,446	5,921	5,678	7,315
Plastic	4%	5,391	72,80	6,069	6,597	6,327	8,151
Wood	4.30%	5,944	80,27	6,691	7,274	6,976	8,987
Gypsum	2.10%	2,903	39,20	3,268	3,552	3,407	4,389
Asphalt	3.10%	4,285	57,87	4,824	5,244	5,029	6,479
Tiles	1.20%	1,659	22,40	1,867	2,030	1,947	2,508
Paper and cardboard	2.60%	3,594	48,54	4,046	4,398	4,218	5,434
Other materials	1.60%	2,212	29,87	2,490	2,707	2,596	3,344

4. Estimation of the Roads Construction Wastes

4.1 Methodology

The construction of roads in the West Bank and Gaza Strip is managed and followed up by either the MPWH or the Local Government Units (LGUs) themselves. The MPWH is responsible for the rural roads, while the LGUs are responsible for the urban roads.

The MDLF is one of the major sources for LGUs funds. Its contribution is around 10% of the infrastructure projects of the LGUs in the West Bank and around 30% in the Gaza Strip.

The roads construction projects can be divided into three types as follows:

- Milling and Overlay Projects
- Reconstruction Projects
- Construction of new roads projects

Assumptions

1. There is no waste from the construction of roads layer, where the contractors are always eager to import the exact quantities of the road materials. Thus, the wastes of roads constructions are assumed to be due to excavation works only.
2. Milling and overlay projects mostly generate construction wastes from milling the existing asphalt layer only, with a 3-cm thickness.

3. Reconstruction projects mostly generates construction wastes from excavation works (existing base course layer) with assumed average thickness of 30 cm, in addition to wastes from excavating the existing asphalt layer with an average thickness of 7 cm.
4. The data of MPWH for the years 2013-2014 is used as a reference for the whole analysis. These data include the widths of both the asphalt layer and the base course layer for each project. Accordingly, this data is used to find the average widths of both the asphalt and base course layers. (8-m and 10-m respectively).
5. The percentage of newly constructed roads projects is very low. Unfortunately, neither MPWH nor MDLF projects are newly constructed roads project. The total quantities of roads wastes are multiplied by 20% to cover the wasted of the newly constructed roads.

The data sources are MPWH data and Municipal Development and Lending Fund (MDLF).

4.2 Analysis of the MPWH data

The MPWH roads projects are available for the years of 2013-2016. The data is available for the following years: 2013-2014 and 2015-2016. No yearly data is available. The projects are classified as milling, overlay projects, and reconstruction projects. **Table 7** shows the results of the years 2013-2014, while **Table 8** shows the results of the 2015-2016 years using the average widths taken from the data of 2013-2014 years. **Figure 17** shows the wastes of rural roads projects (Roads constructed by MPWH) during the years 2013-2016.

Table 7: Wastes of Roads Projects Performed by MPWH 2013-2014

No.	Road Name	Length (km)	Average Asphalt Width (m)	Average Base course Width (m)	Type of Work	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
1	Jenin - Al-Jalamah road/Second stage	1.4	6-7	9-10	Reconstruction	637	3,570
2	Al-Zababdeh – Raba - American University road	3.61			Reconstruction	1,643	9,206
3	Mirka - Al-Jarbah road	1.73			Reconstruction	787	4,412
4	Kufur Ra'I – Al-Rama - Ajjah road	5.43			Reconstruction	2,471	13,847
5	Kufur Al-Deik – Deir Ghassanah road	3.2			Reconstruction	1,456	8,160
6	Wadi Al-Juheir – Al-Sawahrah Al-Sharqiyah (1) road	2.7	6-7	8-9	Reconstruction	1,229	6,885
7	Wadi Al-Juheir – Al-Sawahrah Al-Sharqiyah (2) road	1			Reconstruction	455	2,550
8	Al-Sawahrah Al-Sharqiyah – Al-Sheikh Sa'ad road	1.29			Reconstruction	587	3,290
9	Wadi Al-Nar/ Fifth Stage	1			Reconstruction	455	2,550
10	Increase the traffic safety in Qalandia road	1.4			Milling and Overlay	273	-
11	Al-Tharwa Road in Halhoul and Building Retaining Walls	1.7			Reconstruction	774	4,335
12	Milling and Overlay internal roads in Hebron city	21.2			Milling and Overlay	4,134	-
13	Sanjal Main Entrance	1.88	12-15	14-18	Reconstruction	1,777	9,024
14	Wadi Al-Balat road	1.68			Reconstruction	1,588	8,064
15	Kharabth-Bani Hareth-Ain Ayyoub road	2.2			Reconstruction	2,079	10,560

No.	Road Name	Length (km)	Average Asphalt Width (m)	Average Base course Width (m)	Type of Work	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
16	Doura-Hebron road	2.1	8-10	11-12	Reconstruction	1,323	7,245
17	Yattan-Al-Samou road	5.1			Reconstruction	3,213	17,595
18	Milling and Overlay internal roads in Bethlehem city	2.8	4-5	-	Milling and Overlay	756	-
19	Nablus-Beit Iba- Deir Sharaf road	5.5	18	22	Reconstruction	6,930	36,300
20	Dier Sharaf- Annab road	2			Reconstruction	2,520	13,200
21	Beddo – Beit Anan road	1.29	8	10	Reconstruction	722	3,870
22	Milling and Overlay internal roads in Jenin city	1.8	8		Milling and overlay	432	-
23	Hebron connecting road	1	10	12	Reconstruction	700	3,600
24	Rhabilitation of Khillet Adb in Aboudeis	0.23	6	8	Reconstruction	97	552
25	Reconstruction of Wadi Al-Fara'ah-Series / Tubas Governorate – First Stage	4	6	8	Reconstruction	1,680	9,600
26	Reconstruction of the road leading to the electricity conversion station	0.35	5	8	Reconstruction	123	840
27	Reconstruction of the road connecting the Nour-Shams woods	2	5.5	8	Reconstruction	770	4,800
28	Milling and overlay Bal'a main entrance	0.22	5.5		Milling and Overlay	36	-
	Totals	**79.81**				**39,644**	**184,053**

Table 8: Wastes of Roads Projects Performed by MPWH 2015-2016

No.	Road Name	Length (km)	Type of Work	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
1	Reconstruction Wadi Al-Far'ah – Sereies/ Second stage	2.15	Reconstruction	1,204	6,450
2	Milling and overlay Al-Beireh main entrance	0.80	Milling and Overlay	192	-
3	Rehabilitation of Al-Shuhadaa' Raod	1	Reconstruction	560	3,000
4	Reconstruction of Halhoul-Korea Road	1.5	Reconstruction	840	4,500
5	Rehabilitation if Ramien main entrance	1.2	Reconstruction	672	3,600
6	Reconstruction and widening Silwad-Evangelical school	1.4	Reconstruction	784	4,200
7	Reconstruction Salfit Northern entrance	1.7	Reconstruction	952	5,100
8	Rehabilitation of Ras Atiyiah – Habalah-Qalqeliah connecting road	2	Reconstruction	1,120	6,000
9	Reconstruction Beit Luqia - Kharabtha Al-Mousbah-	3.2	Reconstruction	1,792	9,600
10	Rehabilitation of Ramallah-Beirrzeit road	0.7	Milling and Overlay	168	-
11	Rehabilitation and widening of Izbet Shoufa	3	rec	1,680	9,000
12	rehabilitation of Kufur Qallil road	1.5	rec	840	4,500
13	Reconstruction of Qatna main entrance	3.5	1/3 mi 2/3 rec	1,590	7,035
14	Reconstruction of Deir Istia- Zeita Jamma'en	4.7	Reconstruction	2,632	1,4100
15	Construction of Tubbas road-Al-Jadeedah	5.7	Reconstruction	3,192	1,7100
16	Reconstruction of Burqin road-Jenin	3	Reconstruction	1,680	9,000
17	Rehabilitation of Hassaka road- Halhoul the entrance of Bani Na'eem	3.4	Reconstruction	1,904	10,200
18	Reconstruction of Burin road-Iraq Burin	3	Reconstruction	1,680	9,000
19	Milling and overlay Hezma road	1	Milling and Overlay	240	-
20	Rehabilitation of Aboud – Beit Reema road	0.8	Milling and Overlay	192	-
21	Milling and overlay Sarda – Al-Jalazoun (Education Area)	0.2	Milling and Overlay	48	-
22	Reconstruction of Al-Nazlah Al-Sharqiyah - Saida connecting road	0.9	Reconstruction	504	2,700
23	Rehabilitation Bethlehem-Janata road	2.7	Reconstruction	1,512	8,100
24	Rehabilitation Al-Jeeb road	1.4	Reconstruction	784	4,200
25	Rehabilitation of Deir Neitham Eastern entrance	1	Reconstruction	560	3,000
26	Reconstruction Kufur Qoud- al-Hashimiyah-	4.3	Reconstruction	2,408	12,900

No.	Road Name	Length (km)	Type of Work	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
	Al-araqah- Al-Yamoun road				
27	Rehabilitation Hajjah- Al-Funduq road	2.5	Reconstruction	1,400	7,500
28	Qabatiyah – Al-Jalamah road	14.2	Reconstruction	7,952	42,600
29	Hawwarah-Nablus main road	3.2	Reconstruction	1,792	9,600
30	Ramallah – Rafat (southern entrance)	1.7	Reconstruction	952	5,100
31	Asphalting roads in Khillet Al-Sheikh – Qalandia	1.4	Reconstruction	784	4,200
	Totals	**78.75**		**42,610**	**222,285**

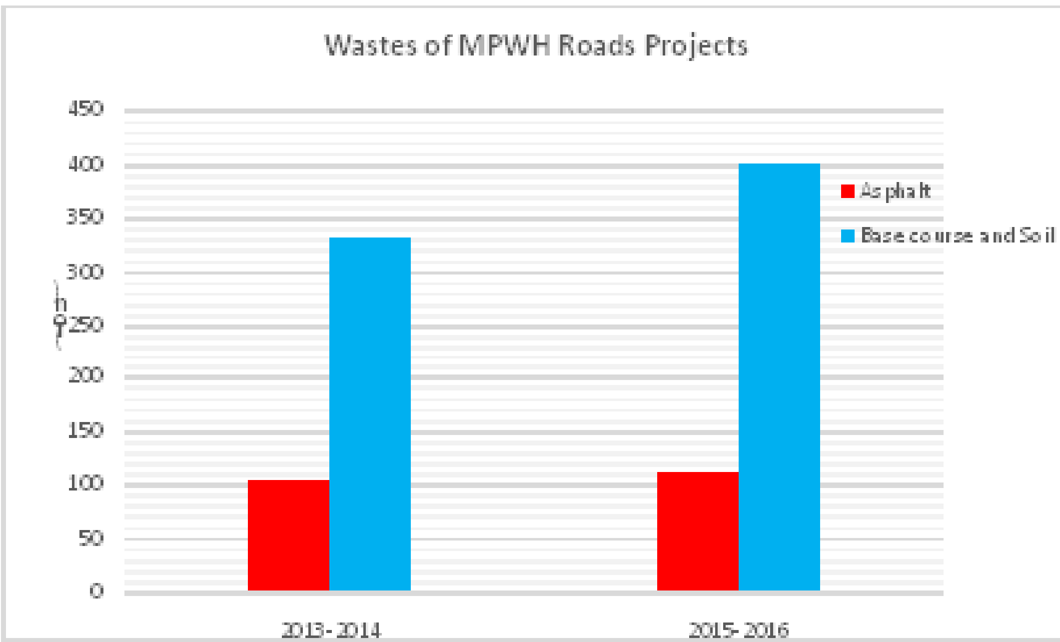


Figure 17: Wastes of MPWH Roads Projects in the West Bank, 2013-2016

4.3 Analysis of the MDLF data

The wastes of the urban roads projects are estimated based on the MDLF projects. Where the north area projects data for the 2015-2016 cycle is analyzed deeply as presented in **Table 9**. This data forms 50% of the total MDLF projects values. In addition, the percentage of the roads projects is calculated to be 80% of the total infrastructure projects in the LGUs based on the MDLF data. **Table 10** and **Figure 18** show the total estimated roads projects wastes in 2015-2016. Assuming the specific gravity for the asphalt and soil as 2.2 kg/m^3 and 1.5 kg/m^3 respectively.

Table 9: Wastes of MDLF Road Projects in Northern Area of the West Bank 2015-2016

No.	LGU	Project Name	Type of Work	Length (Km)	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
1	Kofor Dan	Rehabilitation and asphalting of internal roads	Recon.	1.5	840	4,500
2	Borqin	Rehabilitation and asphalting of internal roads	Recon.	1.875	1050	5,625
3	KuforRa'ie	Rehabilitation and asphalting of internal roads and retaining walls	Recon.	0.35	196	1,050
4	KuforRa'ie	Rehabilitation of internal roads and construction of roundabout and sidewalks	Recon.	0.5	280	1,500
5	Jaba'a	Rehabilitation and asphalting of internal roads	Recon.	3.5	1,960	10,500
6	Seelet Al Hartheyya	Rehabilitation and asphalting of internal roads	Recon.	1.78	996	5,340
7	Arraba	Rehabilitation and asphalting of internal roads	Recon.	1.07	599	3,210
8	Al Yamun	Rehabilitation and asphalting of internal roads	Recon.	3.91	2,186	11,715
9	Al-Muttahida	Rehabilitation and asphalting of internal roads	Recon.	4.36	2,441	13,080
10	Marj Bin Amer	Rehabilitation and asphalting of internal roads	Recon.	1.6	896	4,800
11	Qabatya	Rehabilitation of part of the main street \ phase II	Recon.	4	2,240	12,000
12	Jenin	Rehabilitation and asphalting of internal roads #1	Recon.	3	1,680	9,000
13	Jenin	Rehabilitation and asphalting of internal roads #2	Recon.	4.5	2,520	13,500
14	Jenin	Rehabilitation and asphalting of internal roads #3	Recon.	1.2	672	3,600
15	Sabastya	Rehabilitation and asphalting of internal roads	Recon.	0.61	341	1,830
16	Howwara	Rehabilitation and asphalting of internal roads	Recon.	1	560	3,000
17	Jammaein	Rehabilitation and asphalting of internal roads	Recon.	2.232	1,249	6,696
18	Qabalan	Rehabilitation and asphalting of internal roads	Recon.	1.31	733	3,930

No.	LGU	Project Name	Type of Work	Length (Km)	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
19	Aseera Ash Shamaliyya	Rehabilitation and asphalting of Civil Defense Road	Recon.	0.674	377	2,022
20	Aqraba	Rehabilitation and asphalting of internal roads	Recon.	2.416	1,352	7,248
21	Beta	Rehabilitation and asphalting of internal roads	Recon.	0.95	532	2,850
22	Beit Foreek	Rehabilitation and asphalting of internal roads	Recon.	7.403	4,145	22,209
23	Nablus	Rehabilitation and asphalting of internal roads in eastern area (Alhorshaldahi yard)	Recon.	1.7	952	5,100
24	Nablus	Rehabilitation and asphalting of internal and asphalting roads in western area (Hifa and Yossra Salahrd)	0.6 Milling-0.4 recon	2.3	846	2,760
25	Nablus	Rehabilitation and asphalting Assera - Al- Itihad road	Recon.	0.56	313	1,680
26	Nablus	Rehabilitation and asphalting of internal roads	Recon.	3	1,680	9,000
27	Nablus	Rehabilitation of Al-Zuiot road	Recon.	0.8	448	2,400
28	Jayyus	Rehabilitation of internal roads	Recon.	0.7	392	2,100
29	Kufor Tholoth	Rehabilitation of internal roads	Recon.	1.431	801	4,293
30	Hableh	Rehabilitation of internal roads	Recon.	1	560	3,000
31	Azzun	Rehabilitation of internal roads	Recon.	1	560	3,000
32	Qalqilia	Rehabilitation of internal roads-2	Recon.	3.405	1,906	10,215
33	Qalqilia	Rehabilitation of internal roads-3	Recon.	0.9	504	2,700
34	Qalqilia	Rehabilitation of internal roads-1	Recon.	1.186	664	3,558
35	Tammun	Rehabilitation and asphalting of internal roads	Recon.	1	560	3,000
36	Tubas	Rehabilitation and asphalting of internal roads	Recon.	3.19	1,786	9,570

No.	LGU	Project Name	Type of Work	Length (Km)	Asphalt Volume (m^3)	Base course and Soil Volume (m^3)
37	Al-Kafriyyat	Rehabilitation of internal roads	Recon.	1.3	728	3,900
38	Anabta	Rehabilitation of internal roads	Recon.	1.8	1,008	5,400
39	Baqa Al Sharqeyya	Rehabilitation of internal roads	Recon.	2.036	1,140	6,108
40	Deir Al Ghosoun	Rehabilitation of internal roads	Recon.	1.203	673	3,609
41	Qaffin	Rehabilitation of internal roads	2/3 Milling-1/3 recon	0.4	138	396
42	Atteel	Rehabilitation of internal roads	Recon.	1.33	744	3,990
43	Tulkarem	Rehabilitation of internal roads -2	Recon.	2.48	1,388	7,440
44	Tulkarem	Rehabilitation of internal roads -1	Recon.	1.27	711	3,810
Totals				**83.726**	**46,359**	**246,234**

Table 10: Summary of the Total Wastes of Roads Projects in the West Bank, 2015-2016

Wastes by Source/Area	Asphalt Volume (m^3)	Asphalt Quantities (Ton)	Base Course and Soil Volume (m^3)	Base Course and Soil Quantities (Ton)	Total Roads Wastes (Ton)
Wastes of MPWH Projects	42,610	94	222,285	333	427
Wastes of MDLF Roads Projects in the Northern Area of the West Bank	46,359	102	246,234	369	471
Wastes of Rural Roads	51,132	112	266,742	400	513
Wastes of Urban Roads	890,097	1,958	4,727,693	7,092	9,050
Total Wastes	941,229	2,071	4,994,435	7,492	9,562
Wastes per year	**470,615**	**1,035**	**2,497,217**	**3,746**	**4,781**

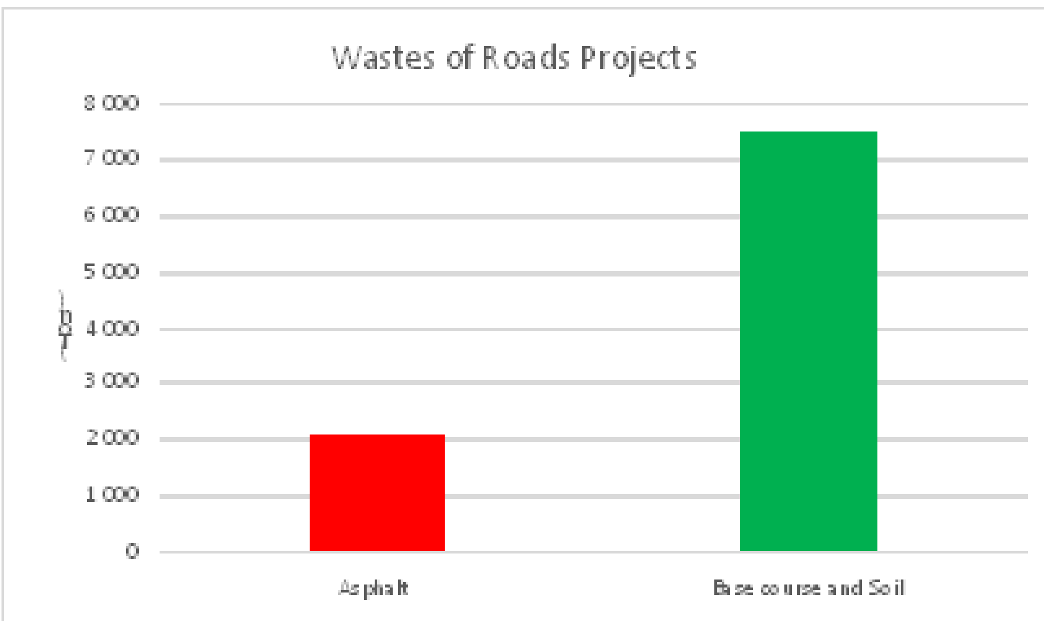


Figure 18: Wastes of Roads Projects in the West Bank by Type, 2015-2016

PART III: Current C&D Waste Handling and Practices

1. Palestinian laws and legislation for C&D waste

Laws and legislations in the Palestinian system about C&D waste in the West Bank had been reviewed. It was found that there is a great lack for environmental legislations and regulating of C&D waste in the Palestinian Territory. Law no 79/1966 has only one article numbered 42 which considers that C&D waste affects negatively the scenery of the streets in the city.

The National Strategy for Solid Waste Management NSSWM in the Palestinian Territory (2010-2014) stated the following: "Currently, there are no clear standards or regulations for handling special waste in the Palestinian Territory and, thus, most of it finds its final destination in solid waste landfills or on remote roadsides (as is the case for C&D waste). There are also no national policies identifying best handling alternatives such as recycling options for these wastes despite the fact that much of it is recyclable".

The Palestinian Environment Law No. 7, 1999 has included constructional waste in its definition of Solid Waste under Article 1. Under Article 5, the law has stated that the Environment law shall protect the natural resources from constructional activities, among others.

The Law has stated under Article 10 that “All agencies and individuals, in conducting any digging, construction; demolition, mining or transportation of debris and sands generated by such activities, shall commit themselves to take all necessary precautions for safe storage and transportation of such materials to prevent any environmental pollution”.

In a survey carried out by the MoLG on 142 LGUs in the West Bank, most of them were keen to enact strict legislations that could control the C&D management in Palestine. The majority of them had asked for rules/legislations/guidelines to control all processes of collection, hauling and disposing of all types of C&D waste (N. Hammad, 2015).

A comprehensive review of international guidelines and bylaws for C&D waste and is management has been conducted. Accordingly, a draft guidelines manual for management of C&D waste as well as a group of suggestions for a C&D waste draft bylaw was developed. The draft guideline is presented in Part VI and the draft Bylaw is in Part VII of this report. An Arabic version of the draft Bylaw is shown in Annex V.

2. C&D waste collection practices

Unlike the domestic solid waste management which is the responsibility of the LGUs, collection of C&D waste is the responsibility of the contractor or the owner of the house to be built or demolished. Waste generated from excavation works is collected using bulldozers. The other C&D waste such as stones, concrete, tiles, metal etc. is also collected by the contractor and reused during construction works or piled somewhere in the yard before being dumped. In the meantime, the house owner contracts a truck and a bulldozer to collect the waste generated from excavation works.

Figure 19: Excavation material in front of a construction site, (Beit-Fuirek Village)

Some of the C&D waste from the constructed house is reused during construction and the rest is loaded in trucks for dumping.

Figure 20: C&D waste during loading in a truck for dumping, (Balata camp-Rujeeb area)

3. C&D waste disposal

Only 7.7% of LGUs in the West Bank have one or more dumpsites designated for the C&D waste within the borders of the LGU (N. Hammad, 2015). Some of these dumpsites are on lands owned by the LGU and others are hired from private land owners.

Figure 21 is a map of 21 C&D dumpsites that have been visited and sited. These are distributed among the 11 West Bank Governorates including East Jerusalem.

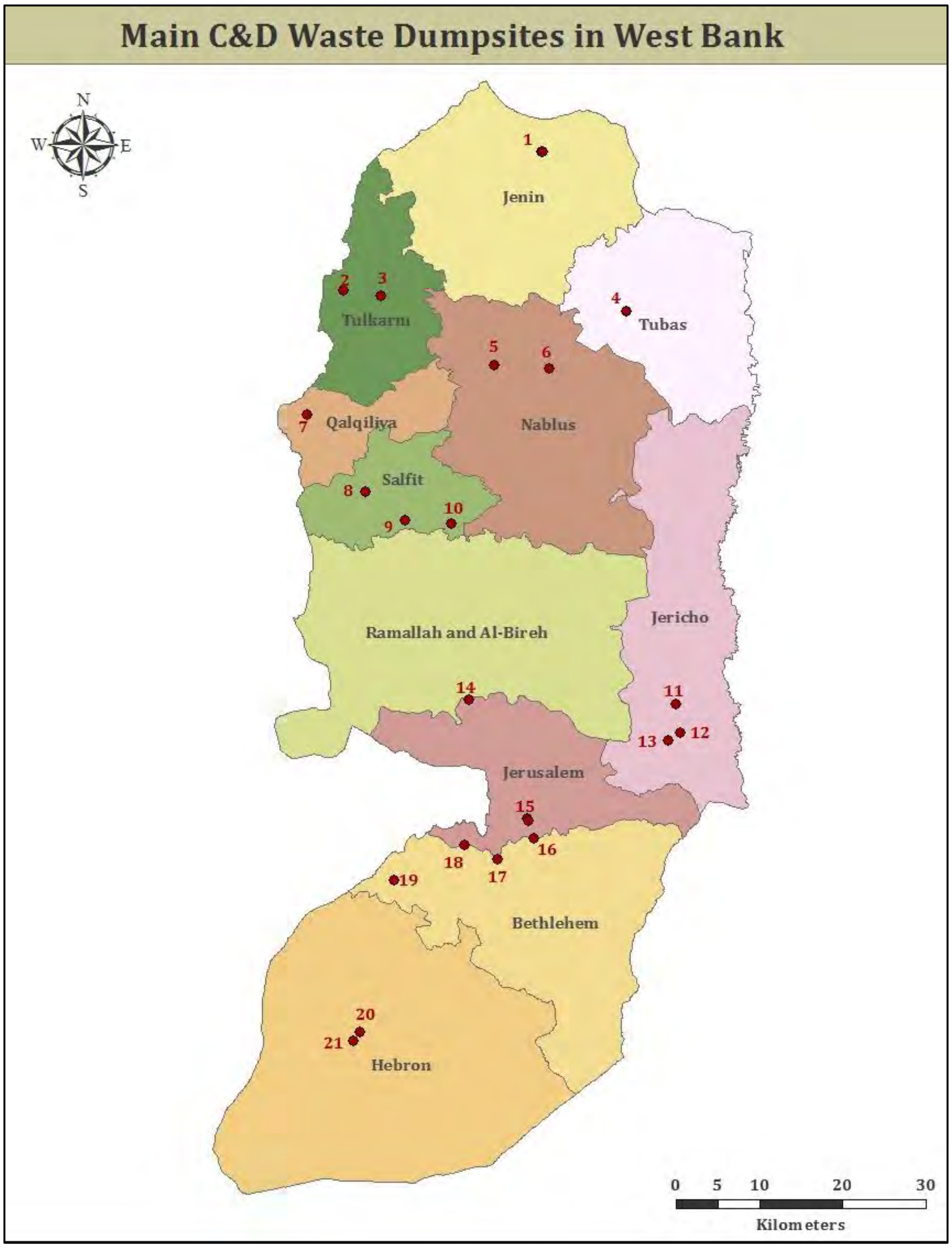


Figure 21: C&D dumpsites visited and mapped in the West Bank

Some of the C&D waste is disposed of in these dumpsites whereas the majority of contactors and truck drivers dispose of this type of waste randomly at different places such as:

- domestic solid waste landfill
- surrounding of construction or demolition sites
- land owned by private entities
- land owned by public entities
- roadsides
- wadis' courses

Figure 22: Random dumping C&D on roadsides, (Tulkarem-Nablus str.)

Figure 23: C&D waste accumulated in front of a construction site (Nablus-Beit Eba street)

Figure 24: C&D waste disposed of along sides of roads (Salfit, Nablus, Nahhalin-Bethlehem, Beitsahour-Bethlehem)

Figure 25: Construction waste disposed of on land owned by private entity (Jenin-Jaba' str.)

In fact, dumping of C&D waste in the nearby privately owned lands had resulted in many problems with the land owners. Random dumping of C&D waste was attributed to the lack of enough dumpsites and the remote distance between the construction workshop and the dumpsite designated for C&D waste dumping.

4. Current behaviors observed during site visits

Observations indicate that behavior in C&D waste management is not satisfactory in terms of environmental protection. This is greatly clear from the evidence of waste disposal practices, which is taking place on different inadequate dumpsite locations.

From the different interviews with contractors, contractor attitudes and behaviors regarding waste management tend to differ based on the size of the contractor, which is indicated by its group or category. Contractors that have positive attitudes toward waste management also have satisfactory behaviors. The important and significant factors that affect contractor attitudes toward waste management include contractor size, source reduction, reuse and recycling measures, the frequency of waste collection, staff participation in training programs and waste disposal method. Factors such as construction-related education among employees, contractor experience in construction works, source-reduction measures, and reuse of materials, waste disposal behaviors and attitudes toward waste management are the most significant factors affecting contractor behavior on waste management. These factors influence contractor attitudes and behaviors and are necessary to effectively improve waste management, growth, and performance, as well as to reduce the environmental degradation of the construction industry.

During the various visits of the data collection team they witnessed some behaviors and practices with regard to C&D waste handling as follows:

a. In some buildings' workshops, C&D wastes were thrown down from upper floors, windows, and balconies.
b. Truck drivers do not cover wastes on their way to the ultimate destination.
c. Truck drivers working within the contractor team, usually, do not violate regulations and laws during transporting C&D wastes.
d. Small contractors generate small quantities of wastes due to economic reasons.
e. Asphalt generated from rehabilitated streets is reused by residents to cover house entrances.
f. Most of the C&D waste illegally dumped on roadsides is being emptied during night hours.

Figure 26: Construction stone waste reused as a cover at a house entrance, (Jamma'een)

Figure 27: Illegal dumping C&D waste on a roadside (Balata-Rujeeb area)

5. Current practices of recycling and reuse of C&D waste

Due to the continuous increase in the volume of C&D waste generated, a well thought out strategy or plan for managing C&D waste is important. Thus, understanding the current practices of recycling, re-use and disposal of C&D waste is vital in establishing a commitment to waste reduction, recovery, reuse , and recycling, not only for economic benefits but also for resource conservation, environmental and even social benefits. It is necessary to include waste diversion goals and objectives, exploration of reduction, recycling, and reuse alternatives, and identification of locally available recycling and reuse outlets. Landfill disposal should be considered the last option for disposing of C&D waste.

At the Palestinian level, there are no regulations or indications determining standards for recycling materials in order to utilize them and make them an alternative to new materials. Most of the C&D waste materials are disposed of in dumpsites spreading in all West Bank districts. In these dumpsites, pickers pick up useful materials from the dumped C&D waste. Those pickers mostly pick up the following materials:

1. Metal: There are two types of metals:
    a. Ferrous metals, such as steel bars which the pickers collect and sell to traders who finally export amounts of this type of metal to industrial countries for recycling purposes.
    b. Non-ferrous metals such as aluminum frames which the pickers collect and sell to aluminum factories in the Palestinian districts or to traders who finally export amounts of aluminum to industrial countries for recycling purposes.
2. Paper and cardboard: pickers sell the amounts of collected paper and cardboard to factories spread around the Palestinian districts for recycling purposes (e.g. Nablus paper and cardboard factory in the Eastern Industrial Area).
3. Wood: It is sold to bakeries relying on burning wood or coal as a heating source. This type of bakeries spreads along the Palestinian districts. Because wood has a high heating value it can be used by a number of industries as boiler fuel.
4. Glass: pickers collect pieces of different types of broken glass used for doors, windows, and partitions. These amounts of glass are sold to glass industries spread along the Palestinian districts for recycling purposes.

Currently, there are no accurate statistics about the percentage of recycling of the C&D waste in the West Bank. Current practices of Recycling and Re-use of C&D Waste in the West Bank are summarized in **Table 11**.

However, in the survey conducted by the MoLG on 142 LGUs, opinions and suggestions towards the reuse of C&D waste had focused on the execution of the following:

1. reclamation of agricultural land and building stone walls.
2. sorting the C&D waste and reuse the materials again during construction works
3. reusing this type of waste as a covering material during solid waste landfilling
4. encouraging the private sector to make use of the C&D waste recycling
5. establishing Joint Service Councils dedicated for C&D waste handling
6. establishing different factories to utilize C&D waste materials in recycling processes such as glass, paper, and cardboard, metal, etc.

Figure 28 shows piling of excavation materials to be reused in leveling a new road, while Figure 29 shows the segregation of C&D waste components at different sites for recycling purposes.

Figure 29: Piling of excavation materials to be reused in leveling a new road

Figure 29: Separation of C&D waste components at different sites for recycling

Table 11: Current practices of Recycling and Re-use of C&D Waste in the West Bank

No.	Type C&D waste	Current Practices of Recycling and Re-use
1.	Excavation material	Excavation materials are arising from the excavation of building foundations. Excavation materials include both urban soils mixed with old construction wastes and contaminants to virgin soils as may be found in Greenfield construction. The composition may range from organic soils, through to clays, gravels, sands, and stones generally in heterogeneous form. Excavation materials represent the bigger amount of C&D waste generated in West Bank, and there are no accurate statistics of their values. Excavation materials are reused for agricultural land reclamation when they have a high content of fine soil and organic materials; others are reused for upraising the low-level areas as backfill material. Excavation materials are sometimes used as filling material for road infrastructure. Excavation materials are normally land/soil and stone surfaces not contaminated by hazardous substances reutilized in the same construction work, in a different work, or in an activity of restoration, conditioning or refill, whenever their re-utilization can be properly accredited. In the literature, land, and stone are the most abundant, amounting from 93% to 97% of the C&D total weight of waste. This grouping corresponds to the movement of land necessary for the construction (Carpio et al., 2016).
2.	Road demolition	Mainly reused to cover agricultural roads or unpaved roads in front of houses.
3.	Concrete, aggregate	It is mainly used as filling material in areas with low level in order to raise the level and use the elevated area for different purposes.
4.	Brick	Bricks are re-used as bricks directly on the construction site. The greatest impediment to this reuse is the time taken to sort and clean suitable bricks. Crushed brick are also used as fill material in many locations.
5.	Wood, Timber	The most common reuse option for wood recovered from C&D waste is for fuel. Normally workers burn wood at the construction site for heating mainly during the cold season. If collected in an organized manner, wood has a high heating value and can be used by a number of industries as boiler fuel. Wood for fuel can be chipped or pelletized for better transportation.

No.	Type C&D waste	Current Practices of Recycling and Re-use
		Wood with minimal soil and other foreign objects, and low moisture content is ideal.
6.	Metal (Steel)	Steel is an ideal recycling material as it does not lose quality in the process. Steel from C&D waste is normally collected by scavengers from dumpsites and sold on weight bases. Steel from C&D waste is sold locally or exported internationally.
7.	Metal (Aluminum)	The collected aluminum from the C&D waste is sold locally and the recovery and recycling of aluminum are carried out by a local Palestinian company that recycles and fabricates aluminum in Nablus district.
8.	Paper and cardboard	There is limited recycling or reuse for paper and cardboard. Normally workers burn Paper and cardboard with wood at the construction site for heating mainly during the cold season.
9.	Building stone	Sometimes it is reused in the construction process in certain locations in the building.
10.	Tiles	Broken tiles are sometimes reused as pavement to roads leading to the house. Other limited uses include the creation of unique floor, kitchen backsplash or wall mosaic in an artistic pattern.
11.	Mixed construction waste	Mixed construction waste is mainly reused as a filling material when there is a need.

Figure 30: Under-construction street while filling with recycled aggregates

PART IV: Environmental and Social Impacts

1. Environmental, health and socio-economic impacts of C&D waste

1.1 General

From the field visits to different construction sites by the team members, it was noticed that sometimes, the rubble generated during construction or demolition is not collected and disposed of directly but left or postponed for a short or long time. If this rubble is left without dumping for a long period in residential areas, residents would suffer from emitted dust, distorting scenery and disabling the traffic stream on the streets.

The potential for environmental impacts from the transportation of materials to the dumpsite will increase such as noise impacts, possible congestion due to increased traffic flows, and dust and exhaust of emissions from the hauling vehicles.

Excavation materials will mainly arise from the excavation works for the building and road constructions. The excavated material will comprise reclamation fill material and could be reused onsite as fill material for other areas of the location. Considering the inert nature of the fill material, reuse on-site would not result in any unacceptable environmental impact. Scattered C&D waste on roadsides will adversely affect the scenery of the region and might cause road narrowing and therefore obstruct the flow of traffic stream.

Study of the environmental impacts was based on the existing environmental baseline data and the changes that the C&D wastes may have on the environment. **Figure 31** presents baseline maps for archeological sites, wadis, land use, and topography of the West Bank. The impact of locations of the C&D dumpsites on the above mentioned elements had been assessed.

However, random dumping of C&D waste generates many negative impacts such as:

1- distorting the overall scenery of the city and the roads between cites
2- narrowing main streets, obstructing traffic flow and obscure vision
3- closing agricultural roads and disrupt the work of farmers
4- closing wadis and culverts which cause flooding in winter
5- causing deterioration of soil properties
6- causing environmental pollution

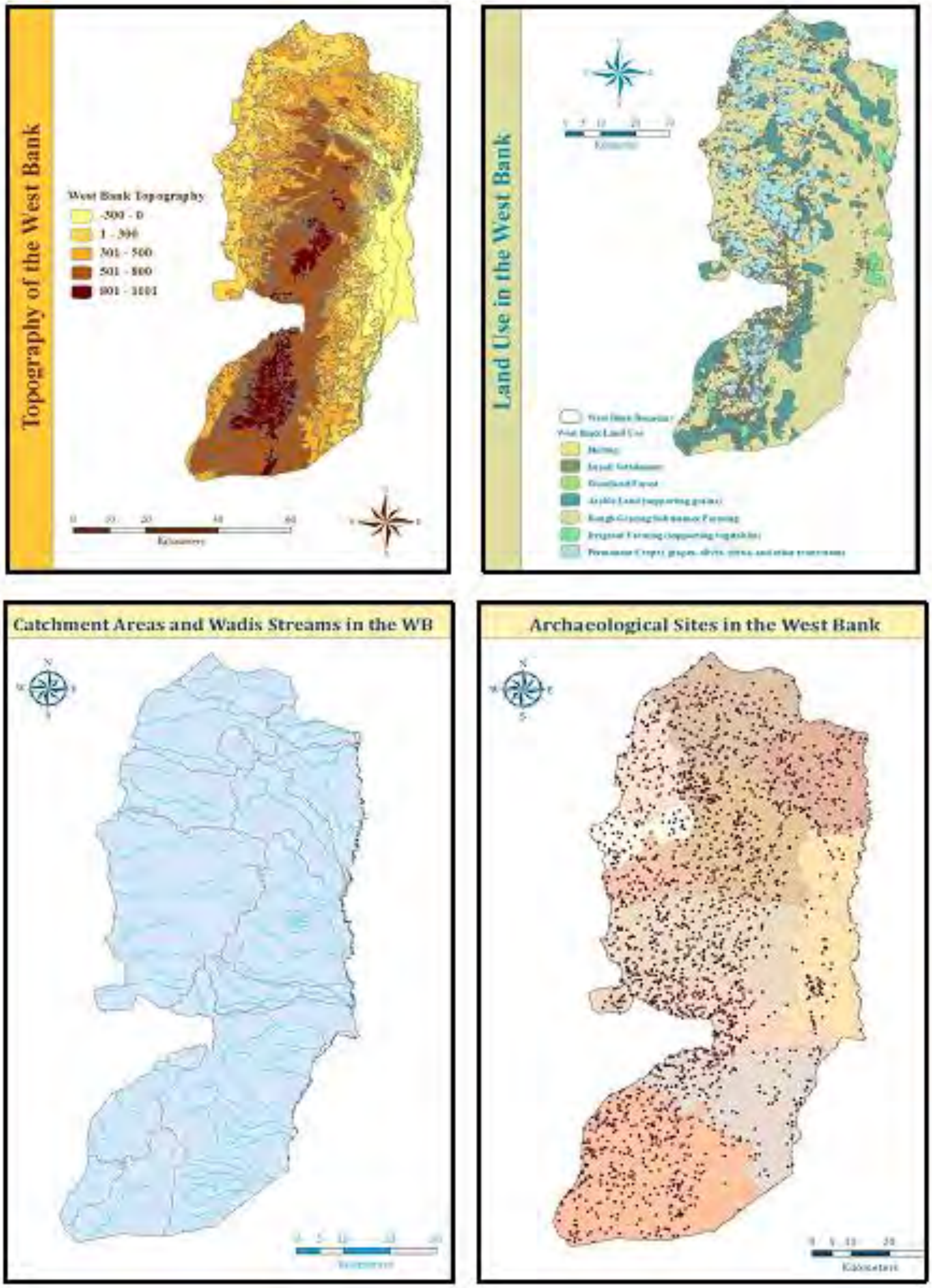


Figure 31: Archeological sites, wadis, land use, and topography of the West Bank

7- causing problems with the private land owners.
8- causing health problems when poultry and butcher wastes are embedded within the C&D

Figure 32: C&D waste in a dumpsite mixed with a slaughterhouse waste (Badan-Nablus)

1.2 Environmental impacts of C&D wastes

The disposal of C&D wastes has become a major concern in the West Bank recent years. Some building owners, waste haulers, and demolition contractors are disposing of this waste improperly and illegally in order to avoid transportation costs and fees at waste disposal facilities.

Huge heaps of various kinds of C&D waste could be observed on the edges of roads, open areas and in wadis, posing an environmental hazard and polluting the flowing streams, agricultural lands, and groundwater, other than being a deformation of the natural areas surrounding the cities and villages. C&D waste has caused the closure of streams in wadis; leading to floods, soil erosion, dumping neighboring roads, as well as fatal accidents which accompany heavy rains.

Due to the absence of enough dedicated sites for C&D waste disposal in the governorates, as well as the lack of clear and specific mechanisms for handling such waste; solid waste official and random landfills are exploited as a final destination for C&D waste, where these wastes are then used for dumping purposes in landfills, as filling materials for streets and excavations, and for leveling some areas. Otherwise, C&D waste is left without any treatment or reuse; as the case of all Palestinian cities.

Environmental damage caused by illegal disposal of C&D waste

The illegal disposal of C&D waste in open spaces and roads edges creates severe environmental damage, including:

- Air pollution

  Fine dust, typically from concrete, cement, wood, stone, silica, etc., can spread for large distances over a long period of time. Dust penetrates deeply into the lungs and causes a wide range of health problems; including respiratory illness, asthma, and even cancer.

- Soil contamination

  The quality of soil may be impacted by littering (wood and metal debris, concrete blocks, empty cement bags, empty paint containers, plastics, etc.). Pollution may occur by intentional or accidental leakage of used chemicals, fuel, or oil products on disposal sites, as well.

- Groundwater contamination and particulate matter of the waste, and the subsequent formation of leachate. The creation of leachate presents a major threat to the current and future quality of groundwater; because of trace amounts of hazardous constituents, which are sometimes encountered.
- Breeding sites for pests

  Debris resulted from demolished buildings containing a pest infestation, can result in spreading of these pests into the surrounding areas, causing morbidity. Moreover, accumulations of surplus or damaged building materials can act as harborage for pests.

Figure 33: Demolition waste as a suitable pest and rodent’s infestation site

- Rodents problem

Rats sometimes become a problem when construction is going on because their burrows are disrupted by digging. They need to find a new place to live, to find their refuge in the accumulated construction waste. The presence of rats, their droppings, and urine within the debris, poses an immediate risk of diseases associated with rats.

- Flames generated by flammable materials

Flammable materials are substances that can ignite easily and burn rapidly, emitting toxic and carcinogenic materials into the air. Concerning C&D waste, they may include:

- Solid wastes that are soaked with flammable liquids, i.e. paper, cardboard, wood, etc.,
- Solvents; as paints, paint thinners, adhesives, etc.

Figure 34: Construction waste containing different flammable C&D wastes

Under certain conditions, improperly disposed gypsum drywall can produce hydrogen sulfide gas that can explode in high concentrations. Decomposing wastes also generate methane and other gasses, which are explosive at certain levels.

- Contamination of lands

Contamination of land is caused mainly by windblown litter and random dumping of C&D waste in open areas, in waterways and along roadways. This contamination causes an aesthetic impact and loss of property value.

- Contamination of streams and flooding of streets

It is common to find the drainage lines and even wadis and streams being filled up with C&D refuse after rainfall. These refuse are good contaminants of streams, groundwater especially shallow wells and the entire environment.

The huge heaps of C&D waste dumps, that are commonly seen on open spaces and shoulders of streets are also been washed by rainstorms. Most of these wastes are been moved by rainstorm into drainage channels that were made for excess runoff thereby preventing easy flow of water and finally lead to flooding of streets.

- Increasing Illegal Disposal of other Types of Waste
An illegal disposal site may also attract the illegal disposal of other types of waste; including conventional municipal waste, industrial waste, and hazardous waste. This would further impact the site and increase the future cost of cleaning up an impacted or contaminated site.

1.3 Hazards of C&D waste on public health

Hazardous materials that can be found in C&D waste include:

- Asbestos

Asbestos is the common name for a set of six naturally occurring silicate minerals. Its fibers are very heat resistant and strong and are used in construction works as:

- Thermal insulating material;
- 'Fireproof' textiles, paper, and boards;
- Asbestos cement products;
- Electrical insulating materials.

Asbestos fibers can have serious health effects if inhaled; including asbestosis, lung cancer. There is no known safe exposure level to asbestos.

- Adhesives

There are several types of adhesives, used in construction, including contact cement, epoxy, polyurethane and super glue.

Cement can cause illness by skin contact, eye contact, or inhalation. The risk of injury depends on duration and level of exposure and individual sensitivity.

Super glue may adhere to body parts, and injuries may occur when parts of the skin are torn off. The generated fumes irritate sensitive membranes in eyes, nose, and throat. Repeated exposure to fumes results in flu-like symptoms.

- Drywall

Drywall, also known as plasterboard, is often made of gypsum and is a commonly dumped item. Plasterboards are hazardous once they are land filled. They are broken down in landfill conditions, releasing hydrogen sulfide, a toxic gas.

H_2S is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. Its health effects can vary depending on the level and duration of exposure.

- Additives for concrete and blocks

The presence of some substances in concrete; including useful and unwanted additives, can cause health concerns. Dust from rubble or broken concrete upon demolition or crumbling may cause serious health concerns depending also on what had been incorporated in the concrete.

- Wood treatment

Wood treatment refers to protecting wood from damage caused by insects, moisture, and decay fungi.

Treated wood may present certain hazards in some circumstances; such as during combustion or where loose wood dust particles or other fine toxic residues are generated or where treated wood comes into direct contact with agriculture.

- Paints and thinners

Paints contain potentially harmful chemicals such as solvents and volatile organic compounds (VOCs). Inhaling VOCs can cause eye, nose and throat irritation.

Lead based paint is another contaminant found frequently at illegal dumpsites. Exposure to lead or lead poisoning is a risk for children and adults. High levels of lead in children have been shown to result in learning disabilities, behavioral problems, and mental retardation.

A paint thinner is a liquid compatible with paint which is used to reduce the viscosity of paints. Paint thinner poisoning occurs when a toxic substance, known as a hydrocarbon, is ingested by mouth or by breathing. Paint thinners can contain these hydrocarbons.

1.4 Socio-economic impacts

During construction or demolition phase of buildings, employment opportunities increase. The C&D waste reuse or recycling will also increase the income of workers specialized in extracting useful materials from the rubble such as scrap metal, electrical wire waste, concrete scraps, and waste etc. Therefore, C&D waste has also positive socio-economic impacts. Sometimes when contractors and drivers dispose of C&D waste randomly in the privately owned lands, quarrels and problems ignite conflict which negatively affects the cohesive social relations of the Palestinian society.

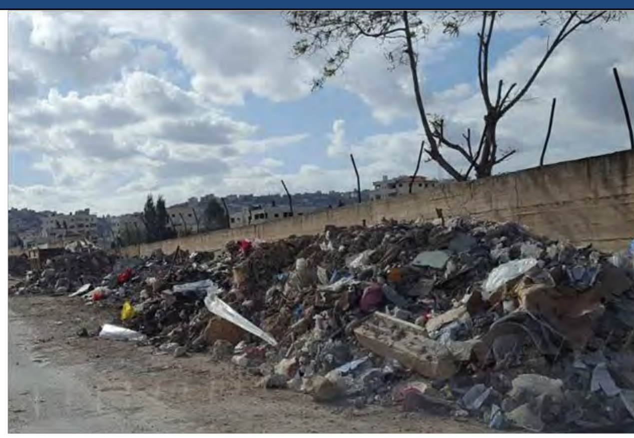
PART V: Mapping of C&D Dumpsites

1. Mapping and Inventory of Dumpsites

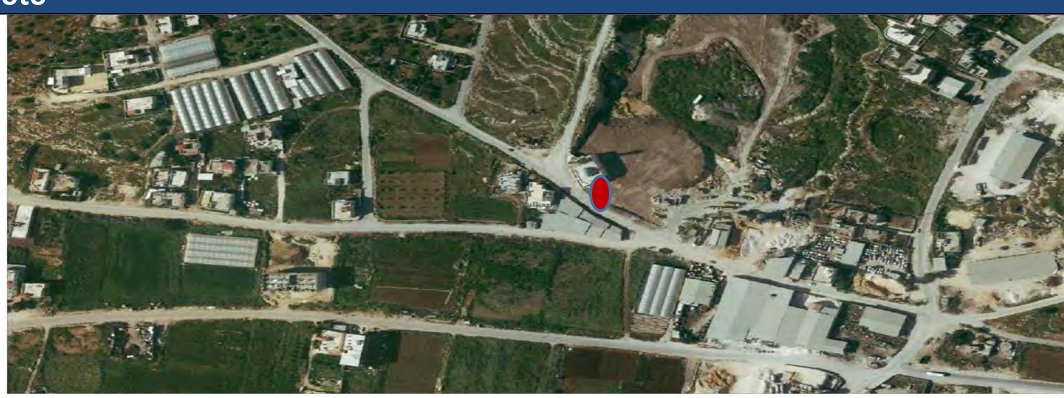
Table 12 lists 21 main dumpsites and provides information and photos about these sites. It gives details including X and Y coordinates, area, distances from nearest house and descriptions. A photo and an aerial map of each of the dumpsites are provided.

Table 12: Inventory of the 21 Visited Main C&D Waste Dumpsites in the West Bank

Dumpsite 1	
Coordinates	**Dumpsite Information**
E: 178178.5 N: 208896.5	**Dumpsite Name**: Jenin Dumpsite, managed by the Municipality **Governorate**: Jenin **Location**: The industrial area, near the WWTP **Area:** 668 m^2 **Distance from the nearest residence:** 14 m **Description**: • C&D wastes are distributed on both sides of the road • Many complaints by nearby residents are raised to Jenin Municipality • Many old damaged electrical appliances such as refrigerators and washing machines are noted there • C&D waste pickers exist from time to time
Photos Taken	



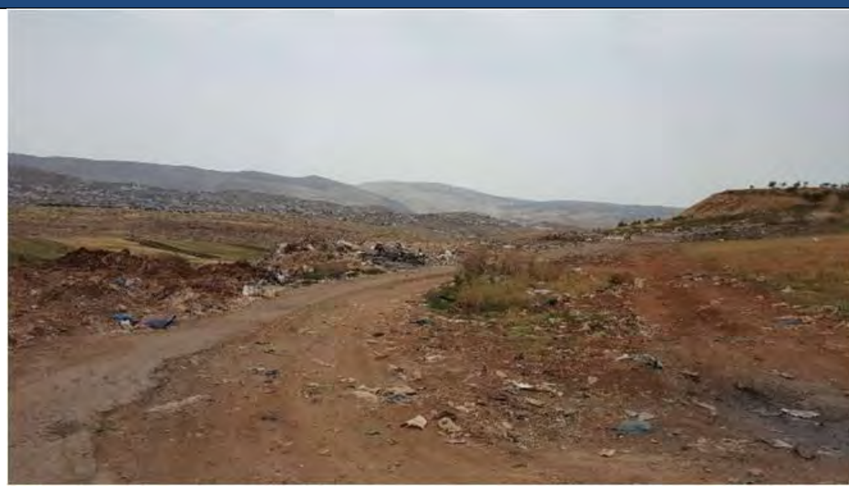
Aerial Photo

<table>
<tr><th colspan="2">Dumpsite 2</th></tr>
<tr><th>Coordinates</th><th>Dumpsite Information</th></tr>
<tr><td>E: 154312.5
N: 192175.1</td><td>Dumpsite Name: Tulkarm Dumpsite, managed by Hassan Al-Qaisi
Governorate: Tulkarm
Location: Near Al-Qaisi Stone Crusher
Area:20 du.
Distance from the nearest residence:60 m
Description:
• C&D wastes and many wheel tires are available
• The nearby crusher (Al-Qaisi Crusher) uses some of C&D wastes available. This crusher collaborates with those in charge of the dumpsite to collect and crash the dumped stone pieces, bricks, tiles and concrete aggregates producing materials which are finally sold to contractors who use them as filling materials in their construction works.</td></tr>
<tr><th colspan="2">Photos Taken</th></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="2">Aerial Photo</th></tr>
<tr><td colspan="2"></td></tr>
</table>

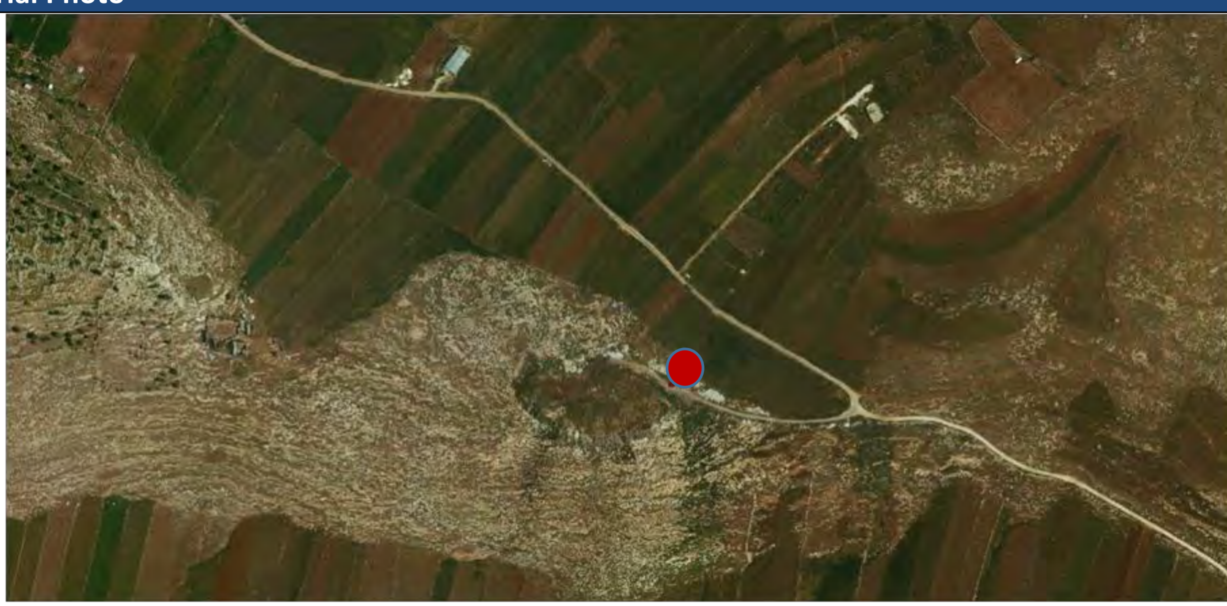
<table>
<tr><th colspan="2">Dumpsite 3</th></tr>
<tr><th>Coordinates</th><th>Dumpsite Information</th></tr>
<tr><td>E: 158808.5
N: 191550.7</td><td>Dumpsite Name: Wadi Al-Sheir Dumpsite, considered as a public/random dumpsite
Governorate: Tulkarm
Location: Wadi Al-Sheir, near Wadi Zumar edges
Area:529 m^2
Distance from the nearest residence:154 m
Description:
• C&D Wastes and wheel tires are distributed along the way from Bala’a to Noor Shams Camp Gate
• C&D waste pickers exist from time to time</td></tr>
<tr><th colspan="2">Photos Taken</th></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="2">Aerial Photo</th></tr>
<tr><td colspan="2"></td></tr>
</table>

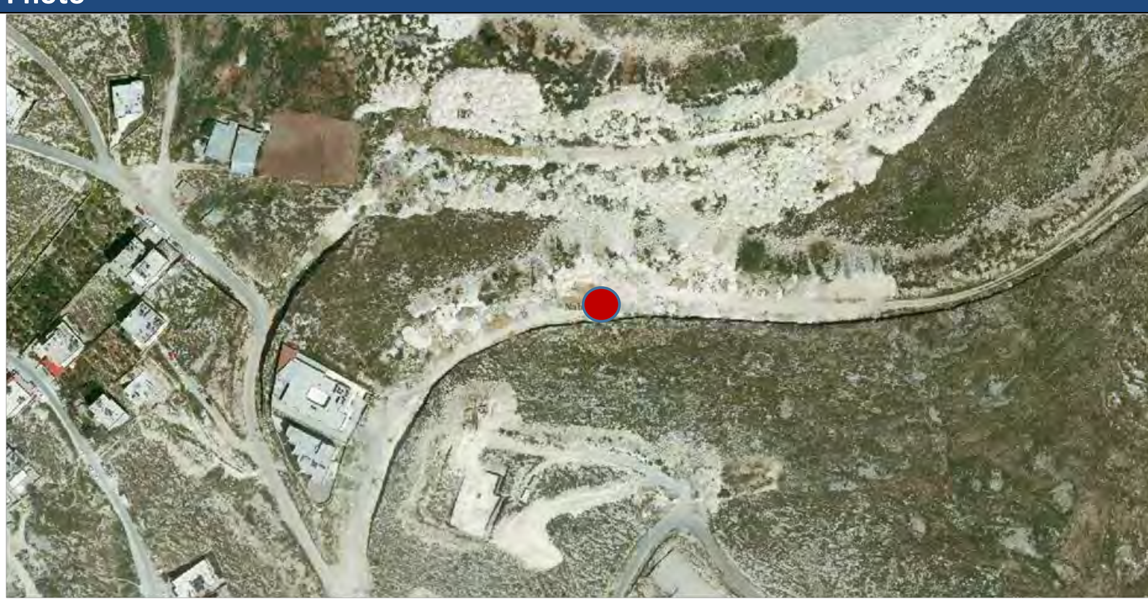
Dumpsite 4	
Coordinates	**Dumpsite Information**
E: 188382.568 N: 189663.918	**Dumpsite Name:** Einoun Dumpsite, managed by the Municipality (random one) **Governorate:** Tubas **Location:** East Tubas, Near the Solar Energy stations of Tubas Electricity Distribution Company **Area:**20 du. **Distance from the nearest residence:** 328 m **Description:** • It was used for dumping domestic waste • Now it is used for C&D wastes

Photos Taken



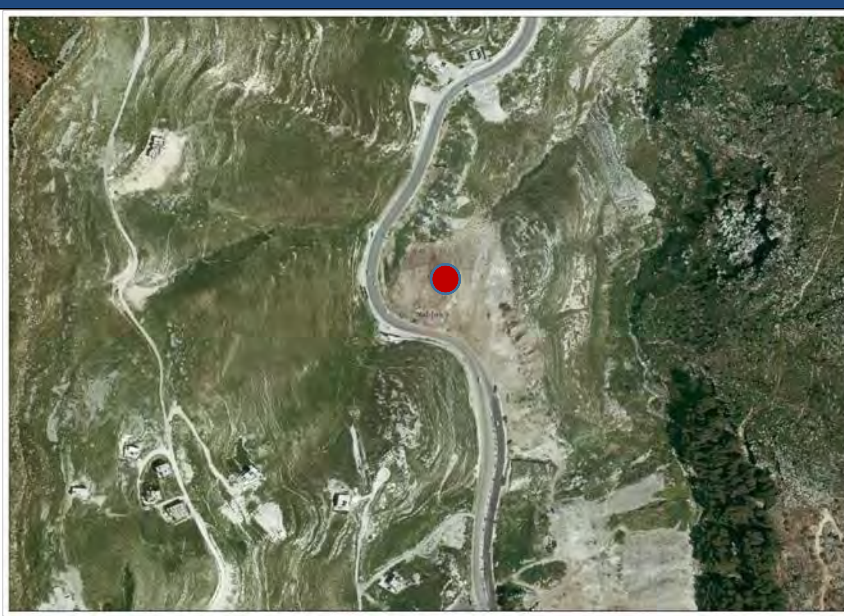
Aerial Photo



<table>
<tr><th colspan="2">Dumpsite 5</th></tr>
<tr><th>Coordinates</th><th>Dumpsite Information</th></tr>
<tr><td>E: 172393.492
N: 183201.422</td><td>Dumpsite Name: Abu Rasheed Dumpsite, followed up by Nablus Municipality
Governorate: Nablus
Location: Near Al-Quds Open University Campus
Area:15 du.
Description:
• Few illegal dumping activities are available
• It is considered as water harvesting area</td></tr>
<tr><th colspan="2">Photos Taken</th></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="2">Aerial Photo</th></tr>
<tr><td colspan="2"></td></tr>
</table>

Dumpsite 6	
Coordinates	**Dumpsite Information**
E: 178957.205 N: 182762.169	**Dumpsite Name:** Bathan Dumpsite, managed by the Municipality (public one) **Governorate:** Nablus **Location:** Near Al-Seirafy Waste Separation Station **Area:**25 du. **Distance from the nearest residence:** 263 m **Description:** • Controlled by Nablus Municipality and guarded by a Municipal Guard • All types of C&D wastes are available • Lots of wheel tires are noted • Slaughterhouse wastes are dumped there • C&D waste pickers exist from time to time
Photos Taken	

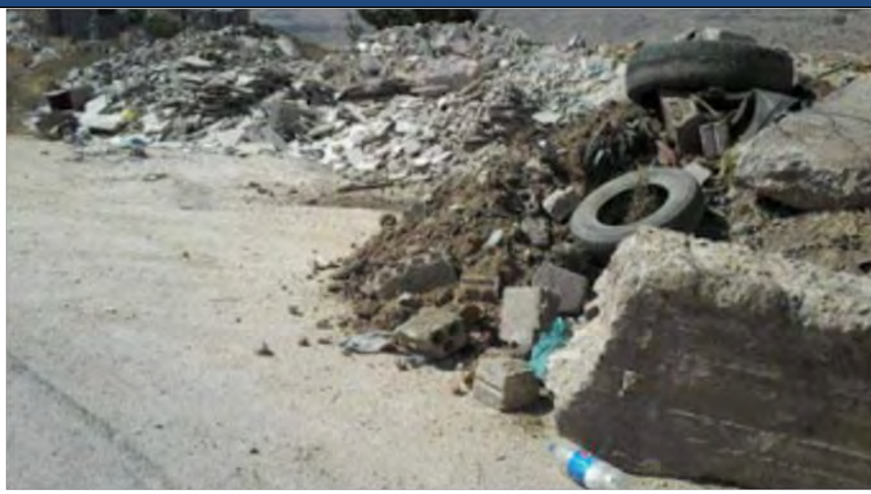
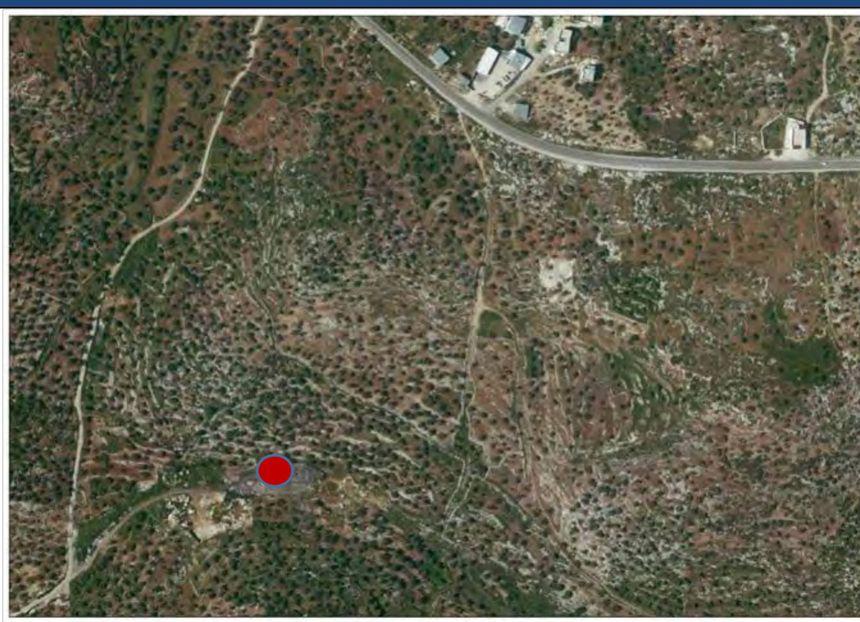
Aerial Photo



Dumpsite 7	
Coordinates	**Dumpsite Information**
E: 149848.1 N: 177303.9	**Dumpsite Name:** Qalqilia Dumpsite, followed by the Municipality **Governorate:** Qalqilia **Location:** Qalqilia Gate, in front of DCO check point **Area:**548 m^2 **Distance from the nearest residence:**115 m **Description:** • Mostly C&D waste (cement) • The location is surrounded by many nurseries • It is the official dumpsite available for the whole governorate

Photos Taken

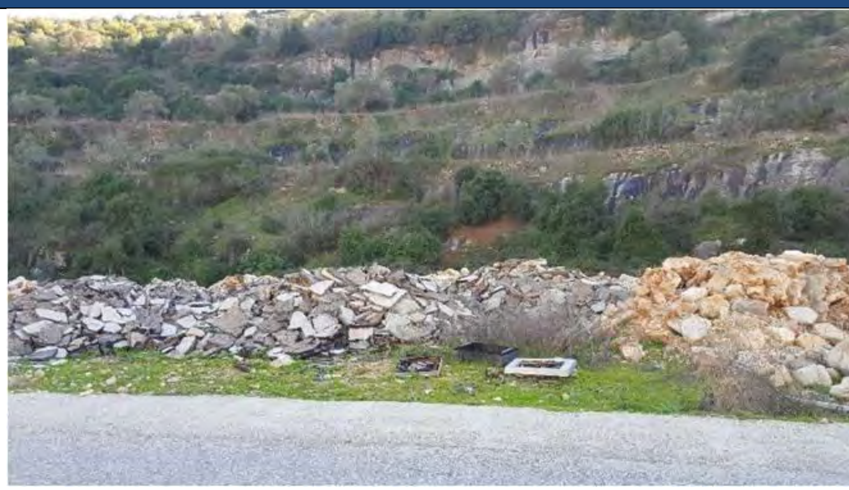
Aerial Photo

Dumpsite 8	
Coordinates	**Dumpsite Information**
E: 156915.336 N: 167940.225	**Dumpsite Name:** Bedia Dumpsite, followed up by the Municipality (random one) **Governorate:** Salfeet **Location**: Bedia **Area:**1.3 du. **Distance from the nearest residence:** 394 m **Description:** • C&D Wastes such as stones, cement, and blocks are notes
Photos Taken	
	
Aerial Photo	
	

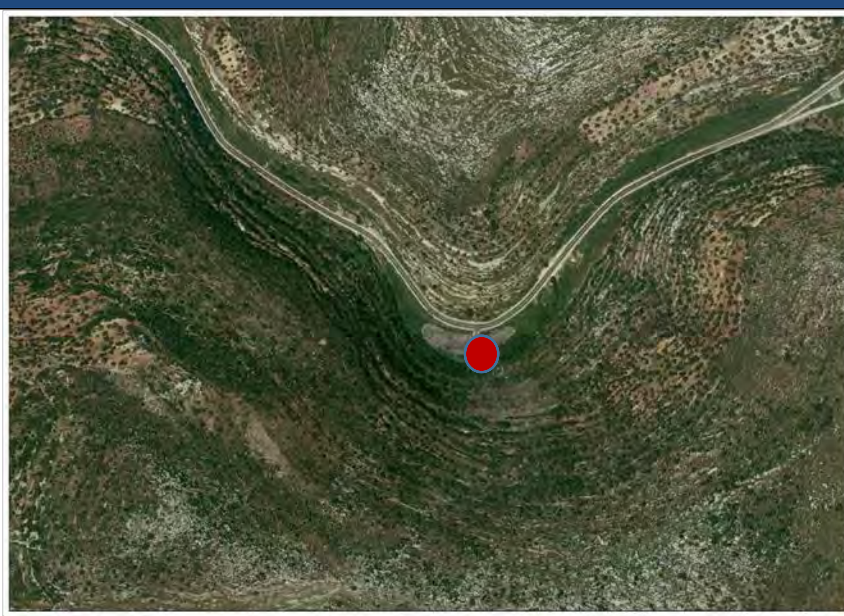
Dumpsite 9

Coordinates	Dumpsite Information
E: 161651.387 N: 164553.551	**Dumpsite Name:** Al-Matwi Road Dumpsite, followed up by the Municipality **Governorate:** Salfeet **Location:** Between Bruqeen Village and Salfeet city **Area:** 2.5 du. **Distance from the nearest residence:** 1.1 km **Description:** • C&D Wastes and wheel tires are distributed along the way • Few C&D waste pickers exist from time to time

Photos Taken



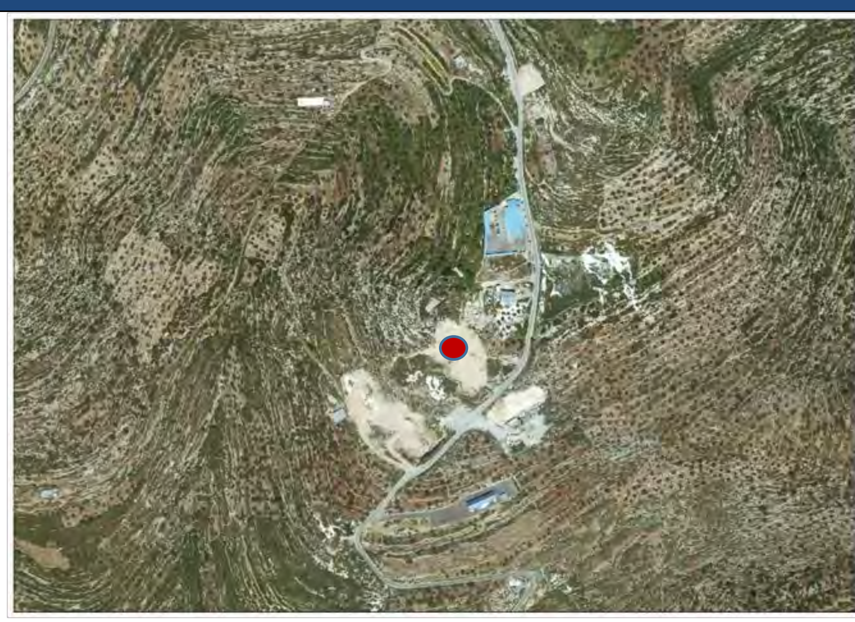
Aerial Photo



Dumpsite 10	
Coordinates	**Dumpsite Information**
E: 167207.648 N: 164209.592	**Dumpsite Name:** Kheirbet Qais Road Dumpsite, managed by crusher owner **Governorate:** Salfeet **Location:** Between Salfeet city and Kheirbet Qais **Area:**303 m^2 **Distance from the nearest residence:**350 m **Description:** • C&D Wastes such as stones, cement, and blocks are notes • The dumpsite was a crusher

Photos Taken

Aerial Photo

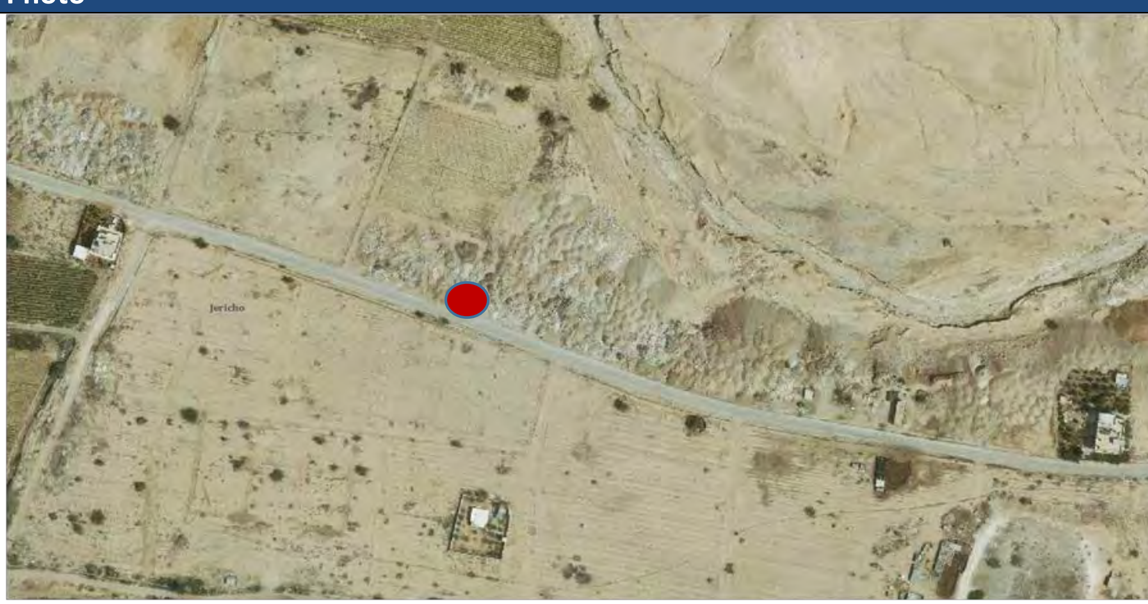


Dumpsite 11

Coordinates	Dumpsite Information
E: 194204.076 N: 142445.895	**Dumpsite Name:** Jericho Dumpsite, managed by the Municipality (random one) **Governorate:** Jericho **Location:** Near '90' Street **Area:** 8.3 du. **Distance from the nearest residence:** 92 m **Description:** • Several types of C&D are dumped randomly in clusters

Photos Taken

Aerial Photo

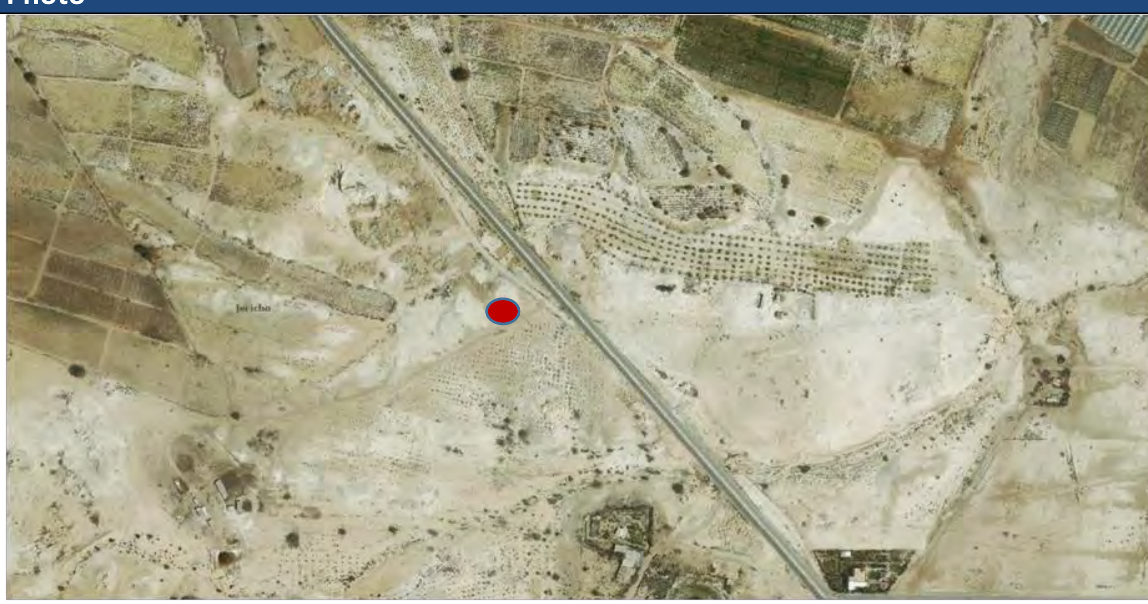


Dumpsite 12

Coordinates	Dumpsite Information
E: 194798.945 N: 138929.091	**Dumpsite Name:** Jericho Dumpsite, managed by the Municipality (random one) **Governorate:** Jericho **Location:** Near the Industrial Area **Area:** 11.8 du. **Distance from the nearest residence:** 260 m **Description:** • Several types of C&D are dumped randomly in clusters • C&D wastes are used in land leveling activities

Photos Taken

Aerial Photo

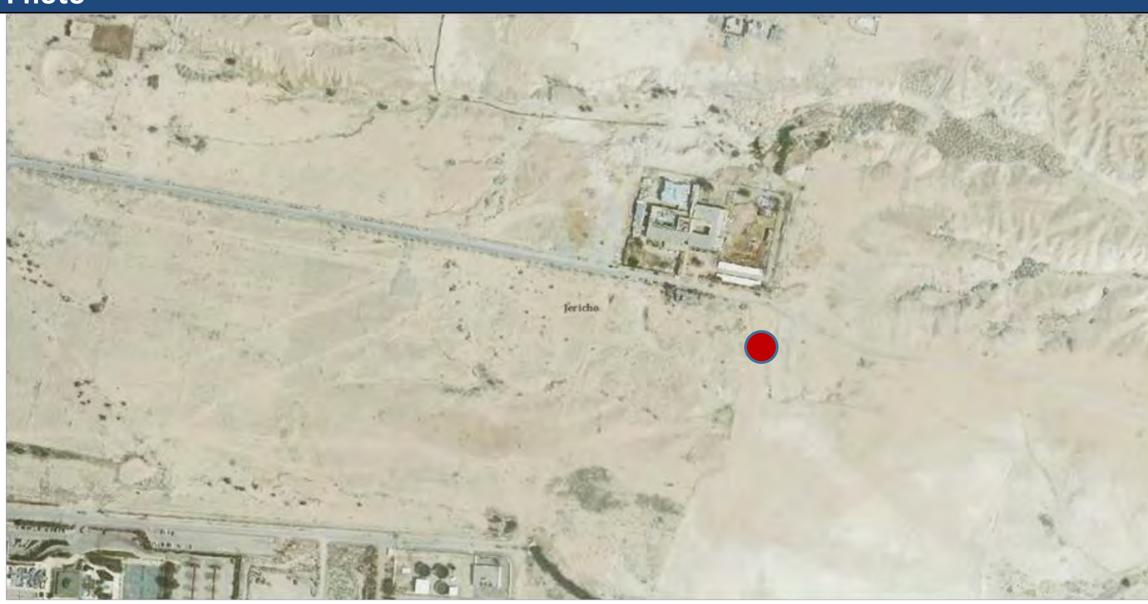


Dumpsite 13

Coordinates	Dumpsite Information
E: 193271.468 N: 138063.482	**Dumpsite Name:** Jericho Dumpsite, managed by the Municipality (random one) **Governorate:** Jericho **Location:** Near Jericho Hospital **Area:** 30 du. **Distance from the nearest residence:** 286 m **Description:** • Several types of C&D are dumped randomly in clusters

Photos Taken

Aerial Photo

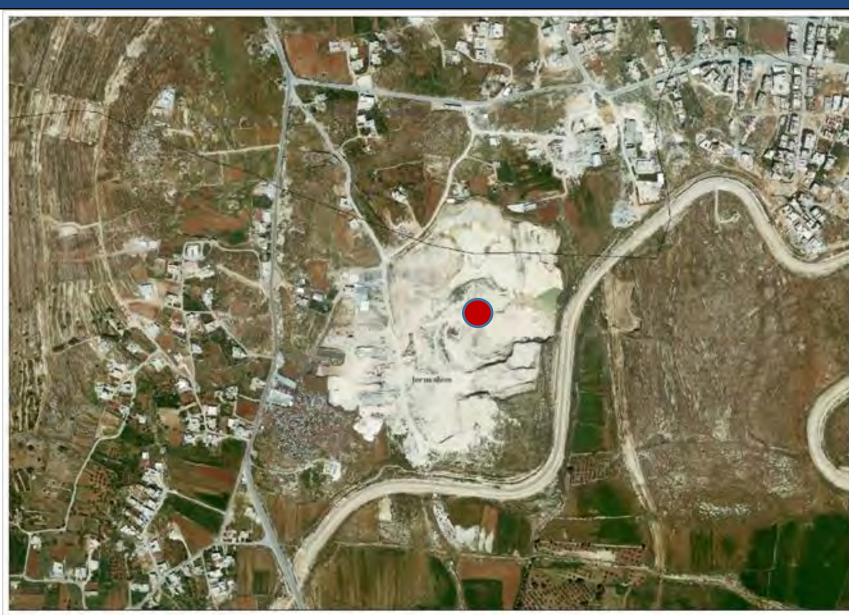


Dumpsite 14

Coordinates	Dumpsite Information
E: 169361.5 N: 142928.3	**Dumpsite Name:** Qandeel Crusher Dumpsite, managed by Qandeel Crusher owner **Governorate:** Ramallah and Al-Bireh **Location:** Between Ramallah and Rafat Village **Area:**123 du. **Distance from the nearest residence:** 253 m **Description:** • The dumpsite is located within Qandeel Crusher borders and controlled by the crusher owners • Stones and other C&D wastes are used by the crusher

Photos Taken

Aerial Photo

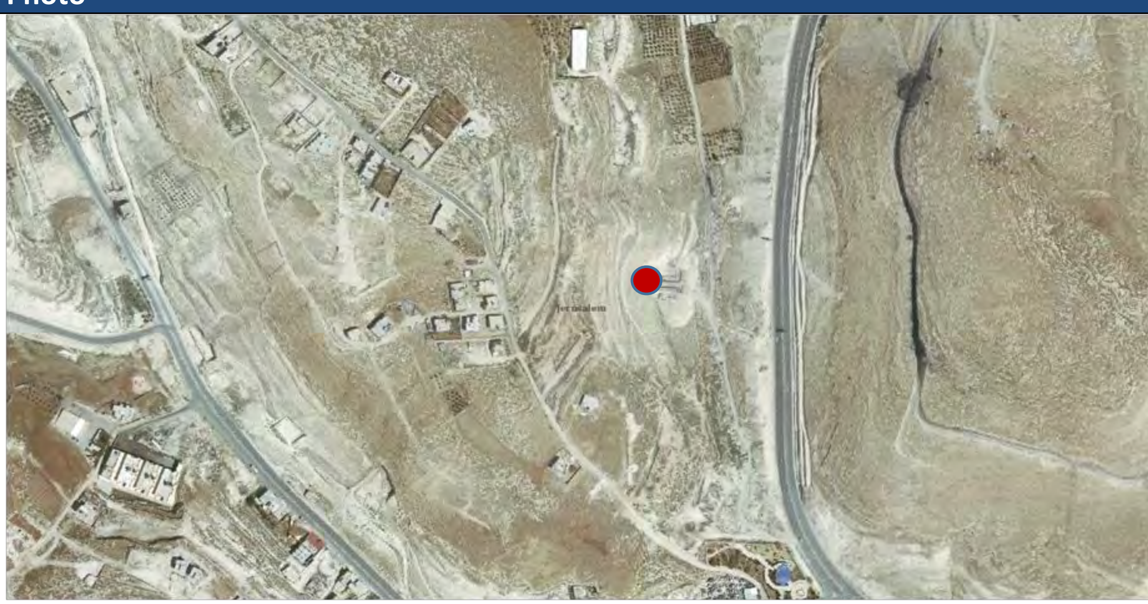


Dumpsite 15

Coordinates	Dumpsite Information
E: 176447 N: 128450	**Dumpsite Name:** Al-Ezareiyeh Dumpsite, followed up by the Municipality (random one) **Governorate:** Bethlehem **Location:** Al-Ezareieh Area **Area:**16.5 du. **Distance from the nearest residence:**90 m **Description:** • It is used by other governorates. • All types of C&D waste are available; gypsum boards, metals, cartoon, plastic, glass and others • Also, other types of wastes are available such as wheel tires • Many C&D waste pickers exist especially for metal wastes (this means reuse activities)

Photos Taken

Aerial Photo

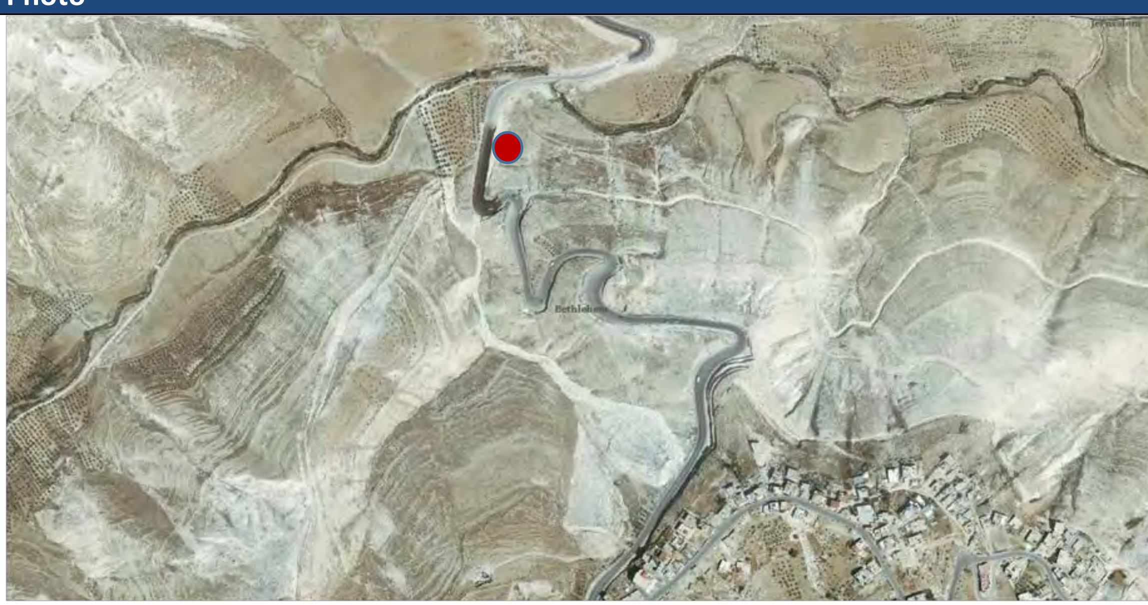


Dumpsite 16

Coordinates	Dumpsite Information
E: 177097.793 N: 126239.162	**Dumpsite Name:** Wadi Al-Nar Dumpsite, managed by the Municipality (random one) **Governorate:** Bethlehem **Location:** Al-Obeidieh, Wadi Nar Area **Area:** 5.7 du. **Distance from the nearest residence:** 500 m **Description:** • It is used by other governorates. • It extends over Wadi Al-Nar Road starting from Abu Deis Gate ending by Al-Obeideieh • All types of C&D waste are available; gypsum boards, metals, cartoon, plastic, glass and others • Also, other types of wastes are available such as wheel tires • Many C&D waste pickers exist especially for metal wastes (this means reuse activities)

Photos Taken

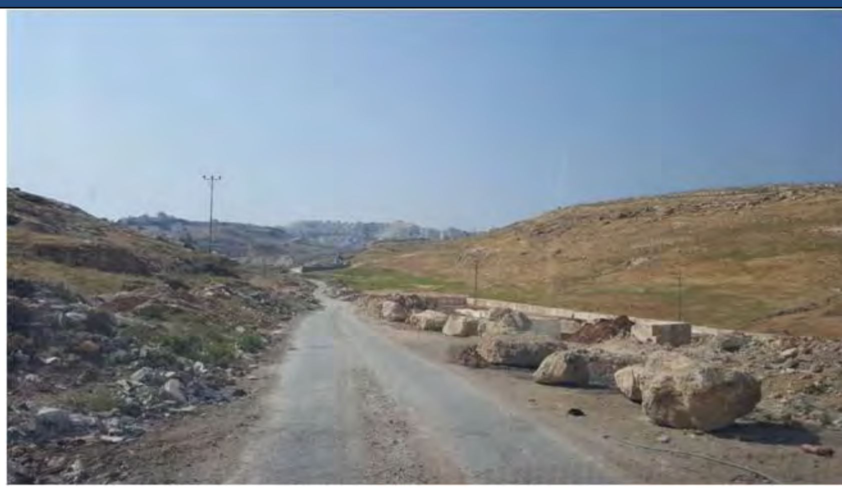
Aerial Photo



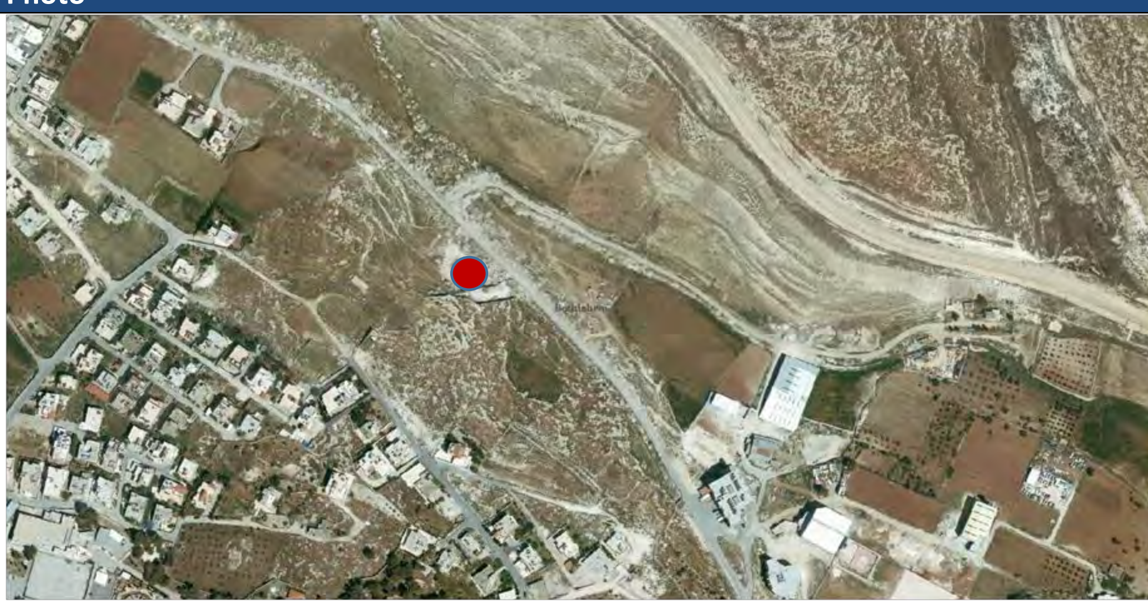
Dumpsite 17

Coordinates	Dumpsite Information
E: 172773.8 N: 123745.7	**Dumpsite Name:** Beit Sahour Dumpsite, managed by the Municipality (random one) **Governorate:** Bethlehem **Location:** Near Separation Wall, Beit Sahour **Area:** 2.5 du. **Distance from the nearest residence:** 133 m **Description:** • It is for C&D wastes only • It was noted that some people had put huge rocks around their nearby lands in order to prevent dumping to extend to these lands

Photos Taken



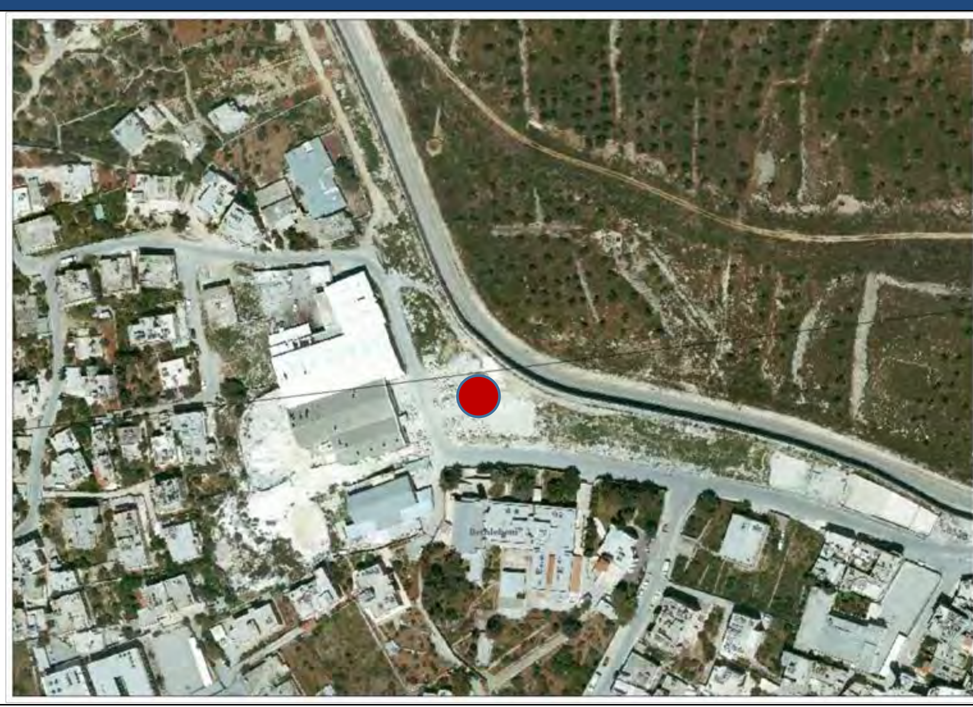
Aerial Photo



Dumpsite 18	
Coordinates	**Dumpsite Information**
E: 168736.943 N: 125445.411	**Dumpsite Name:** Aideh Camp Dumpsite, managed by the Municipality (random one) **Governorate:** Bethlehem **Location:** Aideh Camp, Near the Separation Wall **Area:**1.7 du. **Distance from the nearest residence:**114 m **Description:** • The dumpsite is very close to residential areas of Aideh Camp • Waste pickers exists • Some domestic wastes are available

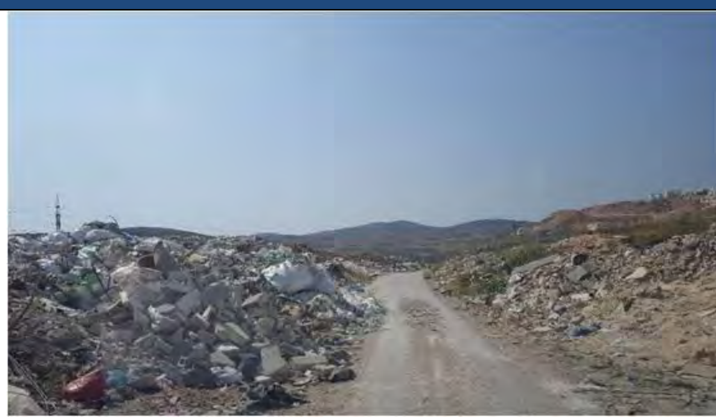
Photos Taken

Aerial Photo

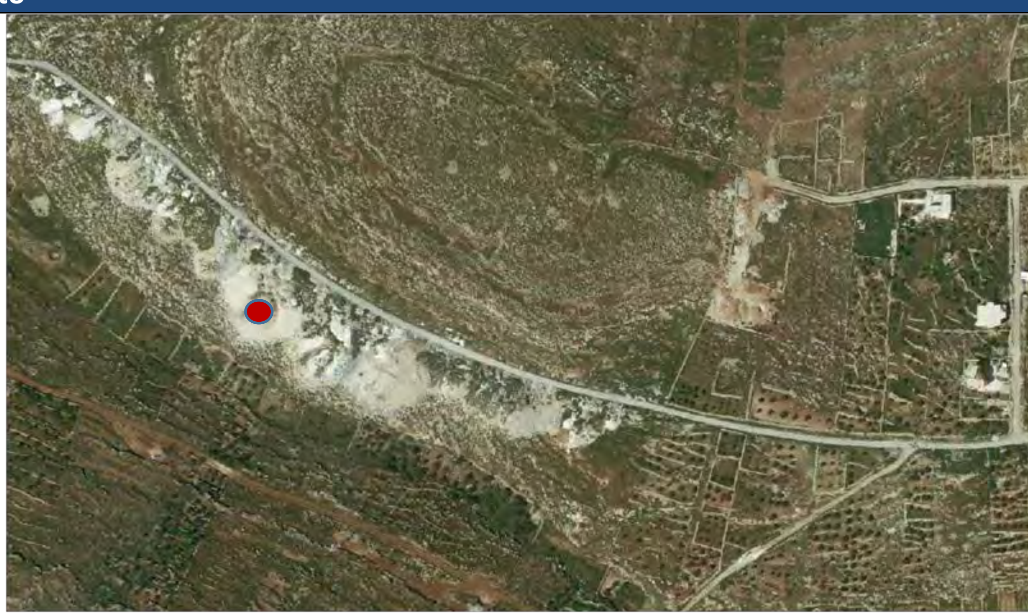


Dumpsite 19	
Coordinates	**Dumpsite Information**
E: 160319.7 N: 121273.7	**Dumpsite Name:** Nahhalin Dumpsite, managed by the municipality (random one) **Governorate:** Bethlehem **Location:** Ein Fares Area, Nahhalin **Area:** 15.5 du. **Distance from the nearest residence:** 120 m **Description:** • The dumpsite has green areas planted with olive trees and a beautiful water spring exists • It was used for dumping domestic waste • The domestic dumpsite was closed in 2011 and transformed to C&D waste only (as informed by Bethlehem JSC) • Recently, some domestic wastes exist • Huge quantities of C&D wastes are distributed also on both road sides. Sometimes, the road is closed by wastes

Photos Taken



Aerial Photo



Dumpsite 20

Coordinates	Dumpsite Information
E: 156177.4 N: 102934.4	**Dumpsite Name:** Dueirban Dumpsite, owned & managed by the Shareef Abu Sneneh **Governorate:** Hebron **Location:** Dueirban area **Area:** 8.3 du. **Distance from the nearest residence:** 133 m **Description:** • Agricultural activities noted there (green houses are available) • Several Types of C&D wastes are available • Many soil excavation wastes exist

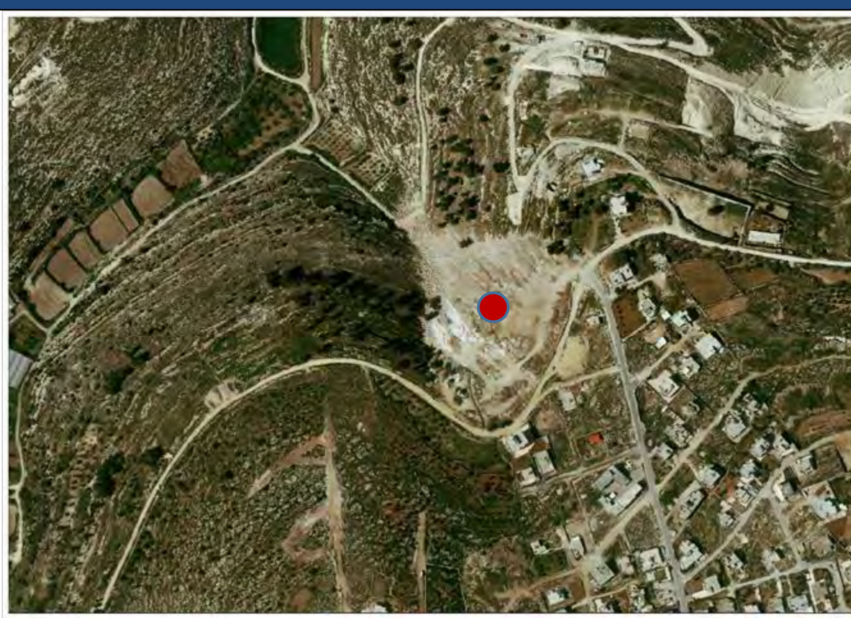
Photos Taken

Aerial Photo

Dumpsite 21	
Coordinates	**Dumpsite Information**
E: 155500.6 N: 101880.8	**Dumpsite Name:** Dura Dumpsite, owned & managed by Amjad Al-Shareef **Governorate:**Hebron **Location:**Dura Entrance from Hebron City side **Area:**24 du. **Distance from the nearest residence:**98 m **Description:** • It is a private land that is used as dumpsite • Fenced Dumpsite with a gate • Several Types of C&D wastes are available • In the way to the dumpsite, lots of C&D waste are distributed on both sides of the road • Its owner intends to close it

Photos Taken

Aerial Photo



PART VI: C&D Waste draft Guideline

1. INTRODUCTION

1.1 Background

In Palestine, C&D waste collection, transportation, and disposing of are the responsibility of the one who generates it. The Local Governmental Units (LGUs) are responsible for monitoring the cleanliness of the generation sites and around, and directing the C&D waste producers (contractors) to the pre-planned dumping areas where the waste is to be stockpiled or disposed of. However, waste management will be the producer's (contractor) responsibility to ensure that all generated wastes during the construction and demolition works are handled, stored, processed, and disposed of in accordance with proper waste management practices, and as per the Palestinian Environmental Law, No.7, 1999. This responsibility of the contractor can be transferred to a "Manager" who will follow up the management of the C&D waste generated throughout the duration of the project.

Most of the C&D waste is commonly dumped in random dumpsites or at roadsides. Therefore, 3Rs "Reduce, Reuse, and Recycling" should be concentrated on to be the main management route of the C&D waste. Recycling of C&D waste has been recommended by all LGUs in the West Bank when surveyed recently by the Ministry of Local Government (MoLG) and the Universal Group (UG) consultants' team.

The MoLG has realized that this problem would be put on the right track of solution via various measures in which developing a Waste Management Guideline is the corner stone.

The main objectives of developing such guideline are likely to provide a consistent guidance on the preparation and implementation of the C&D Waste Management Plan (WMP) and to encourage the diversion of waste from landfilling to reusing and recycling processes. The Glossary of Technical Terms of the Guideline is presented in Annex-VI.

1.2 Purpose of Guidelines

The presented C&D Guidelines are intended to achieve the following:

1) to encourage creating an integrated approach to C&D waste management throughout the project duration;
2) to define the way in which all stakeholders (clients, contractors, planners, designers, authorities concerned, and suppliers) can work collaboratively so

that the C&D waste generation can be reduced and the management can be improved;

3) to provide all stakeholders with an agreed upon basis for determining the efficiency and adequacy of C&D waste management plans; and
4) to provide general and specific guidance in relation to preparing the appropriate C&D waste management plans for certain types of projects which exceed a specified threshold size.

1.3 Waste Management Policy and Legislation

In Palestine, several governmental bodies are expected to be responsible for the licensing and approval of different processes of C&D waste management from the stage of generating the waste till the last stage of disposing of the waste. The main C&D waste relevant Palestinian authorities are:

- Ministry of Local Government (MoLG);
- Environment Quality Authority (EQA);
- Ministry of National Economy (MoNE);
- Ministry of Agriculture (MoA);
- Ministry of Health (MoPH); and
- Ministry of Public Works and Housing (MoPWH).

In Palestine up to date, there are no sufficient policies or legislations related to C&D management. A Bylaw draft has been developed by the UG team as a part of the project "Study on Construction and Demolition Waste in West Bank, Palestine". This draft Bylaw will be legally reviewed and developed under the supervision of the Ministry of Local Government.

These guidelines aim at clarifying and detailing how to deal with C&D waste in accordance with the proposed Bylaws. It is necessary that the requirements attached by the related authorities to these authorizations are fully in accordance with licensees and permit holders. Site contractors should comply with the conditions imposed on their permits and licenses. For example, all haulers engaged for the removal of C&D waste material from the site should possess the requisite authorizations.

Implementation of regulations should be simple to make authorization applications for reduction, reuse and recycling of C&D waste-related activities a more pleasant scheme for contractors.

1.4 Integration or Coordination in the Management of Construction and Demolition Waste (C&DW) and Municipal Solid Waste (MSW)

Integration in the Management of C&D Waste and Municipal Solid Waste MSW is not possible because:

1. Collection, treatment, transportation, and disposal operations are completely different as waste in the two systems is different in nature and source;
2. Collection containers and vehicles used in both MSW and C&DW are different in material, design, and job. Therefore, collecting of C&DW in the MSW containers is not acceptable anymore as the C&DW may damage these containers. Similarly, C&DW transportation in the MSW vehicle is absolutely forbidden as this may damage the compaction and hydraulic systems of the vehicle;
3. The C&DW bylaw assigns the responsibility of collection, transportation and disposing of C&DW to who generates the waste (owner of the building or contractor); and
4. The MSW bylaw assigns the responsibility of collection, transportation and disposing of MSW to LGU in its service area.

Coordination and cooperation are possible in certain cases and for certain purposes such as:

- Assigning the locations of approved dumping sites of the C&DW.
- Reusing some materials of the C&DW like soil for the daily or final cover of solid waste in the sanitary landfill.
- Manufacturing and marketing some types of recycled materials such as cardboard, glass, and plastics which prevail in both MSW and C&DW.

1.5 Functions and Specifications of the Transfer Station

- The transfer Station is a land or building(s) at which C&D materials are received and sorted for later transport to a C&D Processing Facility or to a C&D Disposal Site.

- It is designed in such a way that receiving of the waste via small vehicles of the contractor, sorting, on-site processing, and subsequent transportation of waste to landfill is carried out smoothly without any obstacles;
- The transfer station is equipped with the necessary heavy machines such as loaders and bulldozers;
- Enough transfer stations should be established in each governorate, to avoid illegal dumping of the waste at the roadsides or at the privately-owned land;

- The site (land and/or building(s)) and installations of the transfer station are owned or hired by the LGU and/or the JSC. It could be owned or hired by the private sector (e.g.; contractors). In this case, it must have a license issued by the MoLG and/or approved by EQA. Operation and maintenance of the transfer station is the responsibility of the owner/tenant;
- The personnel in charge of running the station are appointed by the LGU and/or the JSC. If it is owned or hired by the private sector (e.g.; contractors), it is the private sector's responsibility to appoint the personnel;
- Investment of Processing Facilities inside the transfer station could be granted to the private sector as per the LGU regulations. These Processing Facilities might be finally owned by the investor himself;
- In the future, we might witness the establishment of some large transfer station companies which have Processing Facilities and hauling services;
- The following summarizes the processes related to transfer station from the time of collecting the C&D waste till processing or disposal of this type of waste:
    a) the contractor collects the debris, from the generation site, in specific containers that are usually provided or rented by the hauler;
    b) the containers are taken to a previously specified C&D waste transfer station via small vehicles by the hauler;
    c) The amount of waste in the vehicle is weighed at the entrance of the transfer station and certain rate of fees is to be paid for the transfer station;
    d) Recyclable materials are sorted and put in suitable containers or bins which are finally moved to the Processing Facilities inside the transfer station or hauled to Processing Facilities outside the transfer station.
    e) After sorting and waste processing is completed, the recycled goods are taken to the market and the unrecyclable part of the waste is hauled, by large vehicles, to the C&D waste landfill outside the city. This landfill is owned or hired by the LGU and/or the JSC and sometimes by the private sector after issuing the appropriate license. Operation and maintenance of the landfill are the responsibility of the owner/tenant.

f) Some transfer stations have their own processing facilities within their vicinity and hence large trucks load the unrecyclable waste in the transfer station and take it to landfills;
g) Some contractors might transport their own waste and recyclables to and from the transfer station and/or to landfills via their own vehicles.

1.6 Procedures to Obtain the Necessary Licenses

- The license is issued by the relevant authority and according to its specific regulations;
- License for C&D waste handling is issued by the MoLG or the LGU in its service area;
- In some cases, issuing the license needs the approval of EQA or the MoNE or both. This depends upon regulations of issuing the license and the purpose of obtaining such license;
- Hereafter, are some examples of how to obtain and approve a license:

(i) for a temporary owned or hired C&D landfill, it is issued by the MoLG and approved by EQA.
(ii) for a transfer station, it is issued by the MoLG and approved by EQA.
(iii) for a truck (vehicle) used for C&D waste hauling to transfer stations or to dumpsites, it is issued by the Ministry of Transportation (MoT) and approved by the LGU in that area;
(iv) for a Processing Facility inside the transfer station, the license is issued by the MoLG and approved by the MoNE;
(v) for a Processing Facility outside the transfer station, it is issued by the MoNE and the LGU in that area;
(vi) for operating a mobile stone crusher, it is issued by the LGU in that area and approved by EQA and the MoNE.

However, the license application for any of the above facilities should be submitted to the Ministry of Local Government MoLG, which will conduct the necessary contacts with the other concerned authorities to study the application and finally determine which authorities have the right to issue and approve the license.

1.7 Hazardous Types of C&D Waste

- Hazardous wastes are disposed of according to special disposal procedures and regulations, and should be carried out according to the Palestinian Environmental Law, No. 7, 1999;

- Certain C&D waste projects may generate hazardous waste materials that need special handling;
- Hazardous wastes are frequently found in demolition projects and may include asbestos, lead paints, contaminated soil, adhesives, drywall, and additives for concrete and blocks;
- The handling of C&D hazardous waste generated during C&D waste processes is the responsibility of the contractor. He should do the following:
  - (i) collecting the hazardous waste properly;
  - (ii) placing it in special bins and cover these bins;
  - (iii) storing the bins in an isolated area of the project; and
  - (iv) transporting this type of waste in a safe way to an approved landfill after getting the required permission from the landfill operators who will dispose of the waste properly without causing any problems to public health or any environmental negative impacts.

1.8 Waste Management Plan and Thresholds

- The Waste Management Plan (WMP) of the C&D waste is an important plan that helps builders and contractors to achieve contractual and environmental goals by minimizing waste generated from their projects.

- C&D waste management issues should be addressed at an earlier stage of the project; as this allows an optimal period of time for waste reduction and recycling aspects.

- The size of the C&D waste project usually determines the need for preparing a waste management plan WMP. In countries managing the C&D waste properly, it is compulsory that the waste management plans be prepared for projects in excess of certain thresholds. The following is an example of the thresholds at which a WMP of the C&D waste should be prepared. These thresholds could be carefully examined by the LGUs, the Contractor Union, the Engineering Association, etc.,then developed, and finally adopted in Palestine:

  1) projects of new developed 10 residential houses or more;
  2) projects of new development which include educational, health, institutional, and other public facilities, with a collective floor area that exceeds 1,250 m^2;
  3) projects of demolition or renovation generating more than 100 m^3 in volume, of C&D waste;
  4) other C&D projects generating more than 500 m^3 of waste;

- For Projects that are not reaching the threshold values, the C&D waste management should be carried out entirely by the owner of the project or the contractor without preparing a WMP. In this case, the C&D waste generated should be transported to a recognized recycling facility or disposed of at an official C&D waste landfill.

- The C&D waste management plans may be ignored or at least postponed in some conditions where the local authority considers it unworkable to operate such a plan due to nuisance, space restrictions, noise, technical reasons, etc. The consideration of such postpone can be raised during the planning phase of the project. In this case, the C&D waste management should be carried out totally by the owner of the project or the contractor without referring to the prepared WMP until the reasons for ignoring or delaying the implementation of the WMP have ended. In this case, the owner of the project or the contractor should transport the C&D waste generated to a recognized recycling facility or to dispose of this waste at an official C&D waste landfill.

2. BEST PRACTICES in the C&D WASTE MANAGEMENT

2.1 Procedures of Best practices in the C&D Waste Management

Priorities of C&D waste management

- The management of C&D waste should emphasize and consider the waste management sequence as follows:
    - (i) the first priority should be given to waste prevention and minimization
    - (ii) the second priority to reuse and recycling
    - (iii) the disposal of the waste should only be considered as the last option.

Prevention and reduction of C&D waste

- The main advantages of reducing waste in the project site could be summarized as follows:
    1) Reduce project costs
    2) Meet regulatory requirements
    3) Reduce environmental impacts
    4) Meet contractual obligations
    5) Help to avoid the nuisance of new compulsory regulations.

Reduction of waste could be achieved through many precautions such as:

a) limiting over ordering of building materials
b) selecting building materials with low waste rates

c) reducing the risk of materials exposed to damage by appropriate storage of the building materials
d) rejecting to purchase low-quality materials even if offered at low prices
e) purchasing materials with low packaging volumes.

Reuse of C&D waste

- Waste materials generated in the project should be reused on site and not sent to landfill.
- Waste materials removed from demolished or renovated buildings could be offered at certain shops which allow the public to acquire these materials at low prices
- Some materials could be reused in future projects such as soil, sand, bricks, etc.

Recycling of C&D waste

- Recycling of generated waste is considered the best alternative to disposing of C&D waste at landfills.
- Recycling of C&D waste is important in reducing our reliance on limited natural resources.
- Recycling reduces the cost of transporting the C&D waste to landfills.
- Some materials with a recycled content that can be used on-site:

1- sand and soil	2- reinforcement	3- bricks
4- timber products	5- plastics	6- aggregates
7- concrete	8- paving	9- insulation

- It is time for the local authorities (LGUs) in Palestine to implement a C&D waste management plan promoting recycling practices through firm enforcement of the C&D waste bylaw.

Storage of C&D waste

- The remaining C&D waste after reusing or recycling should be stored in a proper way until this waste being disposed of.
- The selected places of storing the C&D waste should not be established in farms or in the land of high agricultural production potential.
- Storage places should be away from any drinking water or irrigation water resources by at least 500 meter.
- Storage facilities should be set up at enough distance from residentiol areas by at least 500 meters.
- An effective monitoring system should be set up in the storage area to enable segregation of different waste materials (if exist).
- If the storage area reached the maximum capacity, then this area should be rehabilitated or another area is to be selected instead.

Transportation of C&D waste

- Vehicles transporting the C&D waste from the generation site should be covered with appropriate materials to prevent any environmental contamination due to the uncovered vehicle load of waste.
- Vehicles should not be overloaded.
- Drivers should clean the wheels of their vehicles from mud and dirt, during transporting the C&D waste.
- Vehicles should not operate if they do not carry a permit issued by the authorized institution explaining what the vehicles are loading and the destination of their cargo, as well.

Disposal of C&D waste

- C&D waste should be disposed of only in a landfill owned or managed by the LGU or has a permit from the authorized institutions to receive this type of waste.
- The landfill in which the C&D waste is to be disposed of should be assigned only for this type of waste.
- C&D waste should not be disposed of in any privately-owned lands.
- C&D waste should not be disposed of at the roadsides.
- Disposal of C&D waste should not be considered as one of the routine choices which can be taken. Instead, reusing and recycling is the preferred option.

2.2 Recommendations to Promote the 3Rs Practices

There is a diverse group of approaches that can promote the 3Rs (Reduction, Reuse, Recycle) practices and subsequently the diversion of the C&D waste away from landfills. The first five of the following recommendations are the most effective in promoting the 3Rs without ignoring the importance of practicing the rest of recommendations addressed below.

(1) **Awareness Raising**

Raising awareness is required to promote the environmental education designed to make people realize the necessity for practicing the 3Rs. Awareness targeting designers, contractors, sub-contractors, and building owners is crucial to promote the 3Rs.

(2) **Incentives**

These incentives can be classified into economic and social types which are important in promoting the 3RS practices. Incentives could be a great beneficial factor in this regard if combined by setting up of priority areas for the 3Rs-related businesses.

(3) **Partnership**

All stakeholders, including the Ministry of Local Government, local government units, the private sector, civil communities, and NGOs, are required to make efforts on their own initiative to promote the 3Rs practices.

(4) **Sharing Available Information**

All stakeholders must share information which leads to 3Rs-related activities. The sharing of information is crucial to enrich the joint understanding and cooperation of various stakeholders. It is worth mentioning that sharing of information between exporting and importing countries is required for proper recycling activities.

(5) **Technology Development**

Developments of clean technologies at the production stage, as well as the design stage, are important to promote the 3Rs nowadays and in the future. Information on science and technology to the public and cooperation between local governments and research centers and universities are important in promoting the 3Rs.

(6) **Economic Factors**

Economic factors which promote the 3Rs practicing include but not limited to the following: (i) saving the cost of transporting the C&D waste to landfills (ii) saving fees and taxes of dumping the waste in landfills (iii) saving cost for purchasing raw materials (iv) expected revenue from sales of recycled products.

The following recommendations are also important in promoting the 3Rs:

1. Establish in each main city reuse centers which are expected to manage the largest volumes of materials, primarily offering items such as doors, windows, cabinets, plumbing fixtures, metals, flooring, hardware, bricks, and fencing.
2. Establish in each governorate, a center within the main LGU service area with a database of expected generated C&D wastes in order to offer that waste for those who need such wastes for road leveling or as soil for house gardens, etc.
3. Establish regulations or indications determining standards for recycling C&D waste materials in order to utilize them and make them an alternative to new materials.
4. Increase the number of recycling facilities in the region.
5. Use modern recycling equipment.
6. Develop a firm policy to control illegal dumping of C&D waste.
7. Encourage recycling by tax exemption or by governmental or municipal subsidies.

8. Encourage recycling by disincentives in the form of penalties.
9. Creating markets for the recycled products in the main cities.
10. Establish standards for the quality of recycled products.
11. Location of recycling facility should consider transport accessibility, air pollution, and safety factors.
12. Use portable recycling crashers onsite.
13. Use the social media for encouraging marketing the recycled products.
14. Educate contractors and subcontractors about what materials will be recycled to be used in the on-site construction works.
15. Regulations for the disposal of construction waste must be enforced as those for municipal solid wastes.
16. Better enforcement by the local authority, if combined with firmer laws and regulations, would have a satisfying outcome in the C&D waste management and subsequently promote of the 3Rs.
17. Developing specifications for the use of recycled products in new buildings.
18. Testing and certifying recycled demolition materials to ensure high standards and performance.
19. Substituting crushing concrete and bricks on-site for use as structural fill instead of purchasing new materials.

2.3 The 3Rs Practices Implemented in Palestine

Currently, there are no accurate statistics on the size and extent of recycling operations of the C&D waste, in the West Bank. Nevertheless, some materials are being reused/recycled at a very limited scale. These materials include:

- Excavation material: reused for agricultural land reclamation, land leveling, and road infrastructure.
- Road demolition: reused for covering unpaved roads in front of houses.
- Concrete aggregate: reused as filling material in areas with low levels.
- Bricks: reused directly in the construction site.
- Wood, Timber: Reused as a heating source and as a boiler fuel.
- Ferrous metal: exported to industrial countries to be recycled there.
- Soil: reused as a covering material during solid waste landfilling.
- Mixed stones, and concrete pieces: crushed and used on-site in the construction work.

The limited activities in reusing and recycling of C&D waste, in the West Bank, is attributed to limited awareness about advantages of the 3Rs activities and the absence of firm legislation controlling both legal and illegal C&D waste dumping.

To promote the 3Rs practices in the West Bank, it is of great importance to adopt the recommendations discussed and listed above.ess

Unlike Gaza Strip which has been practicing the 3Rs since a long time due to economical situation. Activities of the 3Rs have increased in the last few years after the frequent invasions of the Israeli troops, in 2008-2009, 2012 and 2014, which left tens of governmental headquarters and thousands of houses partially or totally destroyed. The situation there has been aggravated due to the siege imposed by the Israeli and the Egyptian governments. For all that, almost everything in the demolished buildings was reused or recycled as no new materials are available in the market to buy.

In Gaza Strip, they are compelled to utilize every piece of concrete, metal, wood, tiles, electrical wires, PVC pipes etc., and make them alternatives to missing new materials.

3. ON-SITE and OFF-SITE RECYCLING

There are two methods for the C&D waste recycling. The C&D waste in the first method is collected, separated, and/or recycled in the project area and called On-Site Source Separation method. The C&D waste in the second one is collected together in the project area and then separated and recycled in a recycling facility outside the project area and called Off-Site Mixed Recycling method.

- In the on-site source separation, the C&D waste is separated on-site and placed in separate bins or bags. Then it is stored at recycling facilities in the project area or taken away by recyclers or suppliers.
- In the off-site mixed waste recycling, all the C&D waste types are placed together in one bin. Then all types of waste are separated at a recycling facility away from the project site.

3.1 Implementing the On-Site Source Separation Method

To implement such a method of recycling, the following instructions should be taken into account:

- to prepare a waste management plan suitable for the size of the project at an earlier stage.
- to engage an experienced “Manager” to follow up the waste management plan.
- to identify the types and estimate amounts of C&D waste to be recycled in order to calculate the number and size of bins to be used.
- to assign enough space and access path on the site for storing the recyclable materials.

- if there is more than one nearby projects in the area, all projects can share the space and cost of bins.
- garbage and rubbish should be placed in different bins as these are to be collected with the municipal solid waste.
- the manager can conduct some kind of training to the personnel with regard to types of materials to be separated and to ways of preventing contamination of the separated materials.
- to encourage subcontractors for separating and recycling processes by granting them financial incentives.
- to examine the plan, periodically, and make the necessary adjustments to ensure its success throughout the duration of the project.
- to roughly, measure the amount of the C&D waste that has been prevented, reduced, reused and recycled.

3.2 Implementing the Off-Site Mixed Waste Recycling Method

To implement such a method of recycling, the following instructions should be taken into account:

- to prepare a waste management plan suitable for the size of the project at an earlier stage.
- to assign enough space for the Mixed Waste Recycling bin.
- to employ a mixed bin contractor who will take the mixed waste materials to a recycling facility.
- to keep contact with the recycling facility to know the recycling rates of your waste and to compare these rates with the contractor claimed rates.
- garbage and rubbish should be placed in a different bin as these are to be collected with the municipal solid waste.
- to conduct training of the personnel with regard to types of materials that cannot be placed in the mixed bins.
- to examine the plan, periodically, and make the necessary adjustments to ensure its success throughout the duration of the project.
- to roughly, measure the amount of the C&D waste that has been prevented, reduced, reused and recycled.

4. GENERAL GUIDANCE for PREPARING a C&D WASTE MANAGEMENT PLAN

- The Waste Management Plan is prepared by the owner of the project or the contractor and should be approved by the LGU in the project area.
- The Waste Management Plan, when written, should be a simple document focusing on measures to be taken to improve the handling and management of waste generated in the project including the 3Rs (reducing, reusing, and recycling).

- The plan should be designed and applied according to the hierarchy of the project phases.
- The plan, when prepared, should take into account the following:
    - (i) Size of the project
    - (ii) Type of the project (construction or demolition)
    - (iii) Construction or demolition work hours
    - (iv) Transportation routes and traffic stream congestion
    - (v) Neighbors of the project
- An experienced "C&D waste Manager" should be employed to follow up the waste during generation, reusing, recycling and disposal.
- The Manager should record the types and the exact quantities of the construction materials purchased for use in the project
- The Manager should record the types and the estimated quantities of the waste outputs for each phase of the project.
- Adjustment of the plan could be made (if necessary) during the continuous tracking and follow up, by the Manager, to the project at any stage of the project.
- The Waste Management Plan should address and describe the following:
    1. Project description
       The project could be described in details via a well-designed sheet that includes the following information:
        - Name of the project
        - Site address of the project
        - Name, phone, fax, and mailing address of project owner or contractor
        - Name, phone, fax, and mailing address of the C&D waste Manager
        - Proposed work: construction or demolition
        - Type of project (residential, commercial, new construction, demolition)
        - Estimated start date
        - Estimated completion date
        - Signature of the project owner/contractor
        - Date of signature

    2. Tabulation of the types of waste and the estimated amounts of the waste material generated

- The information about the generated waste could be organized in a table which is to be filled by the C&D Waste Manager. This information includes:
    - types of waste (concrete, metal, wood, etc.)
    - estimated amounts of the waste material generated from each type of the waste
    - estimated amounts of waste reused on-site
    - estimated amounts of waste recycled on-site
    - estimated amounts of waste recycled off-site
    - estimated amounts of waste disposed of
    - Place of the landfill where the unrecyclable waste materials are disposed of
    - the manner of how the waste be stored on-site for reuse and recycling
    - who will manage the site operations to ensure promoting of the 3Rs in addition to the Manager
    - who is responsible for evaluating the plan.

3. Checklist to assess the plan by the LGU officer
   The purpose of the checklist is to assess the prepared waste management plane. It is designed in such a way to ensure that the waste management plan includes enough information to allow assessing it. The checklist is a form, prepared by the LGU, containing questions to the C&D Waste Manager about the adequacy of information addressed in the waste management plan and the modifications suggested by the LGU. The checklist is filled by the LGU officer. This could be considered as a kind of supervision, from the LGU, on the management and handling of the waste generated throughout the project duration.

4. Demolition Waste Management Plan
   If the project is dedicated for demolishing a building(s), then a specific management plan should be prepared and the following points should be enough highlighted:
    - Sorting and segregation of the demolished waste materials that could be sold or used in other projects;
    - Removal of the hazardous waste materials such as lead and adhesives;
    - Removal of the construction materials containing asbestos; and

- Obtaining a permit from the authorized institutions prior to demolishing a protected high-valued structure.

Part VII: C&D Waste Managing draft Bylaw

1. Purpose

The purpose of this draft bylaw is to regulate and minimize the amount of waste generated by new constructions or demolition of structures that are sent to dumpsites or landfills for disposal. An Arabic version of this draft Bylaw is in Annex IV of this report.

2. Definitions

2.1 definitions of important words and terms:

- **“Building Bylaw”** is the *LGU’s* Building Bylaw No. _____
- "**Building Official**" includes Building Inspectors and Inspectors designated by the *LGU’s* or the EQA.
- "**Building Permit**" is a permit to construct a building or a temporary building issued in accordance with the MoLG laws and regulations.
- **“Waste”** means the construction & demolishing waste.
- "**Demolition Permit**" means a permit to demolish a building or temporary building issued in accordance with the MoLG laws and regulations.
- **"Permit"** means permission or authorization in writing by the Building Official to perform work regulated by this Bylaw.
- **“Authorized Agent”** means a person authorized in writing to act on behalf of the owner in connection with a permit, including a hired tradesman or contractor;
- **“Disposal”** means:
  a) the abandonment, discard, or destruction of any materials, substances, or objects;
  b) the application, release, or incorporation of materials, substances or objects in or to land,
  c) the conduct prescribed in writing by the Building Official as Disposal;
- **“Disposal Facility”** means a Facility that:
  a) has a valid & subsisting permit, license, or operational certificate issued by the MoLG or the EQA for the operation of a disposal facility;
  b) is approved as a disposal facility by the MoLG or the EQA

- **"Facility"** is any kind of land, building, site, or structure;
- **"Fee Refund"** is the refund of a Waste Disposal and Recycling Services Fee paid in respect of a Waste Disposal and Recycling Services Plan as estimated by the MoLG
- **"Hazardous Substances"** are the substances/materials that are declared or defined to be hazardous, toxic or dangerous in or pursuant to any Palestinian applicable laws.
- **"Owner"** is the registered owner in fee simple of land;
- **"Recyclable Material"** is the material, substance, or object that is produced, originated or resulted from Work and satisfies at least one of the following:
  a) is organic material from a residential, commercial or institutional source and is capable of being composted;
  b) is managed as a marketable commodity with an established market by the Owner or operator of a Recycling Facility;
  c) is being used in the manufacture of a new product that has an established market or is being processed as an intermediate stage of an existing manufacturing process; or
- **"Recycling Facility"** is a Facility, other than Disposal Facilities, that:
  a) has a valid and subsisting permit, license, or operational certificate issued by the EQA
  b) is approved as:
     i. a new organics processing facility; or
     ii. a publicly-owned transfer station, for purposes other than Disposal;
- **"Site"** is any land, building, structure, or improvements where Work is or is intended to be performed;
- **"Waste"** is defined as any discarded or abandoned material, substance, or object that is produced, originated, or resulted from Work, and any other prescribed material, substance or object;
- **"Waste Disposal Services Fee"** is the fee estimated by the MoLG or the LGUs for C&D waste disposal sites.
- **"Work"** is the demolition, deconstruction, or systematic disassembly of a building, structure or improvement regulated by the Building Bylaw.

2.2 References in this draft Bylaw to enactments or bylaws of the Municipality and MoLG include those enactments, bylaws, and plans as they may be amended or replaced from time to time.

2.3 Unless otherwise defined herein, all words or expressions used in this Bylaw have the same meaning, like words or expressions used in the Palestinian Environmental Law No. 7, 1999.

3. Application

3.1 No person shall commence, continue, cause or allow the commencement or continuation of any Work except in accordance with the provisions of this Bylaw.

3.2 This Bylaw does not apply to:

a) Any demolition, deconstruction, or systematic disassembly of a building, structure or improvement that the Building Official deems is required to protect public health or safety in an emergency; or

b) Any other demolition, deconstruction, or systematic disassembly of a building, structure or improvement approved in writing by the Building Official.

3.3 Nothing in this Bylaw precludes or relieves a person from complying with any provision of the Building Bylaw, other bylaws of the Municipality, or local government laws or regulations applicable to Work.

4. Permits

For the issuance of a **Demolition Permit**, the following items are required:

a) A completed Waste Management Plan, as prescribed by the **Building Official**.
b) A Waste Management Fee, to be prescribed by the MoLG.

Some projects may be exempted from all or some of the requirements of this bylaw. These exemptions may include:

- Small renovations to Single Family Dwellings.
- Buildings under 50 square meters in area.
- Additions under 20 square meters in area.

A portion of the Waste Management Fee may be returned to the applicant upon completion of the project. A Compliance Report must be submitted to the Building Official with attached receipts from recycling facilities, landfills and/or well recognized C&D dumpsites indicating the amounts of materials recycled and disposed of. The Compliance Report must be submitted within 90 days after the completion of the project to receive the Waste Management Fee return.

5. Recycling

5.1 At the time of submitting an application for a Permit, a properly completed Waste Disposal and Recycling Services Plan regarding the management of Waste and Recyclable Material must be signed by the Owner or Authorized Agent and submitted to the Building Official.

5.2 If Recyclable Material is removed from a Site, the Recyclable Material must be removed:

- to a Recycling Facility; or
- in accordance with an approved Waste Disposal and Recycling Services Plan.

5.3 No person shall commence, continue, cause or allow the commencement or continuation of any Work unless the Building Official has approved a Waste Disposal and Recycling Services Plan for that Work.

5.4 Notwithstanding the provisions of any other bylaw of the MoLG, no Permit issued under the Building Bylaw for Work with respect to which a Waste Disposal and Recycling Services Plan is required under this Bylaw is valid unless the Building Official has approved the Waste Disposal and Recycling Services Plan for that Work.

6. Compliance Reporting and Record Keeping

6.1 To ensure compliance with this Bylaw, records of the surveying, removal, handling, management, and Disposal of Waste and Recyclable Material must be kept, including:

a) payment receipts, donation receipts, weigh bills, inspection reports, clearance letters, sampling reports, and Waste transport manifests;

b) photographs and - if applicable- recording:

i. the use of Recyclable Material on the Site for backfill; or

ii. the removal of Recyclable Material from the Site and used as backfill, or as specified in an approved Waste Disposal and Recycling Services Plan; and

c) any other records that the Building Official specifies at the time of application for a Permit must be kept.

6.2 Within ninety (90) days after Project Completion, the following must be submitted to the Building Official:

a) a properly completed Compliance Report; and

b) originals of the records required to be kept under section 6.1.

7. Hazardous Materials

7.1 At the time of submitting an application for a Permit, a properly completed Hazardous Materials Report regarding the surveying, removal, handling, management, and Disposal of Hazardous Materials must be signed by the Owner or Authorized Agent and submitted to the Building Official.

7.2 No person shall commence, continue, cause or allow the commencement or continuation of any Work unless the Building Official has received a completed Hazardous Materials Report for that Work to the satisfaction of the Building Official.

7.3 Notwithstanding the provisions of any other bylaw of the MoLG, no Permit issued under the Building Bylaw for Work with respect to which a Hazardous Materials Report is required under this Bylaw is valid unless the Building Official has received a completed Hazardous Materials Report for that Work to the satisfaction of the Building Official.

7.4 To ensure compliance with this Bylaw, the Owner or Authorized Agent must keep records of the notification to Work Safe regarding the surveying, removal, handling, management, and Disposal of Hazardous Materials, including:

a) a completed Work Safe “Notice of Project” for Work that is or is intended to be performed on a Site, where a “Notice of Project” is required by Work Safe;

b) if 7.4(a) applies, confirmation from Work Safe that it has received the “Notice of Project” for that Work; and

c) any other records that the Building Official specifies at the time of application for a Permit.

PART VIII: CONCLUSIONS and RECOMMENDATIONS

1. Conclusions

The current C&D waste handling in the West Bank is inappropriate, and solving this problem is the responsibility of all the parties involved in the construction industry. There is an absence of a clear management and regulation system for C&D wastes; inadequate dumpsites in the region; lack of awareness among those who are handling C&D wastes.

The current situation of C&D management has resulted in many environmental, health, economic and social negative impacts such as narrowing or closure of roads, affecting privately owned lands, closing off areas that are potential for LGU expansion and development, obstruction of agriculture activities, changing the course of valleys (impact on surface water), closing the rainwater drainage systems and culverts, and contaminating the surrounding environment.

The analysis of the C&D waste fractions reveals that concrete, bricks, and stone fractions are the materials that are with the highest percentage. Conversely, the gypsum and tiles fractions present the lowest percentages.

Ramallah/Al-Bireh and Nablus are the districts with the highest C&D generation rates based on the licensed construction areas.

There are no regulations or indications determining standards for recycling materials in order to utilize them and make them an alternative to new materials.

2. RECOMMENDATIONS

1. More detailed study for the estimation of the excavation material generation rate and characterization in the West Bank should be conducted.
2. Most of the current C&D waste management practices are oriented to short-term solutions, without taking into account the long-term effects on the environment. Therefore, clear actions should be taken to apply technologies for reusing and recycling of C&D waste. The first step in this manner is to develop the relevant regulations, bylaws and code/norm provisions in order to facilitate the reuse of C&D waste and develop new materials from waste. Extensive research should be encouraged in this regard.

3. Conduct a survey study about environmental awareness among the employees in charge of C&D waste handling, in the private and public sector, with regard to C&D waste.
4. Conduct more studies about C&D waste with regard to quantities and composition.
5. Conduct a study about investment opportunities in the field of C&D waste recycling especially the establishment of stone crushers.
6. In each governorate, establish a center within the main LGU vicinity with a database of expected generated C&D wastes in order to offer that waste for those who need such wastes for road leveling or as soil for house gardens, etc.
7. Establish regulations or indications determining standards for recycling C&D materials in order to utilize them and make them an alternative to new materials.

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Annexes

Annex I: ToR of the Project

Introduction

In the framework of the Palestinian National Strategy for Solid Waste Management, the Ministry of Local Government (MoLG) is implementing a project for technical assistance in solid waste management in Palestine, supported by Japan International Cooperation Agency (JICA), which will continue until the end of January 2018. One of the project items includes studying the current situation of construction and demolition (C&D) waste in Palestine. For this purpose, a preliminary study has been done in order to get an overview of C&D waste problems in Palestine. The study has been done in three stages:

1- Field survey on the connecting roads around Ramallah and Al Bireh city, in which different irregular dump of solid waste including C&D waste of buildings.
2- Questionnaire distributed to Joint service councils (JSCs) of SWM in West Bank governorates.
3- Questionnaire distributed to local governmental units (LGUs) of West Bank governorates.

By which the C&D waste is the collective name of discharged debris resulting from construction, repair, demolition including (not limited to blocks, stones, digging residues, concrete, wood, carton, plastic, all kinds of metals, asphalt, etc.) in addition to fine particles generated from stone mills and crushers. Its aggravating problem and the data available in Palestine about these kinds of wastes are limited regarding types, quantities, and disposal ways.

Because of no clear evidence, it has not been determined how to deal with the accumulated C&D waste, and limited data about the negative impact on human and environment health, in addition to the lack of clear rules and regulation of dealing and administrating these wastes. So MoLG is planning to have a complete wide study on the reality of C&D waste in Palestine.

Study Area

Study area including All governorates of Palestine (West Bank), so a complete survey for all areas of West Bank will be requested, and the consultant should do site visits of C&D generation sites in the following governorates as random samples; Hebron, Bethlehem, Jenin, Nablus, Ramallah-Al Bireh, Jerusalem, and Salfeet.

Study Purpose

The general purpose of this study is (i) to estimate generated quantity and type of the C&D waste in West Bank, Palestine (ii) to know current practices to handle C&D waste, and (iii) to prepare a draft guideline for appropriate C&D waste management in order to clarify the best administrative practices and how to prevent or reduce the environmental and social negative effects to the minimum level.

In addition to those purposes, there are practical targets of the study as mentioned below:

1- Categorize the C&D waste types based on the situation in West Bank, Palestine.
2- Determine and analyze the percentage of these C&D waste observed in West Bank, Palestine.
3- Develop a method to calculate the real produced quantities of C&D wastes in Palestine depending on the results of the site visits which will be done scientific statistical method. This will help in estimating annual C&D waste generation rate.
4- Complete description of all current practices of Collection –Transfer–Disposal of C&D waste with determining the locations of (public & private) transfer stations (if existed) and prepare a map clarifying these locations and the resulting environmental effects.
5- Assessment of the environmental effects of C&D waste.
6- Assessment of the methods applied for the recycling or reuse and usefulness.

Required Duties

The consultant should prepare a technical detailed proposal including the detailed methodology to conduct the study with the action plan which will be followed to implement this study with the time schedule, taking in the consideration that this study will be implemented in two stages, with the following main tasks in each stage.

(1) First phase: data collection and current situation study including the following tasks:

1- Review the previous studies related to C&D waste studies which implemented in the Palestinian areas, with a concentration on the high-value studies, which used the scientific methods.
2- Site visits to cities, municipalities, village councils, in purpose of evaluation of problem size ,data collection of current construction and demolition activities, data collection for real status analysis of C&D waste collection- transfer-disposal, and identification of role of public sector (ministry, governorate, LGU, JSC, etc.) and

private sector in controlling these waste.

3- Site visits for public construction and demolition sites conducted by Ministry of Public Works and Housing, Ministry of Education, and other relevant agencies is also required in order to obtain the data as mentioned above.
4- Compete survey for all C&D waste existing landfills (including private, public, random landfills/dumpsites) with preparation of inventory table and map clarifying the landfills locations and any related information, for example: (not limited to: far from the citizens residences, the formal use of the land for landfills and nearby lands, users number, opening year, landfill size, followed procedures in disposing waste, the owner, environmental precautions, legal status, etc.). Also, it should include the environmental and social impacts study.
5- Carry out detailed observation of C&D waste at least fifteen sites by selecting existing projects list, and transfer sites for clarifying the type and proportion of the danger from it, also specify the type and estimate percentage of each type from the total amount.
6- Prepare a questionnaire to collect data on the management of C&D waste, which includes contracting companies working in the governorates and official bodies that implementing projects under the direct supervision such as the Ministry of Public Works and Housing, the Ministry of Education, the Palestinian Council for Development and Reconstruction, etc., and the questionnaire should be reviewed and discussed with the committee in charge of following up the study prior to distribution, must also be mobilized by conducting direct interviews with related persons, and to be analyzed and compared the results with what has been collected information from local bodies.
7- Review all laws and the Palestinian legislation related to C&D waste in Palestine, and instructions issued by the concerned ministries, and indicate the role of all official regulatory bodies and others according to what is contained in the legislation, and the study of the procedures that are applied and not applied.
8- Prepare a detailed report of the results of the first phase and organize a presentation for the results, in the presence of the technical committee (Task Force or another committee) in charge of the study follow-up.
9- Organize a monthly meeting with the technical committee in charge of the study follow-up in order to update them on progress and obstacles (if existed), in order to facilitate the task of the consultant, and take the necessary corrective actions.

(2) Second phase: The Guideline drafting

This phase will begin after the completion of the first phase, and present the results and approved by the committee in charge, this phase includes the following tasks:

- The drafting of the C&D waste management Guideline, and here we must consider the C&D waste management guideline in neighboring countries, at least the guideline should include the following:

  a. List and definitions of technical terms on C&D Waste.
  b. The relevant authorities assisting the C&D waste, and the role of each party in accordance with the laws and legislation in force.
  c. Best practices in the C&D waste management, priorities, and procedures to be followed during storage – discharging – transportation - disposal, recycling, and reuse of C&D waste.
  d. Technical specifications must be matched in the transfer stations of C&D waste, and procedures to be followed to obtain the necessary licenses from the concerned authorities.
  e. Determine the procedures to be followed in the storage, transport, and disposal of hazardous types of C&D waste.
  f. Identify methods of recycling or reuse and usefulness.
  g. Possibility of integration in the management of C&D waste and municipal solid waste.

- Presentation and discussion of study results at the National Team for the Solid Waste Management and get comments.

Annex II: LGUs Survey Questionnaire

استبانة حول مخلفات البناء والهدم في منطقة الهيئة المحلية

مخلفات البناء والهدم هي المخلفات الناتجة عن أنشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن وألواح الجبس والقرميد إضافة إلى مخلفات تجريف الأراضي من صخور وتراب إلى غير ذلك.

ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم في فلسطين فقد تم إعداد الأسئلة التالية ، حيث ستقوم الجهات المعنية بإدارة النفايات الصلبة باستخدام النتائج المستخلصة من تحليل هذه الاستبانة في صياغة الخطة الإستراتيجية لإدارة النفايات الصلبة ومن ضمنها مخلفات البناء والهدم.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية.................................... **عدد السكان**....................

المحافظة ....

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية بغض النظر عن أماكن التخلص منها، وفي حالة الإجابة نعم، يرجى تحديد الكميات؟

لا [ ]

نعم [ ]

الكمية المنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها، وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة؟

لا [ ]

نعم [ ]

المادة	الكمية (بالطن/يوم او شهر او سنة، يرجى التحديد)

السؤال الثالث: هل يوجد مكب او أكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [ ]، العدد [ ]

لا [ ]

السؤال الرابع: إذا كان هنالك مكب او أكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	
المكب الثاني	

السؤال الخامس: إذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	
المكب الثاني	

السؤال السادس: إذا كان هنالك مكب او أكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا [ ]

نعم [ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن ......، او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية...

السؤال السابع: إذا كان هنالك مكب او أكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [ ]

لا [ ]

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	

	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
	جوانب الطرق	
	مناطق أخرى (الرجاء التحديد)	

السؤال التاسع: في حالة وجود مكب او أكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم [ ]

لا [ ]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (من مخلفات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
القرميد	
الجبص	
الاسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
الكرتون	
الخليط من عدة مواد	
مواد اخرى (الرجاء التحديد)	

السؤال الحادي عشر: هل تقوم الهيئة بترحيل مخلفات البناء والهدم ضمن خدمة جمع وترحيل النفايات الصلبة لديكم الى مكب النفايات الصلبة؟

[ ] نعم، نستقبل يوميا تقريبا، الكمية: ....

[ ] نعم، نستقبل في كثير من الأحيان، الكمية.......................

[ ] نعم، ولكن من الحين الى الآخر، الكمية.......................

[ ] لا نستقبل

[ ] أخرى(الرجاء التحديد)

....

السؤال الثاني عشر: هل لدى الهيئة المحلية أي إجراءات (انظمة، اشتراطات، قوانين) لإدارة مخلفات مواد البناء والهدم؟

نعم [ ]

لا [ ]

إذا كانت الإجابة نعم، الرجاء تحديد الأحكام أو القوانين ذات العلاقة وارفاق نسخة من هذه الإجراءات.

....

السؤال الثالث عشر: إرإبـوـلجـجـبـبـت ٱسؤايٱسـبـب ال، اوحـغـمـذ ان الاحىبَ ٱمىجىيؤرغوبـقيفـمـب يهـ الخلحبحه

....

السؤال الرابع عشر: ما هى نوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص إعادة استخدام مخلفات البناء والهدم

[ ] توجيهات التعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوص مهام وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الخامس عشر: ما هي الأسباب خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[ ] عدم وجود نظام لإدارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[ ] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

السؤال السادس عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ] لا يوجد آثار سلبية

[ ] يوجد لدينا آثار سلبية (الرجاء التوضيح)

....

....

السؤال السابع عشر: هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ]

لا [ ]

إذا كانت الإجابة نعم، الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

....

....

السؤال الثامن عشر: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	
	ه دً الفلسطينيين لمنازلهم القديمة	
	ه دً وتدمير الاحتلال الإسرائيلي لمنازل الفلسطينيين	
	أخرى (الرجاء التحديد)	
	ب ر ي ع ش ل ب ء و إ ب د ة ح أ هي ً اطرق ش ب ي ع ب ل ي ت ح خ ت الاخري	
	ش ب ي ع امرافك ع ب ل م ت)ث ً امدارس و ي غ هب(	
	م خ ب ث ى ا ب ء و اه دً م ه ي ب ث م ح ت أخري ي ر ج ح ج ت هب(	
	خ ف ب ث ي ي ب لم س خ ط ى ن الإس ر ا ي ى ن	

السؤال التاسع عشر: هً يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء، الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم، الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة، الكمية : طن

[ ] لا، حيثىهبن أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

[ ] أخرى (الرجاء التحديد)

....

السؤال العشرون: هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

....

....

السؤال الحادي والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم [ ]

لا [ ]

إذا كانت الإجابة نعم، الرجاء توضيح تفاصيل المسح أو الدراسة، يرجى ارفاقها.

....

....

السؤال الثاني والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص إدارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الإجابة نعم لرجاء التوضيح:

....

....

....

....

Annex III: Survey Data Sheet

<u>جمع البيانات حول مخلفات البناء والهدم في مشاريع بناء وترميم وهدم المباني أثناء الزيارات الميدانية</u>

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم في فلسطين فقد تم إعداد الأسئلة التالية ، حيث ستقوم الجهات المعنية باستخدام النتائج المستخلصة من تحليل هذه الاستبانة في صياغة الخطة الاستراتيجية لادارة مخلفات البناء والهدم.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية..................................... **عدد السكان**.....................

المحافظة ....

اسم المبنى.....................................

مالك المبنى.....................................

مساحة المبنى.....................................

اسم المهندس.....................................

اسم المقاول.....................................

مرحلة البناء الحالية

[ ] الهدم

[ ]الحفر والتسوية

[ ]انشاء المبنى

[ ]التشطيب

السؤال الأول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في المشروع حسب مرحلة التنفيذ، وفي حالة الإجابة نعم، يرجى تحديد الكميات؟

لا [ ]

نعم[ ]

المرحلة	الكمية المنتجة بالطن
الهدم	
الحفر والتسوية	
انشاء المبنى	
التشطيب	

السؤال الثاني: هل تم إعادة تدوير أو استخدام شيء من مخلفات البناء والهدم في المشروع؟

[ ] نعم، قامت شركات البناء بعزل مخلفات البناء والهدم في موقع البناء،

[ ] نعم، قامت جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم

[ ] نعم، قامت شركات خاصة بأعمال سحق الحجارة

[ ] أخرى (الرجاء التحديد)..

[ ] لا لم يكن هنالك أي إعادة تدوير أو استخدام لمخلفات البناء والهدم في المشروع.

السؤال الثالث: إذا كان هنالك تدوير أو إعادة استخدام قد تمت في المشروع، فهل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم الناتجة عن المشروع التي تم إعادة استخدامها، وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة؟

لا [ ]

نعم [ ]

المادة	**الكمية (بالطن/يوم او شهر او سنة، يرجى التحديد)**

السؤال الرابع: هل لديكم علم أين يتم التخلص من مخلفات البناء والهدم الناتجة عن المشروع؟

لا [ ]

نعم [ ]

السؤال الخامس:إذا كان الجواب نعم، هل لديكم علم بالمسافة التي يبعدها المكب الخاص بمخلفات البناء والهدم عن المشروع؟

لا [ ]

نعم [ ]

يرجى تحديد هذه المسافة (................) كم وتكلفة نقل الحمولة الواحدة إلى المكب (.............) شيكل

السؤال السادس:هل المكب الذي تم إرسال مخلفات البناء والهدم إليه خاص بمخلفات البناء والهدم أم ماذا؟

1. نعم، مكب خاص بمخلفات البناء والهدم
2. أحيانا مكب خاص وأحيانا بطريقة عشوائية
3. لا، إنه مكب عشوائي

السؤال السابع: إذا كان التخلص من نفايات البناء والهدم عشوائيا، يرجى تحديد آلية التخلص المستخدمة (في حالة وجود أكثر من مكان، يرجى تحديد النسب)

	المكان	النسبة
	مكبات النفايات الصلبة	
	المناطق المحيطة بموقع البناء	
	المناطق المحيطة بموقع الهدم	
	أراضي تعود ملكيتها للقطاع الخاص	
	أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
	جوانب الطرق	
	مناطق أخرى (الرجاء التحديد)	

السؤال الثامن: أرجو تقدير كميات مخلفات البناء والهدم الناتجة عن مشروعكم حسب نوع المواد؟ مثال: كغم/ اليوم، طن/ اليوم، طن/ الشهر ، طن/ السنة

المواد الناتجة (مخلفات البناء والهدم)	الكمية (الوزن / وحدة الزمن)	النسبة المئوية لكل من مكونات المخلفات من الوزن الكلي لها
الكتل الخرسانية		
الروبة		
الطوب		
المواد الحجرية		
قرميد		
جبص		
اسبست		
التربة والرمال والصخور		
البلاط		
الحديد والمعادن		
البلاستيك		
الخشب		
الزجاج		
كرتون		
خليط من عدة مواد		
مواد اخرى (رجاء التحديد)		

السؤال التاسع: هل لديكم طلبات أو نصائح أو اقتراحات للجهات المعنية بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الإجابة نعم الرجاء التوضيح:

....

....

السؤال العاشر: هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

....

Annex IV: Field Samples for Studying C&D Waste Characterization

Sample #1 C&D waste components (Nablus House Measurements)

Waste component	Component Weight (Kg)	% Component
Concrete	911.9	56.56
Blocks (bricks)	66.6	98.81
Reinforcement Steel	95	6.. 5
Plastic	91.1	5.86
Wood	6.5	9.15
Other materials	1.16	9.69
Paper	1.55	6.1.

Sample #2 C&D waste components (Nablus House Measurements)

Waste component	Component Weight (Kg)	% Component
Concrete	666	88.5
Blocks (bricks)	9. .6	6.8
Reinforcement Steel	6.6	9.6
Plastic	95.16	. .6
Wood	6	6.6
Other materials	6	6.6
paper & cardboard	5.6	9.5

Sample #3 C&D waste components (Nablus House Measurements)

Waste component	Component Weight (Kg)	% Component
Concrete	916.6	5. .1
Blocks (bricks)	95.1	1.6
Reinforcement Steel	6.1	9.5
Plastic	98.8	1.8
Wood	91.8	5.5
Other materials	6	6.6
paper & cardboard	95.1	8..

Sample #4 C&D waste components (C&D Dump Nablus- Albadan Junction)

Waste component	Component Weight (Kg)	% Component
Concrete	916..	%65
Blocks (bricks)	66.6	%96
Stones	81	%1.
Reinforcement Steel	8	%1
Plastic	1.1	%9
Wood	1	%6
Other materials (glass, tiles)	16	%5
Asphalt	.8	%9.
Paper	5	%1

Sample #5 C&D waste components (C&D Dump Nablus- Albadan Junction)

Waste component	Component Weight (Kg)	% Component
Concrete	.1	%95
Blocks (bricks)	68.6	%1.
Stones	.1	%95
Reinforcement Steel	99	%6
Plastic	6.6	%1
Wood	1	%.
Other materials	6.	%9.
Asphalt	66	%96
Paper	. .9	%1

Sample #6 C&D waste components (C&D Al Ezaryeh Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	58	%11
Blocks (bricks)	86	%11
Stones	966	%18
Metal	16	%5
Plastic	1	%6
Wood	95	%.
Gypsum	96	%.
Asphalt	66.6	%1
Tiles	6	%6
Cartoon	96	%6

Sample #7 C&D waste components (C&D Al Ezaryeh Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	89	%66
Blocks (bricks)	59.6	%16
Stones	68	%11
Metal	6	%1
Plastic	1	%6
Wood	95	%5
Gypsum	15	%96
Asphalt	6	%6
Tiles	5	%6
Paper	6	%9

Sample #8 C&D waste components (C&D Al Ezaryeh Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	8.	%65
Blocks (bricks)	85	%68
Stones	6	%6
Metal	95	%5
Plastic	99	%6
Wood	95	%5
Gypsum	6	%6
Asphalt	6	%6
Tiles	1	%.
Paper	5	%6

Sample #9 C&D waste components (C&D Ramallah Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	56	%66
Blocks (bricks)	61	%15
Stones	66	%16
Metal	8	%.
Plastic	8	%.
Wood	96	%.
Gypsum	6	%9
Asphalt	6	%6
Tiles	6	%6
Cartoon	5	%6

Sample #10 C&D waste components (C&D Ramallah Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	915	%65
Blocks (bricks)	968	%61
Stones	66	%96
Metal	9.	%.
Plastic	95	%6
Wood	1	%9
Gypsum	8	%1
Asphalt	91	%.
Tiles	99	%6
Cartoon	5	%1

Sample #11 C&D waste components (C&D Ramallah Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	916	%61
Blocks (bricks)	86	%15
Stones	56	%91
Metal	8	%6
Plastic	96	%6
Wood	95	%6
Gypsum	5	%1
Asphalt	6	%6
Tiles	6	%9
Cartoon	1	%9

Sample #12 C&D waste components (C&D Dura Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	965	%..
Blocks (bricks)	51	%16
Stones	.6	%9.
Metal	96	%6
Plastic	1	%6
Wood	91	%.
Gypsum	99	%.
Asphalt	6	%6
Tiles	8	%6
Cartoon	5.6	**%2**

Sample #13 C&D waste components (C&D Dura Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	88	**%53**
Blocks (bricks)	5.	**%22**
Stones	.1	**%71**
Metal	8	**%5**
Plastic	96	**%2**
Wood	9.	**%2**
Gypsum	6	**%0**
Asphalt	1	**%7**
Tiles	5	**%5**
Paper	8	**%5**

Sample #14 C&D waste components (C&D Dura Dump)

Waste component	Component Weight (Kg)	% Component
Concrete	99.	**%55**
Blocks (bricks)	16	**%21**
Stones	55	**%22**
Metal	96	**%4**
Plastic	6	**%7**
Wood	9.	**%4**
Gypsum	16	**%2**
Asphalt	6	**%0**
Tiles	6	**%0**
Paper	91	**%5**

Annex V: Arabic Version of the draft Bylaw

مسودة نظام إدارة مخلفات البناء والهدم رقم (1) لسنة 2017 صادر بموجب قانون رقم ( ) لسنة 2017

استناداً لأحكام القانون الأساسي لسنة 2003 وتعديلاته، لاسيما المادة (70) منه، واستناداً إلى أحكام قانون الهيئات المحلية رقم (1) لسنة 1997 وتعديلاته وإلى أحكام القانون رقم (7) لسنة 1999 بشأن البيئة وتعديلاته وخصوصا المادة 8 والمادة 10، وإلى أحكام قانون الصحة العامة رقم (20) لسنة 2004، وإلى أحكام القرار بقانون رقم (14) لسنة 2014 بشأن المياه،

وبناءا على تنسيب وزير الحكم المحلي،

وبناءا على مقتضيات المصلحة العامة،

وبناءا على الصلاحيات المخولة لنا قانوناً،

وبناءا على ما أقره مجلس الوزراء في جلسته المنعقدة في مدينة رام الله بتاريخ / / 2017

أصدرنا النظام التالي:

المادة (1) تعريفات

يكون للألفاظ والعبارات التالية الواردة في هذا النظام المعاني المخصصة لها أدناه، ما لم تدل القرينة على خلاف ذلك:

- **القانون:** قانون الهيئات المحلية رقم (1) لسنة 1997.
- **النظام:** نظام إدارة مخلفات البناء والهدم.
- **الوزارة:** وزارة الحكم المحلي.
- **الوزير:** وزير الحكم المحلي.
- **مسئولو الأبنية:** مراقبو الأبنية والمفتشون المعينون من قبل هيئات الحكم المحلي أو المفتشون والمراقبون المعينون من قبل سلطة جودة البيئة.
- **رخصة البناء:** الرخصة الخاصة بالبناء وتصدر عن الجهات المختصة وفقاً للتشريعات ذات الصلة.
- **التصريح بالهدم:** هو الإذن أو التفويض الخطي الذي تمنحه الجهات المختصة لهدم بناء أو هدم بناء مؤقت وفقا للتشريعات ذات الصلة.
- **التصريح:** ويعني الإذن أو التفويض الخطي الذي يصدر عن دائرة تنظيم البناء المختصة بشأن القيام بعمل من الأعمال التي ينظمها هذا النظام.

- **المالك :** الشخص المسجلة باسمه الأرض و/ أو المنشأة والمكلف بدفع الرسوم المستحقة عنها.
- **الوكيل المفوض:** وتعني الشخص المفوض خطياً بالتصرف نيابة عن المالك فيما يخص إدارة مخلفات البناء والهدم وتشمل أي شخص متعاقد معه المالك أو وكيله.
- **التخلص من المخلفات**، وتشمل التالي:
  - رمي أو إلقاء المواد والتخلي عنها أو تحطيمها،
  - أي إجراء آخر وفقاً لما هو محدد في التصريح الصادر عن دائرة التنظيم و/ أو (مسئول الأبنية).
- **موقع التخلص من مخلفات البناء والهدم:** وهو يعني الأرض و/أو المباني و/أو أجزاء المباني المرخصة والمخصصة للتخلص من مواد البناء والهدم أو بقاياها الناشئة عن عمل منشآت معالجة مواد البناء والهدم ، والذي يتم فيه التخلص من المواد عن طريق الطمر أو – والدفن أو بأي وسيلة أخرى.
- **المرفق:** أي نوع من الأراضي أو المباني أو المواقع تستخدم وفق الاستعمال المحدد لها في هذا النظام.
- **إعادة رسوم التأمين:** عملية إعادة رسوم التأمين التي كانت قد دفعت مقابل أعمال التخلص من المخلفات وإعادة تدويرها إلى دافعيها وذلك وفقاً لتقدير وقرار وزارة الحكم المحلي.
- **المواد الخطرة:** أي مادة أو مركب، يشكل خطرا على البيئة بسبب خصائصه الخطرة كالمواد السامة أو المشعة أو البيولوجية أو المتفجرة أو القابلة للاشتعال، بالإضافة لما ورد في اتفاقية بازل من تصنيفات للمواد والنفايات الخطرة وملاحقها.
- **المواد القابلة لإعادة التدوير:** المواد الناتجة عن أعمال البناء والهدم وتتصف على الأقل بأحد الشروط التالية:

أ. المواد العضوية التي مصدرها العمارات السكنية أو التجارية والتي تصلح للاستخدام كأسمدة بعد معالجتها وخلطها مع مواد أخرى، كالخشب، والورق والكرتون.

ب. المواد القابلة للتسويق من خلال المالك أو من خلال المرفق المخصص لإعادة التدوير.

ج. المواد الصالحة للاستخدام في صناعة منتج جديد، أو التي ستصبح صالحة للصناعة من خلال عملية معالجة تتم عليها.

- **مرفق إعادة التدوير:** مرفق خاص بالتدوير ويتصف بالتالي:

أ. لديه تصريح بالعمل ساري المفعول صادر عن جهة رسمية مخولة.

ب. معتمد كمرفق معالجة ذي ملكية عامة أو خاصة يعمل على تحقيق غايات ليس من ضمنها أن يكون مكبا لمخلفات البناء والهدم.

- **المخلفات:** مخلفات البناء والهدم الناشئة عن العمل المهملة أو المهجورة أو المتروكة.
- **رسوم استخدام المرافق الخاصة بمخلفات البناء والهدم:** الرسوم المحددة وفقاً لتعليمات وزارة الحكم المحلي أو وفقاً لتعليمات البلدية المعنية كبدل لاستخدام خدمات المرافق الخاصة بمخلفات البناء والهدم.

- **العمل (البناء أو الهدم):** أعمال البناء والهدم أو تفكيك المباني أو هياكل البناء أو الطرق، أو القيام بأعمال التحسينات على البناء القائم وفقاً لنظام الأبنية.

المادة (2) المرجعية القانونية

ما لم يرد في هذا النظام ما يخالف ذلك فإن المصطلحات والكلمات الواردة في هذا النظام لها ذات المعنى والتعريف والفهم الوارد في قانون البيئة رقم (7) لسنة 1999 وتعديلاته.

المادة (3) السريان

1/3 لا يحق لأحد البدء أو التسبب أو افتعال أو الاستمرار بأي عمل من أعمال الهدم والبناء إلا وفقا لأحكام هذا النظام.

2/3 لا ينطبق هذا النظام على التالي:

أ. أية عملية هدم أو تفكيك للأبنية أو تحسينات تجري على المباني يرى مسئول الأبنية أنها لازمة لأجل حماية الصحة العامة أو السلامة العامة أو لأسباب طارئة.

ب. أية عملية هدم أو تفكيك للأبنية أو تحسينات تجري على المبنى تمت الموافقة عليها خطياً من مسئول المباني.

3/3 لا يعفي هذا النظام أي شخص من واجب الالتزام بمتطلبات نظام الأبنية أو أي نظام آخر من أنظمة البلديات ذات العلاقة، أو من متطلبات وأحكام أي تشريع آخر ذات صلة بهذا العمل.

المادة (4) الأذون أو التصاريح

1/4 يجب على كل شخص أو شركة أو مؤسسة الحصول على إذن من جهة رسمية مخولة قبل البدء بأعمال البناء أو الهدم.

2/4 للحصول على إذن بالهدم يجب على المستدعي أن يرفق بطلبه التالي:

أ. خطة متكاملة لإدارة مخلفات الهدم وفق ما تحدده دائرة التنظيم (مسئول الأبنية)، وتشمل هذه الخطة كل مراحل إدارة مخلفات الهدم من حيث الفصل، وتوفير الحاويات اللازمة، والنقل، وموقع التخلص النهائي لنفايات الهدم، وقد يتطلب ذلك تقرير تقييم الأثر البيئي بناء على تعليمات سلطة جودة البيئة.

ب. وصل دفع رسوم تأمين الالتزام بإدارة مخلفات الهدم وفق ما تحدده الجهات المختصة.

3/4 لا تنطبق أحكام هذا النظام كلياً أو جزئياً على بعض المشاريع، بما في ذلك:

- التجديد البسيط الذي يتم على الشقق أو المنازل العائلية الفردية.
- المباني التي تتراوح مساحتها من 50–70 متر مربع.
- أية إضافات على المباني تتراوح مساحتها من 20–40 متر مربع.

وفي هذه الحالات يتكفل المالك أو المسئول المفوض بإدارة مخلفات البناء أو الهدم بشكل سليم، ويتم تدويرها أو التخلص النهائي منها في الأماكن المحددة وفق هذا القانون وحسب الأصول الواردة في قانون البيئة رقم (7) لسنة 1999.

4/4 من حق المستدعي استرداد جزء من رسوم تأمين إدارة المخلفات المدفوعة من قبله إن هو أثبت من خلال المستندات بنهاية المشروع أنه قد التزم بمتطلبات وأحكام هذا النظام مرفقاً بطلبه الفواتير الصادرة عن مرافق إعادة التدوير ومكبات مخلفات البناء والهدم، و/أو تقديم شهادة صادرة عن مرافق إعادة التدوير ومكبات مخلفات البناء والهدم، مرخص حسب الأصول تبين حجم المواد التي تم إعادة تدويرها وتلك التي تم التخلص منها في مكب مخلفات البناء والهدم، على أن يقدم طلبه ومرفقاته أعلاه خلال مدة أقصاها (90) يوما من تاريخ انتهاء المشروع.

المادة (5) التدوير

1/5 على المستدعي أن يرفق مع طلب الحصول على إذن بالبناء أو بالهدم خطة متكاملة لإدارة مخلفات البناء والهدم تشمل كل مراحل إدارة مخلفات الهدم من حيث الفصل، وتوفير الحاويات اللازمة، والنقل، وموقع التخلص النهائي لنفايات الهدم، وقد يتطلب ذلك تقرير تقييم الأثر البيئي بناء على تعليمات سلطة جودة البيئة. وكذلك خطة متكاملة لأعمال وإجراءات التدوير بشأن المواد القابلة للتدوير موقعة من المالك أو من وكيله مقدمة إلى دائرة التنظيم (مسئول الأبنية).

2/5 المخلفات القابلة للتدوير يجب أن ترحل إلى:

أ. مرفق تدوير المواد

ب. أن يتم التعامل معها وفقاً لخطة إدارة مخلفات البناء والهدم و/أو خطة أعمال وإجراءات تدوير مخلفات البناء والهدم.

3/5 لا يحق لأحد البدء أو الاستمرار أو أن يتسبب أو يسمح بافتعال أو باستمرار أي عمل من أعمال البناء والهدم إلا بعد الحصول على الموافقة اللازمة من دائرة التنظيم على خطة إدارة مخلفات البناء والهدم وخطة أعمال وإجراءات تدوير مخلفات البناء والهدم.

4/5 لا يمنح أي إذن بالبناء أو الهدم على أساس نظام الأبنية إذا لم يرفق بالطلب خطة متكاملة حسب الأصول لإدارة مخلفات البناء والهدم وخطة أعمال وإجراءات تدوير المخلفات معتمدة من دائرة التنظيم المختصة(مسئول الأبنية) وسلطة جودة البيئة.

5/5 مسئولية تحديد موقع التدوير وتحديد المواصفات الفنية له ولمرفقاته من صلاحيات سلطة جودة البيئة

6/5 الحد الأدنى لبعد موقع التدوير عن أقرب منزل هو 500 متر

المادة (6) التخلص من مخلفات البناء والهدم

1/6مسئولية تحديد موقع التخلص من مخلفات البناء والهدم وتحديد المواصفات الفنية له ولمرفقاته من صلاحيات سلطة جودة البيئة

2/6 الحد الأدنى لبعد موقع التخلص من مخلفات البناء والهدم عن أقرب منزل هو 500 متر

3/6 يتم التعامل مع المخلفات القادمة من خارج الوطن

المادة(7) : التعامل مع المخلفات القادمة من خارج الوطن

1/7 يحظر استيراد مخلفات البناء والهدم الخطرة إلى فلسطين.

2/7 يحظر عبور مخلفات البناء والهدم الخطرة عبر الأراضي الفلسطينية أو المياه الإقليمية أو المناطق الاقتصادية الخالصة إلا بتصريح خاص من سلطة جودة البيئة.

3/7 سلطة جودة البيئة هي من يحدد إمكانية أو عدم إمكانية السماح بعبور مخلفات البناء والهدم غير الخطرة إلى فلسطين.

المادة (8) إعداد التقارير وحفظ السجلات والملفات

1/8 لغايات ضمان الالتزام باستحقاقات هذا النظام يجب على المالك أو الوكيل المفوض حفظ الدراسات المسحية والسجلات الخاصة بإدارة مخلفات البناء والهدم، وكذلك الخاصة بأعمال وإجراءات تدويرها، بما في ذلك:

أ. سندات الصرف، وسندات القبض، وشهادات الوزن، وتقارير التفتيش، وشهادات التخليص، وتقارير العينات، وسجلات نقل مخلفات البناء والهدم.

ب. الصور والتسجيلات – في حالة إمكانية ذلك – وتشمل:

1– كيفية استخدام المواد التي جرت عليها أعمال التدوير في الموقع لغايات الطمم.

2– إزالة المواد التي جرت عليها أعمال التدوير من الموقع والتي تم استخدامها في عمليات الطمم أو استخدامها وفق ما تم تحديدها والموافقة عليها وفق خطة إدارة مخلفات البناء والهدم وخطة أعمال وإجراءات تدوير مخلفات البناء والهدم.

ج. حفظ أي سجلات أخرى تحددها دائرة التنظيم (مسئول الأبنية) في موعد تقديم طلب الحصول على الإذن.

2/8 يجب على المالك أو الوكيل المفوض أن يقدم إلى دائرة التنظيم (مسئول الأبنية) الوثائق والمستندات التالية خلال 90 يوماً من تاريخ انتهاء المشروع:

أ. تقديم تقرير متكامل يثبت الالتزام بتنفيذ الأحكام والمتطلبات اللازمة.

ب. السجلات الأصلية الخاصة بالمستندات واجبة الحفظ وفقاً للبند 1/6 أعلاه.

المادة (9) النفايات والمواد الخطرة

1/9 يجب أن يرفق بطلب الحصول على الإذن تقرير متكامل عن المواد الخطرة يتناول الدراسات المسحية، وأعمال إزالة ومعالجة وإدارة والتخلص من المواد الخطرة موقّع من المالك أو من وكيله المعتمد ومقدم حسب الأصول إلى دائرة التنظيم (مسئول الأبنية).

2/9 لا يحق لأحد البدء أو الاستمرار أو التسبب أو السماح بافتعال أو باستمرار أي عمل من أعمال البناء والهدم قبل أن تستلم دائرة التنظيم (مسئول الأبنية) تقرير متكامل عن المواد الخطرة مستوفٍ للشروط والمتطلبات التي تحددها.

3/9 على الرغم من أي نص أو حكم وارد في أنظمة أو تعليمات وزارة الحكم المحلي، فإنه لا يمنح أي إذن بالبناء أو الهدم على أساس نظام الأبنية إذا كان من متطلباته أن يقدم إلى دائرة التنظيم (مسئول الأبنية) تقرير متكامل عن المواد الخطرة مستوفٍ للشروط والمتطلبات التي تحددها طالما أن هذا التقرير لم يقدم بالفعل وحسب الأصول.

4/9 لغايات ضمان الالتزام باستحقاقات ومتطلبات هذا النظام فانه يجب على المالك أو وكيله المعتمد أن يحفظ سجلات خاصة بالإشعارات والإنذارات ذات الصلة بسلامة العمل والمتعلقة بالأعمال المسحية وإزالة ومعالجة وإدارة

المواد والنفايات الخطرة والتخلص منها ويشمل ذلك أي سجلات أخرى تحددها دائرة التنظيم (مسئول الأبنية) وسلطة جودة البيئة في موعد التقدم بطلب للحصول على الإذن.

المادة (10) الإلغاء

يلغى كل ما يتعارض مع أحكام هذا النظام مع مراعاة سياق تراتيبيته التشريعية.

المادة (11) العقوبات

تعتبر مخالفة أحكام هذا النظام مخالفة لأحكام المادة 10 من قانون البيئة المعاقب عليها بنص المادة 61.

المادة (12) تنفيذ أحكام النظام

على جميع الجهات المختصة كل فيما يخصه تنفيذ أحكام هذا النظام، ويعمل به من تاريخ نشره في الجريدة الرسمية.

صدر في مدينة رام الله بتاريخ: / /2017 ميلادية

الموافق: / /1439 هجرية

د. رامي حمد الله

رئيس الوزراء

Annex VI: Glossary of C&D Waste Technical Terms

Aggregates: A granular product obtained by processing natural materials. It may be sand or gravel produced by natural disintegration of rock, or it may be manufactured by passing rock through a series of crushes.

C&DWMP: Construction and demolition waste management plan.

C&D waste: Construction and demolition waste

Commingle: A term referring to the practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed, but presenting challenges for subsequent recovery and diversion.

Construction Waste: Waste generated by construction activities, such as scrap, damaged or spoiled materials, temporary and expendable construction materials, and aids that are not included in the finished project, packaging materials, and waste generated by the workforce.

Demolition Debris: Waste generated from the process of intentional dismantling all or portions of a building, and clearing of buildings and contents destroyed or damaged as a result of natural or anthropogenic hazards. Demolition debris often contains constituents regulated in the US as hazardous waste under RCRA Subtitle C, 40 CFR.

Development Plan: A plan setting out an overall strategy for the proper planning and sustainable development of the area of the development plan indicating the development objectives of the area. It is the responsibility of the planning authority to secure the objectives of the plan.

Diversion: The practice of diverting waste from disposal in a landfill, by means of eliminating or minimizing waste, or reuse of materials.

Hazardous Waste: Waste with properties of hazardous impacts on Man and Environment.

Land clearing Debris: Waste generated from the process of clearing land, including preparing building sites for construction, generally consisting of vegetation, soil, rocks, and constituent matter.

Landfill: Waste disposal facilities where waste is deposited onto or under land

On-site C&D waste management plan: A plan which promotes an integrated approach, whereby the management of construction and demolition waste is given due consideration throughout the duration of a project.

Recovery: The recovery of value from a waste stream either the form of raw materials or energy.

Recycling: A process where materials are collected, processed and remanufactured into new products or use as a raw material substitute. To recycle is defined as the returning of material to a previous stage in a cyclic process or the conversion of wastes into reusable materials.

Residue: Waste which is economically impractical to recover for reuse or to divert from disposal.

Reuse: Reducing the amount of waste disposed of by using a material again in the same form as its prior use without any process.

Salvage: Recovery of components, products, or materials for the purpose of reusing them for the same or similar purposes as their original use.

Selective Demolition Recycling: Removal of recyclable materials from a demolition site in a pre-defined sequence in order to maximize recovery and recycling.

Source Separation: A term referring to the practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity, thus simplifying subsequent processes for recovery of materials and diversion, but presenting challenges for the management of space on the job site, training, and supervision, and inefficiencies associated with hauling.

Waste Audit: Check of waste to determine amount generated, type, sources and potential means to avoid or reduce waste production.

Waste Hierarchy: When considering waste, the following steps should be taken (in this order): prevent, minimize, reuse, recycle, recover and disposal.

Waste Management Plan: A plan devised by the local authority, for their area, to prevent and minimize waste and to encourage and support the recycling and recovery of waste. The plan shall include policies, objectives, and priorities in relation to prevention, minimisation and recovery of waste.

Waste Segregation: Waste should be segregated at source, in the case of C&D waste, on the building site. The contractor should provide and clearly label skips for wood, bricks, metals, hazardous waste, etc.

Annex VII: Minutes of Progress Meetings

1- Minutes of Meetings

Project: The Study on Construction & Demolition Waste in West Bank, Palestine

Project No.: 20161110

Meeting: Discussion of the draft Inception Report

Date: 24/1/2017

Venue: MoLG offices, Ramallah

Attendees:

JICA representatives:

- Dr. Mitsuo Yoshida, Chief advisor
- Eng. Takaaki Murata, Project Coordinator

MoLG representatives:

- Eng. Suleiman Abu Qadah, General Director
- Eng. Nisreen Hammad, Project member
- Eng. Eman Makhloof, Assistant project coordinator

UG representatives:

- Dr. Hafez Shaheen, Backstopping
- Eng. Atef Abu Jaish, Team Leader
- Eng. Nour Atallah, Senior Water & Environmental Engineer
- Eng. Amro Shaheen, Junior Structural Engineer (Data collection)

Agenda:

1. Presentation of the Inception Report
2. Comments
3. Discussion of the Data Collection and Survey
4. Signing of Contract

Minutes:

- General introduction of the attendees from JICA, MoLG, and UG.
- General talk about the importance and scope of the project, the outcome guideline that is needed for the C&D waste at the end of the project and how necessary it is to find a solution for this problem.
- A presentation was made by Dr. Hafez Shaheen (UG) about the inception report delivered as draft covering: objectives, study area, methodology, data collection, questionnaire, the scope of work, our understanding of the project and the expected outcome from the project, in addition to other points.

Actions
• JICA's general approval of the structure of the inception report was stated. • JICA's concerns about the estimation of C&D waste amounts in the methodology was unclear, was stated. UG to consider this • There is no clear definition as well as no control of C&D waste in West Bank. • Clarifications from UG on the methodology: multiple (different) questionnaires (Data collection sheets) for LGUs, generation sites, dumpsites, and contractors; Building experiences, various projects are currently being supervised by UG (road, water and structural) and through the available Bill of Quantities BoQs that can give information on the amount and type of the used construction materials and thus C&D percentage waste can be estimated. • JICA's concern on the amount and accuracy of information at LGUs; licensing data. Other data might be subjective and not very accurate. • UG stated that some other information might be available and useful from the LGUs: permit for demolishes complains on the C&D wastes and records of fines as examples. • Agreement on the importance of a scientific method to be available in addition to the other methodologies for estimating the amounts of C&D waste and amounts and percentages of components of this type of waste. • JICA's concerns were summarized as: (1) more accurate estimation methods as well as clearance of the adopted methodology and (2) evidence that C&D wastes from Israeli settlements are dumped at dumpsites and/or roadsides in the West Bank. • Suggestion of having the survey study deeply on 3 representative governorates at North, Middle and South of West Bank (LGUs, generation sites… etc.) and then obtain the building licenses, the areas of these buildings and the demolition permits in order to have data to implement scientific methods of C&D estimations. • Comments on the inception report were made from JICA and the MoLG and are to be sent officially. • The members of the Task force for the project are MoLG, JSCs for Solid Waste Management, EQA, MoNE, MoPWH, Engineers Association, and Palestinian Contractors Union. • To consider that licensing of the buildings is different from the actually constructed; in rural areas (Area C) many constructed are not licensed while in the cities (municipalities) some of the licensed are not constructed. • In the inception report, page 34, MoLG is the member of National Team and not JICA nor UG. It is to revise that "Presentation and discussion of study results are delivered in the Project seminar and get comments, which will be reported to the National Team for the Solid Waste Management by MoLG". • To make use of data and information found in the Palestinian Central Bureau for statistics PCBS. It is suggested also to consult the Palestinian Contractors Union with respect to the construction industry and C&D waste. • JICA stated that this study is a continuation of the study "National Strategy for Solid Waste Management (NSSWM)" and that C&D waste is at the starting point in

West Bank. The policy on C&D waste is to be included in the strategy.

- MoLG and JICA stated that the study shall include draft bylaws and draft guideline for the management of C&D waste.
- UG is to prepare the minutes of the meeting and mail to MoLG and JICA
- UG is to revise the Inception Report and submit early next week. The comments are to be amended and the work plan to be updated.
- UG is to start the survey and data collection.
- MoLG is to contact the members of the Task force and inform them and will mail the names of the members to UG
- Contract discussion on the first payment. UG asked if it is possible to avoid the bank guarantee while giving two other alternatives. JICA is going to discuss with their office.

2- Minutes of Meetings

Project: The Study on Construction & Demolition Waste in West Bank, Palestine

Project No.: 20161110

Meeting: Discussion of the First Progress Report

Date: 23/2/2017

Venue: MoLG offices, Ramallah

Attendees:

JICA representatives:

- Dr. Mitsuo Yoshida, Chief advisor
- Eng. Shoko Nakatomi, Project Coordinator

MoLG representatives:

- Eng. Suleiman Abu Mufarreh, General Director
- Eng. Nisreen Hammad, Project member
- Eng. Dalia Saa'dah, Assistant of Local Expert Team

UG representatives:

- Dr. Hafez Shaheen, Backstopping
- Eng. Atef Abu Jaish, Team Leader
- Dr. Issam Al-Khatib, C&D Waste Expert

Agenda:

5. Presentation of the First Progress Report
6. Comments on presentation
7. Discussion and consensus on the dates of upcoming meetings

Minutes:

- Introducing Eng Shoko Nakatomi as a project coordinator from JICA team instead of the Ex-project coordinator Eng Takaaki Murata and introducing Dr Issam Al- Khatib who joined the project team of UG as a C&D waste expert.
- General talk from Dr Hafez Shaheen about the C&D waste project components and about those of phase-1 in particular.
- A presentation was made by Eng Atef Abu Jaish (UG) about the "First Progress Report" delivered as soft copy covering the following points: project information, problem statement, objectives, project progress and activities including visits to C&D waste generation sites, interviews with site engineers in different workshops, behaviors observed during site visits, meetings with contractors, Palestinian Contractors Union PCU and Environmental Quality Authority EQA, LGUs questionnaire, quantifying and characterizing of C&D waste, and the planned activities to be performed within phase-1 period.

Actions
❖ JICA's general approval of the structure of the progress report was stated. ❖ JICA's concerns about the methodology of quantification and characterization of C&D wastes were cleared by Dr Issam Al Khatib who explained in details the experiment and procedures to be performed within the next few days. ❖ JICA and MoLG inquired about the extent of commitment of contractors to dispose of C&D waste in dumpsites assigned by LGUs. ❖ UG suggested that establishing enough official dumpsites would minimize the problem of dumping wastes on roadsides and on privately owned lands. ❖ MoLG raised doubts about the expected ratio of questionnaires filled and returned back, from LGUs, for analysis. ❖ UG would not entirely rely on LGUs questionnaires but visiting C&D waste generation sites, dumpsites and LGUs offices would be further sources of important data. ❖ JICA inquired about areas of licensed buildings and of already constructed ones. ❖ UG presented a table from PCBS for the licensed areas of buildings in each governorate in the West Bank through the last 3 years. ❖ UG will prepare a map including official dumpsites designated for C&D waste in the West Bank. ❖ UG stated that meeting with EQA revealed the lack of regulations and laws controlling C&D waste handling and management. ❖ MoLG pointed that UG is expected to make only recommendations with regard to proposed bylaw to the MoLG, and after an internal investigation of MoLG, a draft bylaw on C&D waste management would be proposed to the National Team for Solid Waste Management. ❖ JICA inquired about the possibility of obtaining the total quantities of C&D wastes generated in the West Bank, the percentage of quantities disposed of in official dumpsites and percentage of amounts disposed of randomly in addition to the percentage of amounts recycled. JICA also asked about maps of dumpsites, industrial waste generated, and recycling practices in the West Bank. UG efforts are in progress to achieve all of these issues. ❖ JICA emphasized the necessity to discriminate between C&D waste generated from construction sites and industrial waste generated from stone (marble) cutting factories. They are composed of similar materials, but responsibility for waste management is quite different. The concentration in the study should be about the C&D wastes rather than the industrial wastes. ❖ Consensus was made on the following issues: • phase-1 is not expected to be concluded before the end of next March and accordingly, the work plan needs to be reorganized • the routine monthly meeting will be conducted on March 30th, 2017 • the third monthly meeting will be on May 3rd, 2017.

3- Minutes of Meetings

Project: The Study on Construction & Demolition Waste in West Bank, Palestine

Project No.: 20161110

Meeting: Discussion of the Second Progress Report

Date: Thursday, 30/3/2017

Venue: MoLG offices, Ramallah

Attendees:

JICA representatives:

- Eng. Shoko Nakatomi, Project Coordinator

MoLG representatives:

- Eng. Suleiman Abu Mufarreh, General Director
- Eng. Nisreen Hammad, Project Manager
- Eng. Dalia Saa'dah, Assistant of Expert Team

UG representatives:

- Dr. Hafez Shaheen, Backstopping
- Eng. Atef Abu Jaish, Team Leader
- Dr. Issam Al-Khatib, Waste Management Expert

Agenda:

8. Presentation of the Second Progress Report
9. Comments and Discussions
10. Suggestion of conducting a workshop
11.

Minutes:

Eng Atef Abu Jaish presented the Second Progress Report, that was submitted as soft and hard copies covering: project information, problem statement, objectives, project progress and activities, conducted survey, C&D Waste Characterization, C&D waste composition, C&D Waste Quantification, C&D Waste Estimation in Dumpsites in the West Bank Governorates, and Annual Generation rate of C&D Waste.

Eng Abu Jaish stated that other activities were also conducted but not completed and will be finalized and included in the coming interim report including Environmental Impacts of C&D wastes, Mapping of the main dumpsites in the West Bank governorates, and the current practices of C&D dumping and recycling.

Abu Jaish presented in details the results of the LGU survey and the justification that no additional questionnaires to be applied at LGUs as the data collected are sufficient. He also addressed the suggestion to conduct a workshop during May 2017 and the advantages and outcomes expected from this workshop. The idea of the suggested workshop was further discussed and elaborated.

Dr. Issam Al Khateeb, the waste management expert, presented the C&D waste characterization, composition, and quantification. He also presented the estimation of the quantities accumulated in the dumpsites and the annual generation rate of the C&D Wastes.

Discussions and Actions

- MoLG inquired whether it is necessary to raise awareness about the existing laws controlling C&D handling or to enact new laws. UG will recommend a bylaw for controlling C&D waste handling in phase 2 of this project.
- MoLG inquired about the percentage of stone generated as part of the C&D wastes in general and why this percentage was zero in the house samples of the experiment that was carried out. UG and MoLG agreed that the reuse of some C&D wastes and the stones in the construction works is the reason for the zero wastes of the stones for that particular house.
- How the estimation of the C&D wastes in the dumpsites was calculated; although some buildings were licensed and not built in Bethlehem governorate? UG answered that the important thing is the mechanism of calculation as the licensed and non-licensed ratios are assumed not to differ from one district to another. The mechanism of calculation could be used as an indicator to facilitate computations for other districts. Bethlehem data was applied as an indicator for the other governorates.
- The greater amounts of C&D wastes in Ramallah and Nablus and the difference between the figures per m^2 and per capita are due to the increase in the construction activities in these two governorates compared to the others.
- MoLG inquired about the reasons for the high number of licensed buildings in Ramallah and Nablus compared to other districts. As to the records of PCBS, the licensed m^2 in each of these two are more than the others when compared to the estimated figures per population.
- MoLG inquired about the reason for calculating amounts of C&D in terms of kg/capita at Bethlehem governorate. UG answered that the detailed study carried out earlier in 2014 by Dr. Issam Al-Khatib in Bethlehem was considered as a base for calculating the amounts of the C&D wastes in other governorates.
- The possibility of figuring out the %s of the licensed m^2 per actually constructed was discussed. This can be surveyed as in some LGUs, the owners before starting construction should get a permission to excavate and later they have to apply for water and electricity subscriptions. MoLG recommended considering strengthening the coordination between LGUs and the Property Tax Administration in order to identify those who have constructed after licensing.
- MoLG asked whether to have Bethlehem as the only reference for estimating the generated C&D wastes. UG suggested implementing further C&D wastes projects to estimate the generation and accumulated amounts in other governorates in the future.
- MoLG inquired about the 50kg/m^2 as the average C&D waste generation which was calculated according to PCBS records of licensed areas considering that the built areas are more than the licensed areas in some areas and vice-versa in other areas. There is no information and it is considered that the figure is reasonable as it is based on official figures from PCBS and the conducted experiments.
- MoLG inquired about the 85% as a percentage of the licensed areas that are actually built. UG replied that this figure was concluded from interviews with contractors, site engineers, Engineers'

Association and land/building owners.

- UG recommended performing a comprehensive survey for licensed and not licensed buildings within LGUs service areas as a future study.
- MoLG inquired about the ongoing other project components; environmental impacts of C&D wastes, mapping of dumpsites and current practices of recycling, etc. UG answered that studying this component is not completed but is ongoing and will be included in the interim report.
- MoLG inquired about the 10 questionnaires (9 of which were considered responsive). UG answered that the questioned LGUs were selected as a pilot and not as representative for all LGUs. The sample is of 3 categories: large communities as Ramallah, Al Bireh and Bytonia; medium communities as Birzeit, Beit Leqia, and Deir Abu Masha'al, and small communities as Kober, Surda, and Abu Qash. One of the questionnaires was dropped as non-responsive and not all the questions in the questionnaire were answered by the 9 LGUs. Nevertheless, the results are satisfactory and reasonable; therefore it is not recommended to apply the questionnaire further. The results are to be compared with the results of the other questionnaire that was applied before by MoLG.
- MoLG asked that if the questionnaire is applied to cover more LGUs, do we expect different results? UG said that the answers to the main questions, regarding C&D wastes quantification and characterization, are not expected to differ and that the answers to the other questions are sufficient.
- JICA and MoLG asked about the proposed workshop. UG replied that the workshop is suggested to be conducted during May 2017 and that 100 people are expected to be invited; from which about 70% may respond. The workshop is to invite EQA, LGUs, PCU, EA, NGOs, MoPW, MoNE, etc. It is estimated to cost about 30 USD per person (a total of about 2,000 to 3,000 USD).

5- Minutes of Meetings

Project: The Study on Construction & Demolition Waste in West Bank, Palestine

Project No.: 20161110

Meeting: Progress in the Guidelines and Bylaw

Date: Thursday, June 1st, 2017

Venue: MoLG offices, Ramallah

Attendees:

JICA representatives:

- Eng. Shoko Nakatomi, Project Coordinator

MoLG representatives:

- Eng. Nisreen Hammad, Project Manager

UG representatives:

- Eng. Atef Abu Jaish, Team Leader
- Dr. Issam Al-Khatib, Waste Management Expert
- Eng Amro Shaheen, Data Collector

Agenda:

12. Presentation of the Guidelines
13. Questions and comments
14. Presentation of the Bylaw
15. Questions and comments
16. Next meeting

Minutes:

- Eng. Atef Abu Jaish presented briefly the progress made in the proposed Guidelines and Bylaw, that were submitted as soft and hard copies of slides of PowerPoint covering: project information, a summary of the Guidelines and that of the Bylaw. Bylaw is to be translated into Arabic and reformulated in a proper legal structure.
- Eng. Abu Jaish presented in details the contents of the Guidelines and chapters which are already finalized. He presented the policy and legislations, purposes of Guidelines and the best practices of the C&D handling. He also explained the hierarchy of C&D waste management through prevention, minimization and recycling activities. Eng Abu Jaish talked about hazardous C&D waste, transfer stations and definitions of technical terms on C&D waste.

- Dr. Issam did a presentation about the bylaws proposed for the C&D waste regulations. It included the appropriate definitions concerning the management of C&D waste. More definitions might be added later on if needed. He also presented Application of the proposed Bylaw, Issuance of Demolition Permits, Recycling Issues, Record keeping and Hazardous Materials.
- The following table represents the major questions/comments with the answers provided by UG team:

Question / Comment	Answer
❖ Did you use any references from the neighboring countries?	References for guidelines & bylaws were not found in the close countries (Jordan, Syria, Lebanon… etc.). Thus, the references used were from other countries (in the EU, USA, and Australia).
❖ Did you find any nearby country which has C&D Guidelines?	Israel is the only nearby country that has its own guidelines & bylaws. Whether to be used in this report is to be discussed by the MoLG & JICA.
❖ What do you think the hazardous C&D waste in the demolished houses?	Gypsum is the predominant material considered hazardous to the environment.
❖ How do you think we can consider the threshold figures you have presented?	Threshold figures could be discussed internally in the MoLG in the presence of the international team.
❖ Is what you have presented the draft progress reports?	These are not completed yet and hence need more work.
❖ Who will issue the permit of recycling facilities?	The permit for the recycling facilities is to be issued by EQA and other ministries (to be discussed internally in the MoJG and the International team.
❖ In the definitions add the word "Waste: which means the C&D waste.	It will be added in the next version of Bylaw.

- ➢ At the end of the meeting, JICA & MoLG declared that both the guidelines & the bylaws to be studied within the upcoming days and comments will be sent via E-Mail.
- ➢ Next meeting will be conducted on July 6th, 2017 at 11:00 am.

6- Minutes of Meetings

Project: The Study on Construction & Demolition Waste in West Bank, Palestine

Project No.: 20161110

Meeting: Monthly meeting/Revising Comments on the Draft C&D Waste Bylaw

Date: Thursday, July 6th, 2017

Venue: MoLG offices, Ramallah

Attendees:

MoLG representatives:

- Eng. Nisreen Hammad, Vice Project Manager
- Eng Dalia Saadeh, Project Coordinator

UG representatives:

- Eng. Atef Abu Jaish, Team Leader
- Dr. Issam Al-Khatib, Waste Management Expert
- Eng Amro Shaheen, Construction Engineer

Agenda:

- Revising comments on the draft C&D waste bylaw
- Next coming activities

Minutes:

- Revising the comments made by the MoLG on the Arabic version of the draft C&D waste bylaw. Articles of the draft bylaw were revised one by one taking into account the comments of the MoLG.
- Some of the remarkable comments concerning relevant authorities responsible for licensing, issuing and/or approving permits, fining, etc. are left for more discussion through the National Team of the Strategic Solid Waste Management.
- Revising the comments made by the MoLG on the English version of the draft C&D waste bylaw.

Next coming activities

- Receiving Dr. Yoshida's comments on the draft bylaw and the guidelines (upcoming week).
- Receiving EQA's comments on the draft bylaw and the guidelines (upcoming week).
- Final meeting in the presence of the National Team for the Solid Waste Management to present and discuss the C&D waste study results (during the 3rd week of July).

- Submitting the Final Report of the C&D Waste Study in the West Bank, Palestine (before 31st of July).
- Closing up the project (31st of July).

Note: After closing up the project, the UG consulting team is ready to attend a seminar to discuss the study results obtained from the C&D waste project. This seminar which is suggested to be organized by the MoLG and JICA should be conducted at date and time suitable for all.

Annex VIII: Responsive Data Collecting Forms

مهندس غسان سلامة
مشرف الابنية

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

3000

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية..بلدية سردا ابو قش.. **عدد السكان**..................

المحافظة ......رام الله والبيرة........

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [✓]

نعم [ ]

الكميةالمنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [✓]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)
/	/

1

السؤال الثالث: هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [ ]، العدد [ ]

لا [✓]

السؤال الرابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	ارض خاصة
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	غير واضح
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا [✓]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية..

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [ ]

لا [✓]

2

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	—
	مكبات النفايات الصلبة	—
	المناطق المحيطة لموقع البناء	عن 50 / 70 %
	المناطق المحيطة لموقع الهدم	30 / 50 %
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	20 / 30 %
	أراضي تعود ملكيتها للحكومة	—
	جوانب الطرق	10 / 20 %
	مناطق أخرى (الرجاء التحديد)	—

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [ ]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الاجراءات.

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

....

نرجو اجراءات على المواطنين واصحاب المحلات بغير المخلفات وخلافا

....

لذلك يتم رفع شكوى بهم

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[✓] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[✓] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

4

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[✓] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

مكرهة صحية بيئية ناتجة عن اعمال الحرق وعدم لم المخلفات

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ] أو لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	60 %
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	10 %
	هدم الفلسطينيين لمنازلهم القديمة	—
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	—
	أخرى (الرجاء التحديد)	—
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	20 %
	مشاريع المرافق العامة (مثل المدارس وغيرها)	—
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	10 %
	مخلفات يلقيها المستوطنون الإسرائيليون	—

السؤال الثاني والعشرون : هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[X] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[X] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[X] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[✓] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....................../..................../......................

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

....

توظيف طاقم خاص بهذا الموضوع

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

....

نعم / اجبار الهيئة المحلية بتشكيل طاقم خاص يتعلق بالصحة العامة وسلامة البيئة

....

ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

لا يوجد اي ملفات

شكرا جزيلا لجهودكم

اسامة حامد / بلدية رام الله

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول <u>مخلفات البناء والهدم في محافظة رام الله والبيرة</u>، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية......رام الله............ عدد السكان......50000..

المحافظة ....

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [✓]

نعم [✓] " الجرف " الصخور والتربة

الكمية المنتجة [ ] طن/ يوم ؟ حالياً من الصعب التقدير "ضمن الآليات [illegible] الحجر [illegible]"

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة. " وقد تكون الصخر والأتربة "

لا [✓]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

1

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟ يوجد [illegible] الهيئة [illegible]

نعم[✓]، العدد [ ] [illegible] و كسارات

لا [ ]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[ ]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية..

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [ ]

لا [ ]

2

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	تم توقيفها لاحتمالية مشاكل حالياً
	المناطق المحيطة لموقع البناء	يمنع
	المناطق المحيطة لموقع الهدم	يمنع
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	يمنع
	أراضي تعود ملكيتها للحكومة	يمنع
	جوانب الطرق	حالات خاصة فقط
	مناطق أخرى (الرجاء التحديد)	خارج حدود [illegible]

" إدارة التنمية "

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا[✓]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر ، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر:هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [ ]، اذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.

يوجد مقترحات لإدارة الطمم ومخلفات البناء " خلال مشروع [illegible]

المليار الثالث " [illegible]

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

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السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم " تشريعات قانون البناء والتنظيم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[✓] عدم كفاية المكبات الحالية وبعدها [illegible]

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[ ] توفير أجور النقل

[ ] أخرى (الرجاء التحديد) " ضعف آليات المتابعة والتفتيش وإجراءات [illegible]

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

طمم مباني بالاراضي المواطنين و عشوائية البناء [illegible]

....

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم[✓] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

1- [illegible] المسؤلية [illegible]

2- [illegible] تشويه البيئة والتعدي على اراضي [illegible]

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	✓
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	X
	هدم الفلسطينيين لمنازلهم القديمة	✓
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	X
	أخرى (الرجاء التحديد)	X
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	✓
	مشاريع المرافق العامة (مثل المدارس وغيرها)	✓
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	X
	مخلفات يلقيها المستوطنون الإسرائيليون	X

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[✓] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: — طن —

[ ] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

....

من الممكن التعاون مع القطاع الخاص [illegible] التدوير

ولكن بحاجة لدراسة جدوى

....

بلدية رام الله في حالات هدم مباني قائمة او [illegible] القديمة، تم مطالبة المالك [illegible] البلدية

بالحجارة [illegible] البلدية [illegible]، تركت الأمر [illegible]

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[✓]، <u>إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.</u>

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

وضع نظام يشمل عقوبات [illegible]

....

....

<u>ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.</u>

شكرا جزيلا لجهودكم

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية......مجلس قروي كوبر...... **عدد السكان**......2500......

المحافظة ......رام الله......

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [ ]

نعم [✓]

الكميةالمنتجة [5] طن/ يوم 5

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [✓]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)
[illegible]	5 شهرياً

1

السؤال الخامس عشر:هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، **إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

1) تحديد اماكن للتكبيب

2) العمل على اعادة تدوير المخلفات وتشجيع

الشركات الخاصة [illegible] لتشجيع

[illegible] وعقوبات على [illegible]

[illegible]

السؤال السابع عشر: ما هونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[✓] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

4

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [X]، **إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

1. يتم [illegible] هذا الموضوع [illegible]
[illegible]
[illegible]
[illegible]

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[X] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[ ] توجيهات للتعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[X] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[ ] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[X] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[/]لا يوجد آثار سلبية

[ ] يوجد لدينا آثار سلبية (الرجاء التوضيح)

....

....

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ] أو لا[X]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

....

....

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
✓	بناء سكان المنطقة الفلسطينيين للمنازل	
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	
✓	هدم الفلسطينيين لمنازلهم القديمة	
✓	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	
	أخرى (الرجاء التحديد)	
✓	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	
✓	مشاريع المرافق العامة (مثل المدارس وغيرها)	
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	
	مخلفات يلقيها المستوطنون الإسرائيليون	

السؤال الثاني والعشرون : هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[X] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[X] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[X] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[   ] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

[   ] أخرى (الرجاء التحديد)

[illegible]

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

....

....

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[X]، **إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.**

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

....

....

....

ملاحظة هامة: الرجاء تزوينا بالمرفقات -ان وجدت- فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

شكرا جزيلا لجهودكم

م. رائد حموده

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **<u>مخلفات البناء والهدم في محافظة رام الله والبيرة</u>**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية.... بلدية البيرة .... عدد السكان....8,700 نسمة....

حصل عدد مساكن المعلم المرئي والكثافة ٤ ضريبة الشاغل

المحافظة ......البيرة ورام الله..........

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [X]

نعم [ ]

الكميةالمنتجة [   ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [X]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

1

لا يوجد مكب ولكن يوجد محطة ترحيل بمساحة 4 دونم ولا تستقبل مخلفات بناء، ويتم ترحيل النفايات الى زهرة الفنجان.

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [ ]، العدد [ ]

لا [X]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[ ]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية..

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [ ]

لا [ ]

2

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	**النسبة**
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	
	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
	جوانب الطرق	
	مناطق أخرى (الرجاء التحديد)	

الكسارات
وطرق مفتوحة

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [ ]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	**الكمية (الوزن / وحدة الزمن)**
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [X] أو لا [ ]، إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الاجراءات.

يشترط تقديم تعهد من مقاول خطي بكتاب الكب...

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

....

....

....

....

السؤال السابع عشر: ما هونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

- [ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم
- [ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم
- [✓] توجيهات للتعامل مع مخلفات البناء والهدم
- [ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم
- [ ] أخرى (الرجاء التحديد)

اتفاقيات مع بروتوكولات غير مكتملة...

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

- [✓] عدم وجود نظام لادارة مخلفات البناء والهدم
- [✓] عدم كفاية المكبات الحالية
- [ ] التحكم والإدارة الخاطئة للمكبات الحالية
- [✓] توفير الوقت واختصار المسافات
- [✓] توفير أجور النقل
- [ ] أخرى (الرجاء التحديد)

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

...إغلاقات طرق، تعدي على أراضي مجاورين، [illegible]...

...[illegible] للمكب ... الحالية التجريبية مكب مخلفات [illegible] (بشكل عام)

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [✓] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

...بسبب وجود تعدي على الطرق وعلى الأراضي بشكل [illegible]...

...[illegible]...

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	70 %
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	10 %
	هدم الفلسطينيين لمنازلهم القديمة	2 %
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	0 %
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	2 %
	مشاريع المرافق العامة (مثل المدارس وغيرها)	2 %
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	14 %
	مخلفات يلقيها المستوطنون الإسرائيليون	0 %

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[X] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

- اعادة استخدام المواد كالحجارة - اعادة طحن و استخراج المواد الخام من المخلفات

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[X]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

....

....

....

ملاحظة هامة: الرجاء تزوينا بالمرفقات -ان وجدت- فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

شكرا جزيلا لجهودكم

<u>استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة</u>

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **<u>مخلفات البناء والهدم في محافظة رام الله والبيرة</u>**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية....بلدية بيرزيت.... **عدد السكان**....6150....

المحافظة ....رام الله....

<u>استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية</u>

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [ ]

نعم [✓]

الكميةالمنتجة [1,5] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [ ]

نعم [✓]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)
[illegible] حجارة	1 طن باليوم

1

مواد بلاستيكية	2 طن يوميا
مواد معدنية	3 طن يوميا

السؤال الثالث: هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [✓]، العدد [1]

لا [ ]

السؤال الرابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	15 دونم تقريبا
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	65 طن / شهر
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[ ]

نعم[✓]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن 45-40 طن/شهر او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية........طبرية، الرام..............................

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم[✓]

لا [ ]

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	
	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
	جوانب الطرق	
	مناطق أخرى (الرجاء التحديد)	

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا[✓]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر:هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، <u>**إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الاجراءات.**</u>

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

[illegible]

....

....

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[✓] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[✓] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[✓] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[✓] أخرى (الرجاء التحديد)

[illegible]

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[✓] التحكم والإدارة الخاطئة للمكبات الحالية

[✓] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[✓] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ] لا يوجد آثار سلبية

[ ] يوجد لدينا آثار سلبية (الرجاء التوضيح)

....

....

السؤال العشرون: هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

كانت هناك احتجاجات على استقبال مخلفات خطيرة اجرام

وتم التوقف عن استقبال المخلفات الخطيرة

وكل غير ذلك مخلفات البناء والهدم

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
✓	بناء سكان المنطقة الفلسطينيين للمنازل	%40
✓	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	%20
✓	هدم الفلسطينيين لمنازلهم القديمة	%20
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	%1
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	%6
	مشاريع المرافق العامة (مثل المدارس وغيرها)	%3
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	%10
	مخلفات يلقيها المستوطنون الإسرائيليون	

السؤال الثاني والعشرون: هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[✓] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

أن يتم إعادة استخدام الحجر والباطون بسكينة كـ

حيث يتم إعادة التدوير مثل مصانع الكسارات للباطون

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

لا

....

....

ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

شكرا جزيلا لجهودكم

6

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية....[illegible] دير أبو مشعل.......   عدد السكان......5 آلاف نسمة

المحافظة ...رام الله والبيرة............

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [ ]

نعم [✓]

الكميةالمنتجة [1] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [✓]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

1

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [✓]، العدد [1]

لا [ ]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	4
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	1
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[✓]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية...

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [✓]

لا [ ]

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
✓	مكبات مخصصة لمخلفات البناء والهدم	%75
✓	مكبات النفايات الصلبة	%100
	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
✓	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	%25
	أراضي تعود ملكيتها للحكومة	
✓	جوانب الطرق	%0.5
	مناطق أخرى (الرجاء التحديد)	

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [✓]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر ، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر:هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، **<u>إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.</u>**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

1) [illegible] التطوير

[illegible]

2) [illegible] (التصنيف)

....

السؤال السابع عشر: ما هونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[✓] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[✓] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[✓] التحكم والإدارة الخاطئة للمكبات الحالية

[✓] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

4

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

تلوث البيئة المحيطة للمكب بالاضافة الى تعطيل عملية الزراعة في المنطقة

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [✓] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

عدم الرغبة في تحويل الأرض لتصبح مكبا للنفايات

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	85
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	
	هدم الفلسطينيين لمنازلهم القديمة	
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	25
	مشاريع المرافق العامة (مثل المدارس وغيرها)	15
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	
	مخلفات يلقيها المستوطنون الإسرائيليون	

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[✓] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

(١) إيجاد مواقع لإعادة تجميع الحجارة وإعادة استخدامها مرة أخرى في عملية البناء

(٢) إعادة استخدامها في عملية الردم

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

- يجب أن يكون هناك خطة رسمية يتم بموجبها التعامل مع مخلفات البناء والهدم. تعزيز الشراكة والتعاون بين الحكم المحلي وبين المجالس التي تعمل في البلدة.

ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

شكرا جزيلا لجهودكم

م. غداء عازم
رئيس قسم الترخيص والمباني

<u>استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة</u>

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية.....بلدية سردا.......... **عدد السكان**.....3000 نسمة........

المحافظة.....رام الله والبيرة..............

<u>استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية</u>

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [X] حالياً

نعم [ ]

الكميةالمنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [X]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

1

السؤال الثالث: هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [ ]، العدد [ ]

لا [X]

السؤال الرابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[X] لا يوجد مكب

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية..

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

لا يوجد مكب تابع للهيئة

نعم [ ]

لا [ ]

2

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	
	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
✓	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
✓	جوانب الطرق أحياناً	
	مناطق أخرى (الرجاء التحديد) عكس في الشوارع المراد فتحها	

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[X]

لا [ ]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

هذا السؤال يوجه للجهات المستقبلة للطمم مثل المكبات، الكسارات ...

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمل والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [ ]، اذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الاجراءات.

يتم الزام المالك والمقاول بدفع تأمين مالي لغايات عدم الاعتداء على قطع الاراضي او الكب في اراضي الدولة او بطريقة عشوائية بالاضافة لمراقبة اعمال الحفر من قبل مراقبي البلدية.

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

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السؤال السابع عشر: ما هونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[ ] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[ ] توجيهات للتعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[X] أخرى (الرجاء التحديد)

قوانين بخصوص كل ما ذكر.

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[ ] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[ ] توفير أجور النقل

[X] أخرى (الرجاء التحديد) جميع ما ذكر أعلاه

4

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

الحجارة تقطع الطرق، تلوث بيئي، عبء على البيئة المحلية

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [X] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

مخاطر، شكاوى من الاعتداء على قطعهم او على الشوارع

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

النسبة %	المصدر	
	بناء سكان المنطقة الفلسطينيين للمنازل	✓
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	✓
	هدم الفلسطينيين لمنازلهم القديمة	✓
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	✓
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	✓
	مشاريع المرافق العامة (مثل المدارس وغيرها)	✓
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	
	مخلفات يلقيها المستوطنون الإسرائيليون	

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[X] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

1) اقترح ان يتم خارج حدود المدن بعيدا عن السكان
2) ان تكون باشراف جهة معينة وضمن البيئة او
مناطق الاختصاص
3) ان يتم الاستفادة من مخلفاتها بطريقة توفر على جميع الأطراف ذات العلاقة
المالك , الهيئة ...

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[X]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

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السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

يجب ان يتبنى الحكم المحلي مسؤولية حل اشكالية
الطمم من حدود المدن من خلال تشريع انظمة وقوانين
ناظمة للعملية

ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

شكرا جزيلا لجهودكم

قسم التخطيط
٢/٢/٢٠١٢

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية.....بيرزيت.............. عدد السكان......٥٢٠٠.....

المحافظة ....رام الله والبيرة.......

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [X]

نعم [ ]

الكميةالمنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [X]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [X]، العدد [١] [ ] نفس مكب النفايات

لا [ ]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	٩٥
المكب الثاني	—
المكب الثالث	—

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	2
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[X]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية..

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [X]

لا [ ]

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	
	مكبات النفايات الصلبة	50
	المناطق المحيطة لموقع البناء	
	المناطق المحيطة لموقع الهدم	
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	
	أراضي تعود ملكيتها للحكومة	
	جوانب الطرق	
	مناطق أخرى (الرجاء التحديد) شوارع حي الفتح والشهداء	50

مصادرة على [illegible]

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [X]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر:هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [X]، **إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الاجراءات.**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

وجود سياسة صارمة لتحريم التخلص من مخلفات الحفر

وجود مكبات معينة ومخصصة لطمر مخلفات البناء والهدم

وبحاجة إلى الاستفادة منها لاحقا

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[X] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[X] توجيهات للتعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[X] عدم وجود نظام لادارة مخلفات البناء والهدم

[X] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[X] توفير الوقت واختصار المسافات

[X] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

4

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[X] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ] لا يوجد آثار سلبية

[ ] يوجد لدينا آثار سلبية (الرجاء التوضيح)

....

....

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ] أو لا [X]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

....

....

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	90
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	
	هدم الفلسطينيين لمنازلهم القديمة	
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	10
	مشاريع المرافق العامة (مثل المدارس وغيرها)	
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	
	مخلفات يلقيها المستوطنون الإسرائيليون	

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[X] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

يمكن اعادة استخدام الطمم في أعمال ردم وطمم مكب

النفايات حيث انه بحاجة لكميات في المكب ثم يلزم

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[X]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

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....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

وجود تعليمات وسياسات واضحة بالتعامل معها [illegible]

بالإضافة لتركيبي المخلفات من اصحاب البيوت وشركات [illegible]

النقل

<u>ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.</u>

شكرا جزيلا لجهودكم

6

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول <u>مخلفات البناء والهدم في محافظة رام الله والبيرة</u>، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الإسئلة التالية.

نشكر لكم حسن تعاونكم،،،،

اسم الهيئة المحلية......بلدية بيت لقيا..........　　　　عدد السكان.........9700.........

المحافظة .....رام الله والبيرة.................

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [X]

نعم [ ]

الكميةالمنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [X]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [✓]، العدد [1]

لا [ ]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب		المساحة بالدونم
المكب الاول	مكب القطيعة	15 دونم
المكب الثاني		
المكب الثالث		

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب		الكمية المستقبلة يوميا بالطن
المكب الأول	مكب القطيعة	100 طن
المكب الثاني		
المكب الثالث		

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[✓]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية...

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [✓]

لا [ ]

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	١٥٪
	مكبات النفايات الصلبة	٢٥٪
	المناطق المحيطة لموقع البناء	٢٥٪
	المناطق المحيطة لموقع الهدم	٢٥٪
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	١٥٪
	أراضي تعود ملكيتها للحكومة	٥٪
	جوانب الطرق	٢٥٪
	مناطق أخرى (الرجاء التحديد)	

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [✓]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، **<u>إذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.</u>**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

تفعيل احكام [illegible] داخل [illegible] ....

....

....

....

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[✓] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[✓] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[✓] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[ ] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[✓] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد) (قلة الوعي لدى المواطنين)

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[ ] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح) 1. تعطيل حركة الطرق 2. تشويه المنظر 3. تغيير مجرى الأودية

4. تسكير العبارات الخاصة بتصريف مياه الأمطار

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [✓] أو لا[ ]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

شكاوى شفوية

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	30 %
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	40 %
	هدم الفلسطينيين لمنازلهم القديمة	24 %
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	1 %
	أخرى (الرجاء التحديد)	
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	5 %
	مشاريع المرافق العامة (مثل المدارس وغيرها)	0 %
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	0 %
	مخلفات يلقيها المستوطنون الإسرائيليون	0 %

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[ ] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[ ] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[ ] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[   ] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

[   ] أخرى (الرجاء التحديد)

لا يوجد ....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير واستخدام مخلفات البناء والهدم؟

1. [illegible] تدوير [illegible] واستخدام الطمم [illegible] الكبيرة

....

....

....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[   ] او لا[✓]، <u>إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.</u>

....

....

....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

- تفعيل دور البلديات في ذلك

- اصدار تشريعات وقوانين [illegible] تتماشى مع الواقع

- عمل دراسة تشخيصية للوضع الحالي

<u>**ملاحظة هامة: الرجاء تزوينا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.**</u>

شكرا جزيلا لجهودكم

3000

استبانة حول مخلفات البناء والهدم في محافظة رام الله والبيرة

مخلفات البناء والهدم هي المخلفات الناتجة عن انشطة البناء والترميم والهدم وتشمل الباطون والاسفلت والخشب والمعادن والواح الجبس والقرميد اضافة الى مخلفات تجريف الاراضي من صخور وتراب الى غير ذلك.

تقوم الطالبة أماني جبريل في برنامج ماجستير علوم المياه والبيئة بدراسة حول **مخلفات البناء والهدم في محافظة رام الله والبيرة**، ولمعرفة المعلومات حول الوضع القائم لمخلفات البناء والهدم فقد تم اعداد الاسئلة التالية.

نشكر لكم حسن تعاونكم،،،

اسم الهيئة المحلية.......... عدد السكان..................

المحافظة ......رام الله والبيرة.........

استبانة حول مخلفات البناء والهدم في منطقة خدمة الهيئة المحلية

السؤال الاول: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية، بغض النظر عن أماكن التخلص منها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات.

لا [✓]

نعم [ ]

الكميةالمنتجة [ ] طن/ يوم

السؤال الثاني: هل يمكن تقدير الكميات الإجمالية من مخلفات البناء والهدم في منطقة الهيئة المحلية التي يتم إعادة استخدامها أو تدويرها؟ وفي حالة الإجابة نعم، يرجى تحديد الكميات حسب نوع المادة.

لا [✓]

نعم [ ]

المادة	الكمية (بالطن/يوم اوشهر اوسنة، يرجى التحديد)
/	/

1

السؤال الثالث:هل يوجد مكب او اكثر خاص لمخلفات البناء والهدم تابع للهيئة المحلية؟

نعم [ ]، العدد [ ]

لا [✓]

السؤال الرابع:اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي مساحة كل منها بالدونم تقريبا؟

المكب	المساحة بالدونم
المكب الاول	١ ١/ ارض خاصه
المكب الثاني	
المكب الثالث	

السؤال الخامس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فما هي الكمية الاجمالية التي يتم استقبالها يوميا؟

المكب	الكمية المستقبلة يوميا بالطن
المكب الأول	غير واضح
المكب الثاني	
المكب الثالث	

السؤال السادس: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل تستقبل بعض المخلفات من هيئات محلية اخرى؟

لا[✓]

نعم[ ]، اذا كان الجواب نعم، فما هي الكمية التي يتم استقبالها بالطن .... او على الأقل نسبتها من الكمية المستقبلة كل يوم.

يرجى تحديد أسماء هذه الهيئات المحلية...

السؤال السابع: اذا كان هنالك مكب او اكثر تابع للهيئة المحلية، فهل هي كافية لاستيعاب مخلفات البناء والهدم في المنطقة التابعة للهيئة؟

نعم [ ]

لا [✓]

2

السؤال الثامن: اذا لم يكن هنالك مكب خاص لمخلفات البناء والهدم، او ان المكبات الموجودة غير كافية، فاين يتم التخلص من هذه المخلفات، (في حالة وجود اكثر من مكان، يرجى تحديد النسب) ؟

	المكان	النسبة
	مكبات مخصصة لمخلفات البناء والهدم	—
	مكبات النفايات الصلبة	—
	المناطق المحيطة لموقع البناء	من 50 / 70 %
	المناطق المحيطة لموقع الهدم	30 / 50 %
	أراضي تعود ملكيتها للقطاع الخاص أو أراضي المواطنين	20 / 30 %
	أراضي تعود ملكيتها للحكومة	—
	جوانب الطرق	10 / 20 %
	مناطق أخرى (الرجاء التحديد)	—

السؤال التاسع: في حالة وجود مكب او اكثر خاص بمخلفات البناء والهدم، هل يتم فصل المواد عن بعضها؟

نعم[ ]

لا [✓]

السؤال العاشر: اذا كان جواب السؤال السابق نعم، ما هي كميات مخلفات البناء والهدم التي يستقبلها المكب حسب نوع المواد؟ مثال: كغم/ يوم، طن/يوم، طن/شهر، طن/ سنة

المواد الناتجة (نفايات البناء والهدم)	الكمية (الوزن / وحدة الزمن)
الكتل الخرسانية	
الروبة	
الطوب	
المواد الحجرية	
قرميد	
جبص	
اسبست	
التربة والرمال والصخور	
البلاط	
الحديد والمعادن	
البلاستيك	
الخشب	
الزجاج	
كرتون	
خليط من عدة مواد	
مواد اخرى (رجاء التحديد)	

3

السؤال الخامس عشر: هل لدى الهيئة المحلية أي اجراءات (انظمة، اشتراطات، قوانين) لادارة مخلفات مواد البناء والهدم؟

نعم [ ] أو لا [✓]، **اذا كانت الاجابة نعم الرجاء تحديد الأحكام أو القوانين ذات العلاقة. وارفاق نسخة من هذه الإجراءات.**

....

السؤال السادس عشر: اذا كانت إجابة السؤال السابق لا، او تعتقد ان الاحكام الموجودة غير كافية، فما هي اقتراحاتك

نرجو اجراءات على المواطنين او جهة ما الذي يقوم بالمخالفات و مخالفتها

لذلك يتم رفع شكوى بهم

السؤال السابع عشر: ماهونوع الأحكام، دليل، التشريعات المطلوبة للتعامل مع مخلفات البناء والهدم؟

[ ] اطار قانوني بخصوص تفريغ مخلفات البناء والهدم

[✓] أحكام بخصوص اعادة استخدام مخلفات البناء والهدم

[✓] توجيهات للتعامل مع مخلفات البناء والهدم

[ ] اطار قانوني بخصوصها وحقوق التعامل مع مخلفات البناء والهدم

[ ] أخرى (الرجاء التحديد)

....

السؤال الثامن عشر: ما هي الأسباب الكامنة خلف التخلص الخاطئ من مخلفات البناء والهدم؟

[✓] عدم وجود نظام لادارة مخلفات البناء والهدم

[✓] عدم كفاية المكبات الحالية

[ ] التحكم والإدارة الخاطئة للمكبات الحالية

[ ] توفير الوقت واختصار المسافات

[✓] توفير أجور النقل

[ ] أخرى (الرجاء التحديد)

السؤال التاسع عشر: هل تعتقد ان هنالك آثار سلبية بسبب وجود مخلفات البناء والهدم في منطقة الخدمة لديكم سواء في المكب المخصص او المكبات العشوائية؟

[✓] لم يسبق أن لاحظت آثار سلبية، حيث أن مخلفات البناء والهدم في منطقة الخدمة مكونة من المواد الحجرية والتي هي مواد خاملة وغير خطرة.

[ ]لا يوجد آثار سلبية

[✓] يوجد لدينا آثار سلبية (الرجاء التوضيح)

مكره صحية بسبب انبعاثات عن اعمال الحرق وعدم لجم الحاويات

....

السؤال العشرون : هل قام سكان المنطقة بالاحتجاج على وجود مخلفات البناء والهدم سواء بسبب المكب المخصص او بسبب المكبات العشوائية؟

نعم [ ] أو لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل الشكاوى ضد مخلفات البناء والهدم:

....

....

السؤال الواحد والعشرون: ما هي مصادر مخلفات البناء والهدم في منطقة الخدمة لديكم؟ يرجى تحديد النسبة.

	المصدر	النسبة %
	بناء سكان المنطقة الفلسطينيين للمنازل	60 %
	نقل مخلفات البناء والهدم من خارج منطقة الخدمة الى الأراضي التابعة لمنطقتكم	10 %
	هدم الفلسطينيين لمنازلهم القديمة	—
	هدم وتدمير الاحتلال الاسرائيلي لمنازل الفلسطينيين	—
	أخرى (الرجاء التحديد)	—
	مشاريع انشاء وإعادة تأهيل الطرق ومشاريع البنية التحتية الاخرى	20 %
	مشاريع المرافق العامة (مثل المدارس وغيرها)	—
	مخلفات البناء والهدم من هيئات محلية أخرى (يرجى تحديدها)	10 %
	مخلفات يلقيها المستوطنون الإسرائيليون	—

السؤال الثاني والعشرون :هل يوجد لديكم إعادة تدوير واستخدام لمخلفات البناء والهدم في منطقة الخدمة لديكم؟

[X] نعم، تقوم شركات البناء بعزل مخلفات البناء والهدم في موقع البناء. الكمية: طن

[X] نعم، تقوم جهات غير رسمية مثل ملتقطي المخلفات بعزل المواد القابلة للتدوير من مخلفات البناء والهدم ،الكمية: طن

[X] نعم، تقوم شركات خاصة بأعمال سحق الحجارة ،الكمية: طن

[✓] لا، حيث هناك أنشطة إعادة تدوير واستخدام لمخلفات البناء والهدم بشكل نادر

5

[ ] أخرى (الرجاء التحديد)

....

السؤال الثالث والعشرون :هل لديكم اقتراحات بخصوص إعادة تدوير وإستخدام مخلفات البناء والهدم؟

....
تم طرح [illegible] خلال [illegible] بهذا الموضوع
....
....

السؤال الرابع والعشرون: هل قمتم من قبل بعمل مسح أو دراسة بخصوص مخلفات البناء والهدم في منطقة الخدمة لديكم؟

نعم[ ] او لا[✓]، إذا كانت الاجابة نعم الرجاء توضيح تفاصيل المسح أو الدراسة ، يرجى ارفاقها.

....
....
....

السؤال الخامس والعشرون :هل لديكم طلبات أو نصائح أو اقتراحات موجهة لوزارة الحكم المحلي بخصوص ادارة مخلفات البناء والهدم في فلسطين؟ إذا كانت الاجابة نعم الرجاء التوضيح:

....
نعم / اجبار الجهات المعنية بتشكيل لجان خاصة تتعلق بالحد من [illegible] وسلامة البيئة
....

ملاحظة هامة: الرجاء تزويدنا بالمرفقات –ان وجدت– فيما يخص السؤالين (15)، و (24) ، واضافة اوراق اضافية في حال لم تكف المساحة المخصصة لاي من الاجابات.

لا يوجد اي مرفقات

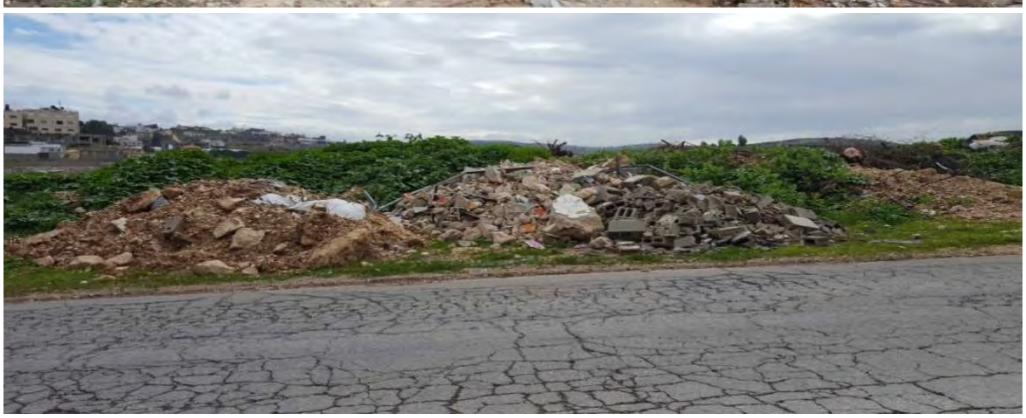
شكرا جزيلا لجهودكم

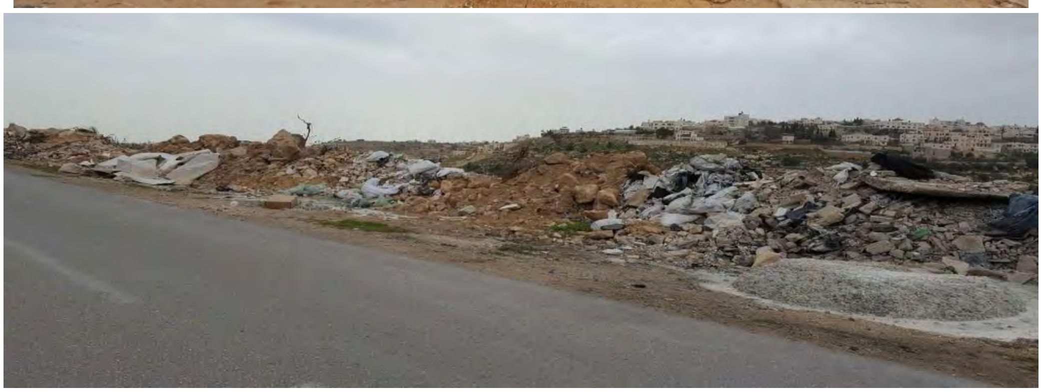
6

Annex IX: Consultancy Team Members

Name	Position
Eng. Atef Abu Jaish	Team Leader/ Environmental Expert
Dr. Issam Al-Khateeb	Waste Management Expert
Fawz Kobari	Road Construction Engineer/Data Collection
Eng. Noor Attahllah	Environmental Engineer
Eng. Amro Shaheen	Structure Engineer
Eng. Ali Abdo	Data Collection
Dr. Hafez Shaheen	Environmental Expert/ Backstopping
Dr. Riyad Awad	Construction Expert

Annex X: Photos





وزارة الحكم المحلي
Ministry of Local Government
State of Palestine

دليل اجراءات
إدارة مخلفات البناء والهدم

اعداد وزارة الحكم المحلي

بدعم و تمويل من الوكالة اليابانية للتعاون الدولي (JICA)

وزارة الحكم المحلي
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دليل اجراءات
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شباط، ٢٠١٨

قائمة المحتويات

1 . مقدمة

1.1 خلفية عامة

يعتبر جمع ونقل مخلفات البناء والهدم والتخلص منها في فلسطين من مسؤولية الجهات التي تنتجها. وتتمثل مسؤولية الهيئات المحلية في مراقبة نظافة مواقع إنتاج هذه المخلفات ومحيطها وتوجيه منتجيها (المقاولين) إلى الأماكن المخصصة مسبقاً للتخلص منها، أما إدارة مخلفات البناء والهدم فإنها مسؤولية منتجها (المقاول) وذلك لضمان أن جميع المخلفات الناتجة أثناء عملية البناء والهدم يتم إزالتها وتخزينها وإعادة تدويرها أو التخلص منها حسب الإجراءات المناسبة الواردة في قانون البيئة الفلسطيني رقم (7) لسنة 1999. ويمكن نقل المسؤولية التي يتحملها منتج نفايات البناء والهدم (المقاول), إلى «مدير المشروع» الذي يتحمل مسؤولية إدارة مخلفات البناء والهدم المنتجة خلال فترة عمر المشروع.

يتم التخلص من مخلفات البناء والهدم في فلسطين بشكل عشوائي إما في مكبات عشوائية أو على جوانب الطرق. لذلك يجب التركيز بشكل رئيسي على تطبيق سياسات وممارسات التقليل وإعادة الإستخدام والتدوير (3Rs) لتشكل المسار الرئيسي لهذه المخلفات. وقد أوصت كافة الهيئات المحلية في الضفة الغربية بإعادة تدوير هذه المخلفات أثناء المسح الذي قامت به وزارة الحكم المحلي والفريق الإستشاري المحلي لمشروع «المساعدة الفنية في إدارة النفايات الصلبة في فلسطين».

لقد قررت وزارة الحكم المحلي ضرورة وضع هذه المشكلة في إطارها الصحيح وإتخاذ عدد من الإجراءات المختلفة كإعداد نظام مخلفات البناء والهدم ودليل الإرشادات لإدارة هذه النفايات و التي تُشكل حجر الأساس لذلك.

يهدف تطوير هذا الدليل الإرشادي بشكل رئيسي إلى تقديم

الإرشـادات لإعـداد وتنفيـذ خطـط إدارة مخلفـات البنـاء والهـدم وتشـجيع تحويـل وجهـة هـذه المخلفـات مـن الدفـن إلى عمليـات إعـادة الإسـتخدام والتدويـر.

2.1 أهداف الدليل

يهدف دليل اجراءات ادارة مخلفات البناء والهدم إلى تحقيق التالي:

- تشـجيع إيجـاد آليـة متكاملـة لإدارة مخلفـات البنـاء والهـدم خـلال فـترة عمـر المـشروع.
- تحديـد الطريقـة التـي يعمـل ويتعـاون بهـا كافـة أصحـاب العلاقـة (الزبائـن، والمقاولـين، والمخططـين، والمصممـين، والمزوديـن والجهـات الحكوميـة المعنيـة) مـن أجـل الحـد مـن كميـات مخلفـات البنـاء والهـدم وتحسـين إدارتهـا.
- توفـير الأُسـس اللازمـة لتحديـد كفايـة وفعاليـة خطـط إدارة مخلفـات البنـاء والهـدم لجميـع أصحـاب العلاقـة.
- توفـير إرشـادات عامـة وخاصـة متعلقـة بإعـداد الخطـط المناسـبة لإدارة مخلفـات البنـاء والهـدم للأنـواع محـددة مـن المشـاريع والتـي يزيـد حجمهـا عـن المحـددات الـواردة لاحقـا.

3.1 سياسات وتشريعات إدارة مخلفات البناء والهدم

تتعـدد الجهـات الحكوميـة المسـؤولة عـن الترخيـص ومنـح الموافقـات لمختلـف العمليـات الخاصـة بـإدارة مخلفـات البنـاء والهـدم إبتـداءً مـن مرحلـة تولدهـا حتـى آخـر مرحلـة وهـي التخلـص النهـائي منهـا، ومـن أهـم هـذه الجهـات:

- وزارة الحكم المحلي
- سلطة جودة البيئة
- وزارة الإقتصاد الوطني

- وزارة الزراعة
- وزارة الصحة
- وزارة الأشغال العامة والإسكان

لا يوجد في فلسطين سياسات أو تشريعات كافية خاصة بإدارة مخلفات البناء والهدم. لذلك قامت شركة إستشارية محلية و بناءاً على طلب من وزارة الحكم المحلي بإعداد مسودة لنظام نفايات البناء والهدم كجزء من مشروع « دراسة مخلفات البناء والهدم في الضفة الغربية، فلسطين» والذي ستتم مراجعته قانونيا وإقراره تحت إشراف وزارة الحكم المحلي.

يسعى هذا الدليل إلى توضيح الإجراءات التفصيلية لكيفية التعامل مع مخلفات البناء والهدم وفق النظام المقترح. من الضروري أن تتوافق متطلبات التصاريح الممنوحة من قبل جهات الاختصاص مع صلاحيات الرخص الصادرة لهذا الغرض لحامليها. فعلى سبيل المثال: على جميع متعهدي النقل و العاملين في نقل مخلفات البناء والهدم من الموقع الحصول على التصاريح اللازمة.

يجب أن تكون عملية تنفيذ التشريعات عملية سهلة لجعل تقديم طلبات الترخيص للأنشطة المتعلقة بممارسات تقليل وإعادة استخدام وتدوير نفايات البناء والهدم من قبل المقاولين عملية مريحة.

4.1 التكامل أو التنسيق في إدارة مخلفات البناء والهدم والنفايات الصلبة البلدية

يمكن التنسيق والتعاون في إدارة نفايات البناء والهدم و إدارة النفايات الصلبة البلدية في بعض الحالات ولغايات محددة منها:

- تحديد الأماكن المُقرّة لمواقع التخلص من مخلفات البناء والهدم.
- إعادة استخدام بعض المواد الناتجة عن مخلفات البناء والهدم مثل الأتربة في طمر النفايات في مكبات النفايات الصحية.

- تصنيـع وتسـويق بعـض أنـواع المـواد المـراد تدويرهـا مثـل الكرتـون والأخشـاب والحديـد والزجـاج والبلاسـتك والمتوفـر في كلا النوعـين مـن النفايـات.

ولكن لا يمكن أن تدار من خلال نظام واحد, للأسباب التالية:

- عمليـات الجمـع والمعالجـة والنقـل والتخلـص النهـائي مختلفة بشـكل كلي لاختـلاف مصـدر النفايـات وطبيعتهـا لـكلا النوعين.
- حاويــات الجمــع ووســائط النقــل المســتعملة في جمــع و نقــل النفايـات البلديـة تختwلـف عـن تلـك المسـتعملة لنفايـات البنـاء والهـدم مـن حيـث طبيعـة المـواد، والتصميـم، والوظيفـة، لـذا فـإن جمـع مخلفـات البنـاء والهـدم في حاويـات النفايـات البلديـة لا يجـوز إطلاقـا، بسـبب إمكانيـة تدمـير هـذه الحاويـات و كذلـك فـإن نقـل مخلفـات البنـاء والهـدم في سـيارات جمـع «ضاغطـات» النفايـات البلديـة محظـور لمـا قـد يسـببه مـن تخريـب لأنظمـة الضغـط والهيدروليـك فيهـا.
- حـدد نظـام مخلفـات البنـاء والهـدم مسـؤولية جمـع ونقـل نفايـات البنــاء والهــدم والتخلــص منهــا عــلى منتجهــا (مالــك البنايــة أو المقــاول).
- حـدد نظـام إدارة النفايـات الصلبـة البلديـة مسـؤولية جمـع ونقـل النفايــات البلديــة والتخلــص منهــا عــلى الهيئــات المحليــة ضمــن حــدود خدماتهــا.

5.1 وظائف ومواصفات محطات الترحيل

- محطــات الترحيــل عبــارة عــن أرض أو بنــاء يتــم فيــه اســتقبال مخلفـات البنـاء والهـدم وتخزينهـا ليتـم لاحقـا نقلهـا إلى منشـآت إعــادة التدويــر أو إلى مكبــات التخلــص النهــائي منهــا.
- يتـم تصميمهـا بطريقـة يتـم فيهـا اسـتقبال المخلفات بواسـطة وسـائل نقـل صغـيرة مـن قبـل المقـاول، مـع عمليـة تصنيـف ومعالجـة في

الموقـع يتبعهـا نقـل المخلفـات إلى موقـع التخلـص النهـائي بشـكل سـهل دون أيـة معيقـات

- يتـم تجهيـز محطـة الترحيـل بالمعـدات الثقيلـة اللازمـة مثـل الجرافـات ومعـدات التحميـل.
- يجـب إقامـة عـدد كافٍ مـن محطـات الترحيـل في كل محافظـة لمنـع التخلـص العشـوائي للمخلفـات في الأراضي الخاصـة وعـلى جوانـب الطـرق.
- الموقـع (الأرض و/أو البنـاء) وتجهيـزات محطـة الترحيـل يتـم امتلاكها أو إسـتئجارها مـن قبـل الهيئـة المحليـة أو مجلـس الخدمات المشـترك. كـما يمكـن أن تكـون مملوكـة أو مسـتأجرة مـن قبـل القطـاع الخـاص وفي جميـع الحـالات يجـب أن يتـم ترخيصهـا مـن قبـل وزارة الحكـم المحـلي مـع الحصـول عـلى موافقـة سـلطة جـودة البيئـة.
- تقع مسؤولية تشغيل وصيانة محطة الترحيل على مالكها.
- الطاقـم المسـؤول عـن تشـغيل محطـة الترحيـل يتـم تعيينـه مـن قبـل الهيئـة المحليـة /مجلـس الخدمـات المشـترك . و في حـال كانـت مملوكـة أو مشـغلة مـن قبـل القطـاع الخـاص فعندهـا تكـون مسـؤولية طاقـم تشـغيل المحطـة عـلى عاتـق القطـاع الخـاص.
- الإسـتثمار في منشـآت المعالجـة داخـل محطـة الترحيـل يمكـن منحهـا للقطـاع الخـاص مـن خـلال تشريعـات الهيئـات المحليـة وهـذه المنشـآت يمكـن في النهايـة تمليكهـا للمسـتثمر نفسـه.
- في المسـتقبل يمكـن أن نشـهد إنشـاء بعـض الـشركات الكبـيرة لمحطـات الترحيـل لتشـغيل وتـولي إدارة هـذه المحطـات.
- يمكـن تلخيـص العمليـات ذات العلاقـة بمحطـات الترحيـل ابتـداءً مـن وقـت جمعهـا مـرورا بتصنيفهـا ومعالجتهـا إلى حـين إتلافهـا في الخطـوات التاليـة:

- يقـوم المقـاول بجمـع مخلفـات البنـاء والهـدم (الحطـام المتناثـر) مـن الموقـع في حاويـات خاصـة يقدمهـا أو يسـتأجرها الناقـل.
- يتـم نقـل الحاويـات إلى محطـة الترحيـل المحـددة مسـبقاً بواسـطة شـاحنات صغـيرة مـن قبـل الناقـل.
- يتـم توزيـن كميـة النفايـات عـلى مدخـل محطـة الترحيـل ويتـم دفـع الرسـوم المحـددة مقابـل اسـتقبال هـذه المخلفات.
- المـواد القابلـة للتدويـر يتـم فصلهـا في حاويـات مناسـبة ويتـم لاحقـا نقلهـا إلى منشـآت المعالجـة داخـل أو خـارج محطـة الترحيـل.
- بعـد الانتهـاء مـن تصنيـف ومعالجـة المخلفـات، يتـم نقـل المـواد المعـاد تدويرهـا إلى الأسـواق، أمـا المـواد غـير القابلـة للتدويـر يتـم نقلهـا في وسـائل نقـل كبـيرة إلى مكـب مخلفـات البنـاء والهـدم خـارج المدينـة، والـذي تملكـه أو تسـتأجره الهيئـة المحليـة / مجلـس الخدمـات المشـترك وفي بعـض الأحيـان القطـاع الخـاص بعـد الحصـول عـلى التراخيـص المطلوبـة. ويكـون تشـغيل وصيانـة المكـب هـي مسـؤولية المالـك / المشـغل
- بعـض محطـات الترحيـل تمتلـك منشـآت المعالجـة الخاصـة بهـا في محيطهـا لذلـك فإنهـا تسـتخدم شـاحنات كبـيرة لنقـل المـواد غـير القابلـة للتدويـر إلى مكبـات التخلـص النهـائي.
- بعـض المقاولـين قـد يقومـون بنقـل المـواد المعـاد تدويرهـا والمخلفـات غـير القابلـة للتدويـر مـن وإلى محطـة الترحيـل بوسـائل النقـل الخاصـة بهـم.

1.6 إجراءات الحصول على التراخيص اللازمة

- يصـدر الترخيـص عـن الهيئـة الحكوميـة ذات العلاقـة وحسـب قوانينهـا الخاصـة.
- يصـدر الترخيـص الخـاص باسـتقبال مخلفـات البنـاء والهـدم عـن

وزارة الحكـم المحـلي أو مــن قبـل الهيئـة المحليـة ضمــن حــدود خدماتهــا.

- في بعـض الحـالات إصـدار التراخيـص يحتـاج إلى موافقـة مسـبقة مـن قبـل سـلطة جـودة البيئـة أو وزارة الاقتصـاد الوطنـي أو كليهـما معـا و هــذا الأمـر يعتمـد عـلى التشريعـات الخاصـة باصـدار التراخيـص والغايـة مـن إصدارهـا.
- الأمثلة التالية توضح كيفية الحصول على التراخيص أو اعتمادها:

- في حالـة المكـب المسـتأجر أو المملـوك بشـكل مؤقـت يتـم إصـداره مـن قبـل وزارة الحكـم المحـلي والموافقـة عليـه مـن قبـل سـلطة جـودة البيئـة.
- بالنسـبة لمحطـات الترحيـل يتـم إصـداره مـن وزارة الحكـم المحـلي والموافقـة مـن قبـل سـلطة جـودة البيئـة.
- الشـاحنات المسـتخدمة في نقـل نفايـات الهـدم و البنـاء إلى محطـات الترحيـل والمكبـات الخاصـة، يتـم إصـدار الترخيـص مـن وزارة النقـل والمواصـلات وموافقـة الهيئـة المحليـة في تلـك المنطقـة.
- لمنشـآت المعالجـة داخـل محطـات الترحيـل يَصـدر الترخيـص عـن وزارة الحكـم المحـلي بعـد موافقـة وزارة الإقتصـاد الوطنـي.
- لمنشـآت المعالجـة خـارج محطـات الترحيـل يصـدر الترخيـص عـن وزارة الإقتصـاد الوطنـي بعـد موافقــة الهيئــة المحليــة في تلــك المنطقــة.
- لتشـغيل كسـارة متحركـة يصـدر الترخيـص عـن وزارة الاقتصـاد الوطنـي في تلـك المنطقـة بعـد موافقـة كل مـن وزارة الحكـم المحـلي وسـلطة جـودة البيئـة.

في جميـع الأحـوال يُقـدَم طلـب الترخيـص إلى وزارة الحكـم المحـلي والتـي

تقـوم بدورهـا بإجـراء الإتصـالات اللازمـة مـع الجهـات الحكوميـة ذات العلاقـة لدراسـة الطلـب، و إتخـاذ القـرار بتحديـد أي مـن المؤسسـات الحكوميـة لهـا الحـق في إصـدار الموافقـات عـلى التراخيـص.

7.1 الأنواع الخطرة من مخلفات البناء والهدم

- المخلفـات الخطـرة يتـم التخلـص منهـا بموجـب تشريعـات وإجـراءات إتـلاف خاصـة، ويجـب التعامـل معهـا بموجـب قانـون البيئـة رقـم (7) لسـنة 1999.
- بعـض مشـاريع البنـاء والهـدم يمكـن أن ينتـج عنهـا مخلفـات خطـرة تحتـاج إلى معاملـة ومعالجـة خاصـة.
- يتكـرر وجـود المخلفـات الخطـرة في مشـاريع الهـدم وقـد تحتـوي عـلى الأسبسـت ومـواد الطـلاء التـي تحتـوي عـلى الرصـاص والأتربـة الملوثـة والمـواد اللاصقـة والجـدران الاصطناعيـة والمـواد المضافـة إلى منتجـات الإسـمنت.
- التعامـل مـع مخلفـات البنـاء والهـدم الخطـرة الناتجـة خـلال عمليـة المعالجـة هـي مسـؤولية المقـاول و الـذي يجـب عليـه القيـام بمـا يـلي:
  - جمع المخلفات الخطرة بشكل منفصل حسب الأصول.
  - وضع النفايات المجموعة في حاويات خاصة مغطاة.
  - تخزين هذه الحاويات في منطقة معزولة في موقع المشروع.
  - نقـل هـذه المخلفـات بطريقـة آمنـة إلى مكـب نفايـات موافـق عليـه بعـد الحصـول عـلى الموافقـة المطلوبـة مـن مشـغل مكـب النفايـات الخـاص والـذي تقـع عـلى عاتقـه مسـؤولية التخلـص مـن هـذه النفايـات بطريقـة مناسـبة تمنـع التسـبب بأيـة مشـاكل عـلى الصحـة العامـة أو أيـة آثـار سـلبية عـلى البيئـة المحيطـة.

8.1 خطة إدارة نفايات البناء والهدم ومحدداتها

- خطة إدارة مخلفات البناء والهدم هي خطة هامة لمساعدة المقاولين وأصحاب الأبنية لتحقيق الشروط والمتطلبات البيئية للتقليل من المخلفات الناتجة عن مشاريعهم.
- يجب التعامل مع مواضيع إدارة مخلفات البناء والهدم في مرحلة مبكرة من المشروع لتوفير الوقت الأمثل لجوانب التقليل والتدوير.
- حجم المشروع هو الذي يحدد الحاجة لإعداد خطة لإدارة مخلفات البناء والهدم عادةً، ففي الدول التي تدير مخلفات البناء والهدم بشكل مناسب يكون إعداد خطة لإدارة نفايات المشروع خلال فترة محددة من الوقت.

وتبين المحددات التالية أمثلة على وجوب إعداد خطة لإدارة مخلفات البناء والهدم. ويجب فحص هذه المحددات بعناية من قبل الهيئة المحلية، وإتحاد المقاولين، ونقابة المهندسين .... الخ و ذلك ليتم تطويرها وتطبيقها في فلسطين في نهاية المطاف وتشمل:

- المشاريع التي تشمل 10 بيوت سكنية جديدة وأكثر.
- المشاريع التي تشمل مشاريع تطويرية جديدة ، كالمنشآت التعليمية، والصحية، والمؤسساتية والمرافق العامة والتي تزيد مساحتها الكلية عن 1250 متر مربع.
- مشاريع الهدم والترميم التي ينتج عنها أكثر من 100 متر مكعب من المخلفات.
- أية مشاريع أُخرى ينتج عنها أكثر من 500 متر مكعب من المخلفات.

- بالنسبة للمشاريع التي لا تصل إلى قيم المحددات الواردة أعلاه، فإن إدارة مخلفات البناء والهدم يجب أن تتم بشكل كامل من قبل صاحب المشروع أو المقاول وبالتنسيق مع مسؤول الأبنية في الهيئة المحلية دون تحضير خطة إدارة مخلفات البناء والهدم، في هذه الحالة يجب نقل المخلفات إلى محطة إعادة تدوير معتمدة أو إلى مكب خاص معتمد.
- خطة إدارة مخلفات البناء والهدم من الممكن التغاضي عنها أو تأجيلها في بعض الظروف في حال إرتأت الهيئة المحلية أن الخطة غير قابلة للتطبيق لما تُسببه من إزعاج، أو تضييق المكان، أو الضجيج، أو لأسباب فنية ...، الخ. من الممكن أن تتم عملية التأجيل هذه عادةً في المرحلة التحضيرية للمشروع وفي هذه الحالة فإن إدارة مخلفات البناء والهدم يجب أن تتم بشكل كامل من قبل صاحب المشروع أو المقاول دون الإشارة إلى خطة إدارة النفايات لحين إنتهاء سبب تأجيل إعداد خطة إدارة نفايات الهدم و البناء، و في هذه الحالة على صاحب المشروع أو المقاول نقل مخلفات البناء والهدم المنتجة إلى منشآت تدوير معتمدة أو إتلافها في مكب نفايات معتمد تحت إشراف مسؤول الأبنية في الهيئة المحلية.

2. أفضل الممارسات في إدارة مخلفات البناء والهدم

1.2 تطبيق أفضل الممارسات في إدارة مخلفات البناء والهدم

أولويات إدارة مخلفات البناء والهدم

إن إدارة مخلفات البناء والهدم يجب أن تأخذ بعين الإعتبار الأولويات وفق ترتيبها التالي:

- الأولوية الأُولى يجب أن تعطى ل» الحد والتقليل من إنتاج هذه المخلفات للحد الادنى.
- الأولوية الثانية هي لإعادة الاستخدام أو التدوير.
- التخلص النهائي من مخلفات البناء و الهدم يجب اعتباره خياراً أخيراً لإدارة هذه المخلفات.

<u>الحد والتقليل من مخلفات البناء والهدم</u>

- يمكن تلخيص الفوائد الرئيسية لتقليل المخلفات في موقع المشروع فيما يلي:
  - التقليل من تكلفة المشروع.
  - الاستجابة للمتطلبات القانونية.
  - التقليل من الآثار البيئية.
  - الاستجابة للمتطلبات التعاقدية.
  - تساعد في تجنب المضايقات الناتجة عن اصدار أية تعليمات الزامية جديدة.

التقليل من المخلفات يمكن تحقيقه من خلال الكثير من الإجراءات الإحترازية مثل:

- الحد من الطلب الزائد على مواد البناء.
- إختيار مواد البناء ذات الانتاجية القليلة للنفايات.
- التقليل من خطر تَعرُض مواد البناء في الموقع لأية تلف من

خـلال توفـير طـرق التخزيـن المناسـبة.

- تَجنُـب شراء مـواد البنـاء ذات النوعيـة المتدنيـة حتـى لـو كانـت بأسـعار زهيـدة.
- شراء مواد البناء ذات التغليف القليل.

إعادة استخدام مخلفات البناء والهدم

- المخلفـات التـي يتـم إنتاجهـا في موقـع المـشروع يجـب أن يتـم إعـادة إسـتخدامها في الموقـع، و أن لا يتـم إرسـالها إلى مكـب النفايـات.
- المخلفـات التـي يتـم إزالتهـا مـن البنايـات التـي يتـم هدمهـا أو إعـادة تأهيلهـا يمكـن منحهـا لأماكـن متخصصـة لبيـع مـواد البنـاء ، مـما يتيـح الفرصـة للأفـراد الحصـول عليهـا بسـعر منخفـض.
- بعـض المـواد يمكـن إعـادة اسـتخدامها في مشـاريع مسـتقبلية مثـل الأتربـة، والرمـال، والطوب...الـخ.

إعادة تدوير مخلفات البناء والهدم

- إعـادة تدويـر هـذا النـوع مـن المخلفـات يُعتـبر أفضـل بديـل للتخلص مـن مخلفـات البنـاء والهـدم في مكبـات خاصة.
- إعـادة تدويـر مخلفـات البنـاء والهـدم ذو أهميـة كبـيرة في خفـض الاعتـماد عـلى المـوارد الطبيعيـة و المحـدودة.
- مـن الأمثلـة عـلى بعـض المـواد و التـي تحتـوي عـلى مكونـات قابلـة للتدويـر ويمكـن إعـادة إسـتخدامها في الموقـع:

1. الرمال والأتربة
2. مواد الدعم والتقوية
3. الطوب
4. منتجات الأخشاب
5. البلاستك

6. الحصى
7. الباطون
8. التعبيد
9. مواد العزل

- إنه الوقت المناسب للهيئات المحلية في فلسطين لتنفيذ خطة إدارة مخلفات البناء والهدم وتطبيق إعادة التدوير من خلال التطبيق الفعلي لنظام مخلفات البناء والهدم.

تخزين مخلفات البناء والهدم

- بقايا مخلفات البناء والهدم بعد إعادة الإستخدام والتدوير يجب تخزينها بطريقة مناسبة لحين التخلص النهائي منها.
- عدم إقامة أماكن التخزين لمخلفات البناء والهدم في المزارع أو الأراضي الزراعية ذات الجودة العالية.
- أماكن التخزين يجب أن تكون بعيدة عن مصادر مياه الشرب أو مياه الري مسافة 500 متر كحد أدنى.
- أماكن التخزين يجب أن تكون بعيدة عن الأماكن السكنية مسافة 500 متر كحد أدنى.
- النظام الفعّال للرقابة يجب أن يُؤسس في منطقة التخزين لتفعيل الفصل بين مختلف مكونات المخلفات (إن وجدت).
- في حال إمتلاء منطقة التخزين لحدها الأقصى، يجب المباشرة بعملية إعادة تأهيل أو إختيار منطقة أُخرى بديلة.

نقل مخلفات البناء والهدم

- وسائل النقل التي تنقل المخلفات من موقع إنتاجها يجب تغطيتها بمواد مناسبة لمنع أي تلوث بيئي نتيجة الحمولات غير المغطاة من المخلفات.

- يجب أن لا تحمل الشاحنات زيادة عن حمولتها المسموحة.
- على السائقين تنظيف عجلات شاحناتهم من الأوساخ والعوالق أثناء عملية النقل.
- لا يتم تشغيل الشاحنات إذا لم تحمل تصريح صادر عن الجهة المختصة، و الذي يبين حمولة هذه الشاحنات ومسارها.

التخلص من مخلفات البناء والهدم

- يتم التخلص من مخلفات البناء والهدم يتم في مكبات خاصة تمتلكها أو تديرها الهيئات المحلية أو في المكبات التي تحمل تصريحا من المؤسسات ذات العلاقة لإستقبال هذا النوع من النفايات.
- المكبات المخصصة للتخلص من مخلفات البناء والهدم يجب أن تكون مخصصة فقط لمثل هذا النوع من المخلفات.
- يُمنَع التخلص النهائي من المخلفات في الأماكن التي تُعتبر ملكية خاصة.
- يُمنَع التخلص من المخلفات على جوانب الطرقات.

الخيار الأفضل لإدارة هذا النوع من النفايات هو إعادة تدويرها، بينما يبقى التخلص النهائي منها في المكبات الخاصة الخيار الأخير.

2.2 توصيات ترويج ممارسات (3Rs) (التقليل وإعادة الاستخدام والتدوير)

يشار إلى مجموعة السياسات أو الممارسات الرامية لخفض كميات نفايات البناء والهدم التي من المتوقع تولدها من اي نشاط قبل إنتاجها، واذا أنتجت أن يتم إعادة إستخدام ما يمكن إستخدامه منها دون إجراء أي عمليات إضافية عليها والتدوير الذي يستوجب إجراء

عمليات إضافية على تلك النفايات لتصبح قابلة للإستخدام قبل عملية التخلص النهائي منها بسياسات او ممارسات (3Rs) يتم إتباع طرق ووسائل مختلفة للترويج والوصول إلى تطبيق ممارسات (3Rs)، وبالتالي تحويل واستبعاد مخلفات البناء والهدم بعيداً عن مدافن أو مكبات النفايات الصحية. وتُعتبَر التوصيات الخمس التالية الأكثر فعالية للوصول إلى تحقيق 3Rs بدون إهمال أهمية ممارسة بقية التوصيات الواردة أدناه:

رفع مستوى الوعي

رفع مستوى الوعي مطلوب لترويج التعليم البيئي و المصمم لإيجاد قناعة لدى المواطنين والمجتمع بضرورة وأهمية ممارسة (3Rs). كما تُعتبر أنشطة رفع مستوى الوعي لدى المصممين، والمقاولين، والمقاولين الفرعيين، وأصحاب الأبنية ضروياً للترويج لممارسات التقليل وإعادة الاستخدام والتدوير(3Rs).

الحوافز

تُعتبر الحوافز عاملاً هاماً لترويج ممارسات (3Rs)، و التي تُصنف إلى حوافز اقتصادية، واجتماعية، كما يمكن أن يكون لهذه الحوافز فوائد كبيرة في هذا المجال في حال تم دمجها مع وضع المجالات ذات الأولوية لـ (3Rs) والمرتبطة بالمهن ذات العلاقة.

الشراكة

يُطلب من جميع الشركاء وأصحاب العلاقة بما فيهم وزارة الحكم المحلي والهيئات المحلية والقطاع الخاص والمجتمع المدني والمنظمات غير الحكومية بذل الجهود المطلوبة وبمبادرات من قبلهم للعمل على تطبيق استراتيجيات (3Rs).

مشاركة و تبادل المعلومات المتوفرة

يجب على جميع أصحاب العلاقة المشاركة في المعلومات التي تؤدي

إلى النشـاطات ذات العلاقـة بـ (3Rs). للمشـاركة في المعلومـات أهميـة كبـيرة في إغنـاء الفهـم المشـترك والتعـاون بـين أصحـاب العلاقـة المختلفـين. وهنـا يجـدر الذكـر أن مشـاركة المعلومـات بـين الـدول المصـدرة والـدول المسـتوردة هـو إجـراء مطلـوب لتحقيـق نشـاطات التدويـر الخاصـة.

التطوير التقني

تطويـر التقنيـات النظيفـة في مرحلـة الإنتـاج كـما في مرحلـة التصميـم يُعتبر عامـلاً هامـاً لتحقيـق ممارسـات (3Rs) عـلى المسـتوى الحـالي والمسـتقبلي. و تُشـكل عمليـة توفـير المعلومـات العلميـة والتكنولوجيـة للجمهـور، وكذلـك التعـاون بـين الهيئـات المحليـة ومراكـز البحـث والجامعـات عوامـل أساسـية وهامـة لتحقيـق ممارسـات (3Rs).

العوامل الاقتصادية

العوامـل الاقتصاديـة التـي تسـاهم في تحقيـق ممارسـات (3Rs) تشـمل التـالي:

- توفير تكلفة نقل المخلفات إلى المكبات الخاصة.
- توفير رسوم التخلص من المخلفات في المكبات الخاصة.
- توفير تكلفة شراء مواد بناء أولية.
- الإيرادات المتوقعة من بيع المواد المعاد تدويرها.

التوصيات التالية هي أيضا هامة لتحقيق ممارسات (3Rs)

- إقامـة مراكـز رئيسـة لإعـادة الإسـتخدام في مراكـز المـدن، والتـي مـن المتوقـع أن تُديـر المـواد ذات الأحجـام الكبـيرة، والتـي تُوفـر بشـكل أولي تجهيـزات مثـل الأبـواب، والنوافـذ، والخزائـن، والأنابيـب والمعـادن، والأرضيـات والأجسـام الصلبـة والطـوب والسـياج.
- إقامـة مركـز معلومـات في كل محافظـة ضمـن حـدود منطقـة عمـل الهيئـة المحليـة الرئيسـية، و ذلـك لتوفـير قاعـدة بيانـات بالمعلومـات حـول كميـات المخلفـات الموجـودة و ذلـك لتمكـين الجهـات التـي

تحتاجها من إعادة إستخدامها في تسوية الطرق أو التربة لحدائق المنازل ...،الخ.

- وضع المؤشرات أو التشريعات التي تحدد معايير إعادة تدوير مخلفات البناء و الهدم لإستخدامها كبديل للمواد الأولية.
- زيادة عدد منشآت إعادة تدوير هذه المخلفات في المنطقة.
- استخدام معدات حديثة لإعادة التدوير.
- تطوير سياسات صارمة لمراقبة ومنع التخلص غير القانوني من مخلفات البناء والهدم.
- تشجيع إعادة التدوير من خلال توفير الإعفاء الضريبي، أو توفير الدعم من الحكومة أو الهيئات المحلية.
- تشجيع إعادة التدوير من خلال فرض عقوبات و مخالفات.
- فتح أسواق للمواد المعاد تدويرها في المدن الرئيسة.
- وضع مواصفات لنوعية المواد المعاد تدويرها.
- يجب أن يُؤخذ بعين الإعتبار عند إختيار مواقع منشآت تدوير مخلفات الهدم و البناء، سهولة الوصول، وتلوث الهواء ومتطلبات السلامة العامة.
- إستخدام كسارات محمولة (متحركة) داخل الموقع.
- إستخدام وسائل التواصل الإجتماعي للتشجيع على إستخدام المواد المعاد تدويرها.
- توعية المقاولين والمقاولين الفرعيين على نوعية المواد التي يمكن تدويرها وإستخدامها في موقع البناء.
- تطبيق التشريعات الخاصة بالتخلص من مخلفات البناء كما هو الحال بالنسبة للنفايات الصلبة البلدية.
- التفعيل الأفضل من قبل الهيئات المحلية بدمج هذه الإجراءات

مـع تشريعـات صارمـة سـيقود إلى مخرجـات أفضـل في إدارة مخلفـات البنـاء والهـدم وبالتـالي ترويـج ممارسـات (3Rs).

- وضـع مواصفـات لإسـتخدام منتجـات إعـادة التدويـر في المبـاني الجديـدة.
- إختبـار ومنـح شـهادة لمـواد الهـدم المعـاد تدويرهـا لضـمان تطبيـق مواصفـات إعـادة التدويـر بفعاليـة أعـلى.
- إسـتبدال مـواد الباطـون والطـوب المكسـور في الموقـع كمـواد تعبئـة بـدل شراء مـواد جديـدة.

3.2 ممارسات إعادة التدوير المطبقة في فلسطين

حاليـا لا يوجـد أرقـام دقيقـة لمـدى وحجـم عمليـات التدويـر لمخلفـات البنـاء والهـدم في الضفـة الغربيـة. لكـن بعـض المـواد يتـم إعادة إسـتخدامها / تدويرهـا بدرجـة محـدودة، و تشـمل هـذه المـواد:

- ناتـج عمليـات الحفـر: يُعـاد اسـتخدامها في إعـادة إسـتصلاح الأراضي الزراعيـة، وتسـوية الأراضي، وكذلـك في البنيـة التحتيـة للطـرق.
- مخلفـات هـدم الطـرق: يُعـاد إسـتخدامها لتغطيـة الطـرق غـير المعبـدة أمـام المنـازل.
- مخلفـات الباطـون: يُعـاد إسـتخدامها كمـواد تعبئـة للمناطـق ذات المسـتوى المنخفـض.
- الطوب: يُعاد إستخدامه مباشرة في موقع البناء.
- الأخشـاب: يُعـاد إسـتخدامها كمصـدر للتدفئـة وكوقـود لوسـائل التدفئـة.
- مواد الحديد: يُصدّر إلى الدول الصناعية ليُعاد تدويره هناك.
- الأتربـة: يعـاد إسـتخدامها كـمادة لطمـر النفايـات في مكبـات النفايـات الصحيـة.

- الخليط من الحجارة وقطع الباطون : يتم تكسيره وإستخدامه في أعمال البناء في الموقع.

إن الأنشطة المحددة لإعادة الإستخدام والتدوير لمخلفات البناء والهدم يعود إلى الوعي المحدود فيما يتعلق بفوائد الأنشطة الخاصة ب (3Rs)، ولغياب التشريعات الصارمة التي تتحكم في التخلص القانوني وغير القانوني من هذه المخلفات. ومن أجل الوصول إلى ممارسة (3Rs) في الضفة الغربية فمن المهم جداً إعتماد التوصيات الواردة أعلاه.

على عكس الوضع في قطاع غزة حيث يتم تطبيق ممارسات (3Rs) منذ وقت طويل نتيجة الأوضاع الإقتصادية. حيث أن نشاطات (3Rs) إرتفعت خلال السنوات القليلة الماضية بعد الإجتياحات المتكررة للجيش الإسرائيلي في 2008-2009، 2012، 2014 والتي تركت عشرات المراكز الحكومية وآلاف المنازل مهدمة جزئياً أو كلياً. إن الوضع في القطاع قد إزداد خطورةً نتيجة الحصار المفروض على قطاع غزة من الجانب الإسرائيلي والحكومة المصرية، و نتيجة لكل ذلك ، فقد تم إعادة إستخدام أو تدوير معظم مخلفات المنازل المهدمة بسبب عدم توفر مواد جديدة في الأسواق والتي يمكن شرائها.

فالمواطنين في قطاع غزة، مجبرين على إعادة إستخدام كل قطعة من الباطون، والمعدن، والخشب، والبلاط، والأسلاك الكهربائية، وأنابيب البلاستيك ...،إلخ، لتكون بديلا للمواد الجديدة المفقودة.

3. إعادة التدوير داخل وخارج الموقع

يوجد طريقتان لإعادة تدوير مخلفات البناء والهدم. حيث يتم في الطريقة الأولى جمع النفايات ومن ثم فصلها و/ أو يتم إعادة تدويرها في موقع المشروع وتسمى هذه الطريقة بطريقة الفصل من المصدر، أما في الطريقة الثانية يتم جمعها مختلطة ومن ثم يتم فصلها وإعادة

تدويرهـا في منشـآت إعـادة التدويـر خـارج موقـع المـشروع وتسـمى طريقـة التدويـر المختلـط خـارج الموقـع.

- **طريقـة الفصـل مـن الموقـع:** يتـم فيهـا فصـل مخلفـات البنـاء والهـدم في الموقـع ثـم وضعهـا في حاويـات أو أكيـاس منفصلـة، ليتـم فيـما بعـد تخزينهـا في موقـع إعـادة التدويـر ضمـن موقـع المـشروع أو إسـتلامها مـن قبـل المزوديـن أو الذيـن يعملـون في إعـادة التدويـر.
- **طريقـة التدويـر المختلـط خـارج الموقـع:** يتـم تجميـع كافـة أنـواع مخلفـات البنـاء والهـدم في نفـس الحاويـة ليتـم فصلهـا لاحقـا في منشـآت إعـادة التدويـر خـارج موقـع المـشروع.

1.3 تطبيـق طريقـة الفصـل مـن المصـدر فـي موقـع المشـروع

من أجل تطبيق هذه الطريقة يجب الأخذ بالإعتبار التعليمات التالية:

- تحضـير خطـة لإدارة المخلفـات تناسـب حجـم المـشروع في مراحلـه الأولى.
- توظيف مدير ذو خبرة كافية لمتابعة خطة إدارة المخلفات.
- تحديـد الأنـواع وتقديـر الكميـات مـن المخلفـات التـي سـيتم تدويرهـا مـن أجـل إحتسـاب حجـم وعـدد الحاويـات التـي سـيتم إسـتخدامها.
- إيجـاد مسـاحة كافيـة وممـرات في الموقـع لتخزيـن المـواد المعـاد تدويرهـا.
- في حـال وجـود أكـثر مـن مـشروع في المنطقـة، جميـع المشـاريع تتشـارك في مـكان وتكلفـة الحاويـات.
- النفايـات العاديـة يجـب تخزينهـا في حاويـات تختلـف عـن حاويـات مخلفـات البنـاء و الهـدم و ذلـك لأنـه سـيتم جمعهـا مـن قبـل

سـيارات جمـع النفايـات الصلبـة البلديـة.

- يمكـن للمديـر عمـل تدريـب للعاملـين يتعلـق بأنـواع المـواد التـي يتـم فصلهـا وطـرق منـع تلـوث المـواد المفصولـة.
- تشـجيع المقاولـين الفرعيـين عـلى ممارسـة عمليـات الفصـل وإعـادة التدويـر مـن خـلال منحهـم حوافـز ماليـة.
- إختبـار الخطـة بشـكل دوري وعمـل التعديـلات الضروريـة مـن أجـل ضـمان النجـاح خـلال فـترة عمـر المـشروع.
- التقديـر التقريبـي لكميـات المخلفـات التـي تـم تقليلهـا، أو إعـادة إسـتخدامها، أو تدويرهـا.

2.3 تطبيق طريقة التدوير المختلط خارج الموقع

من أجل تطبيق هذه الطريقة يجب الأخذ بالإعتبار التعليمات التالية:

- تحضـير خطـة لإدارة المخلفـات تناسـب حجـم المـشروع في مراحلـه الأولى.
- تحديد مساحة كافية لحاويات التدوير المختلطة.
- توظيف مقاول لنقل الحاويات إلى منشأة إعادة التدوير.
- إسـتمرار التعاقـد مـع منشـأة إعـادة التدويـر لمعرفة رسـوم المخلفات الخاصـة بالمـشروع ومقارنتها بالرسـوم التي يطلبهـا المقاول.
- النفايـات العاديـة يجـب تخزينهـا في حاويـات أخـرى حيـث سـيتم جمعهـا مـن قبـل وسـائل جمـع النفايـات الصلبـة البلديـة.
- عمـل تدريـب للعاملـين يتعلـق بأنـواع المـواد التـي لا يُسـمح التخلص منهـا في حاويـات النفايـات البلدية.إختبـار خطـة إدارة نفايـات الهـدم و البنـاء بشـكل دوري وعمـل التعديـلات اللازمـة عليهـا لضـمان نجاحهـا خـلال فـترة عمـر المـشروع.

- الحساب التقريبي لكميات نفايات الهدم و البناء التي تم الحد منها، أو إعادة إستخدامها، أو تدويرها.

4. توجيهات عامة لإعداد خطة إدارة مخلفات البناء والهدم

- يتم إعداد خطة إدارة المخلفات من قبل صاحب المشروع أو المقاول، كما يجب أن تُعتمد من قبل الهيئة المحلية في منطقة المشروع.
- يجب أن تكون خطة إدارة المخلفات وثيقة ذات لغة سهلة تركز على الإجراءات التي يجب العمل بها لتحسين التعامل مع وإدارة المخلفات الناتجة من المشروع بما في ذلك (3Rs) (التقليل، إعادة الاستخدام، إعادة التدوير).
- يجب تصميم وتطبيق الخطة حسب ترتيب مراحل المشروع.
- أثناء تحضير الخطة يجب الأخذ بالإعتبار ما يلي:
  - حجم المشروع.
  - نوع المشروع (هدم أو بناء).
  - ساعات العمل في الهدم أو البناء.
  - طرق النقل وساعات الإزدحام على الطرق.
  - المجاورين للمشروع.
- توظيف مدير ذو خبرة كافية لمتابعة خطة إدارة المخلفات.
- على المدير حفظ وتسجيل أنواع والكميات الدقيقة لمواد البناء المستخدمة في المشروع.
- على المدير حفظ وتسجيل أنواع وتقدير الكميات من النفايات الخارجة لكل مرحلة من مراحل المشروع.

- عمل تعديلات على الخطة والتي يمكن القيام بها إذا كانت ضرورية خلال التنفيذ المستمر والمتابعة من قبل المدير للمشروع في أي مرحلة من مراحله.
- يجب أن تتناول خطة إدارة المخلفات و تصف ما يلي:

وصف المشروع:

يمكن وصف المشروع بالتفصيل من خلال نموذج خاص يشمل المعلومات التالية:

- إسم المشروع.
- عنوان موقع المشروع.
- إسم وهاتف وفاكس وعنوان المراسلة لمدير إدارة المخلفات.
- نوع العمل – بناء أو هدم.
- نوع المشروع – سكني أو تجاري ، أو بناء جديد أو هدم.
- التاريخ المتوقع للبدء بالمشرع.
- التاريخ المتوقع لإنتهاء المشروع.
- توقيع صاحب المشروع/المقاول.
- تاريخ التوقيع.

جدولة إنواع المخلفات والكميات المتوقعة من المخلفات المنتجة.

يمكن تعبئة معلومات نفايات البناءء والهدم المنتجة في جدول من قبل مدير الموقع وتشمل:

- نوع المخلفات – باطون، معادن، خشب ...،إلخ.
- تقدير كميات المخلفات الناتجة عن كل نوع من مواد البناء.
- تقدير كميات المخلفات التي يتم إعادة استخدامها في الموقع.
- تقدير كميات المخلفات التي يتم إعادة تدويرها في الموقع.

- تقدير كميات المخلفات التي يتم إعادة تدويرها خارج الموقع.
- تقدير كميات المخلفات التي يتم التخلص منها.
- موقع المكب الخاص الذي يتم التخلص من المواد غير القابلة للتدوير فيه.
- كيفية تخزين المخلفات في الموقع لإعادة الاستخدام والتدوير.
- من سيقوم بالإضافة إلى المدير بإدارة العمليات في الموقع والترويج لـ (3Rs).
- من المسؤول عن تقييم الخطة.

قائمة تدقيق الخطة من قبل الموظف المسؤول في الهيئة المحلية

الهدف من هذه القائمة هو تقييم خطة إدارة المخلفات المعدة، والتي يتم تصميمها بطريقة تضمن إحتوائها على المعلومات الكافية لتقييمها. هذه القائمة عبارة عن نموذج يُحضر من قبل الهيئة المحلية ويحتوي على أسئلة لمدير إدارة خطة المخلفات حول كفاية المعلومات الواردة في الخطة والتعديلات المقترحة من قبل الهيئة المحلية. يتم عادةً تعبئة هذه القائمة من قبل موظف الهيئة المحلية المختص، ويُعتبر هذا الإجراء نوع من الإشراف من قبل الهيئة المحلية على كيفية تناول وإدارة المخلفات الناتجة خلال عمر المشروع.

خطة إدارة مخلفات الهدم

إذا كان المشروع مخصص لهدم مباني، فيتم إعداد خطة إدارية خاصة، ويجب التركيز فيها على الأمور التالية:

- تصنيف وفصل المواد الناتجة عن مخلفات الهدم والتي يمكن بيعها، أو إعادة إستخدامها في مشاريع أخرى.
- إزالة المخلفات الخطرة مثل الرصاص والمواد اللاصقة.
- إزالة جميع المواد التي تحتوي على الأسبست.
- الحصول على تصريح من المؤسسة المختصة قبل المباشرة بهدم المباني ذات القيمة العالية.