

Solid Waste Project Report

May 2017

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Section 1 - Objectives of visit by Glenn Fleet and Derek Greedy

1. Advise on the suitability of the two landfill facilities presently being used by Kenema and Makeni City Councils.
2. Provide technical advice on the design of the two Landfills sites and review the design of Bo Mile 5 site
3. Provide our thoughts on the draft design to turn Bo cities central dump into a public open space.
4. Give our general view on the other services being provided by the councils.
5. Give advice on the overall capacity needed for the proposed landfill sites.

Section 2 - Summary of outcomes during the visit 4th to 14th May

2017

Key outcomes from the visit include the following:- :

We held briefing meeting with Harrison on what the overall project now wants to achieve, including rolling out the project to both Kenema and Makeni City Councils with funding from UKAid over the coming years.

WHH requested we look at both Kenema and Makeni council's present activities and evaluate if they are both suitable for rolling out the same practise as being introduced at Bo City Council, including both composting and processing inert waste. This would mean converting the present dumps into sustainable landfill sites, providing best practice. To advise if they have sufficient space to accommodate these practices over the next 20 to 25 years.

Kenema City Council

Kenema dump is only 5 acres in size and with some 52,900 tonnes of waste per year to process. The waste analysed shows that some 65% of this material is bio-waste, 10% being inert material. The City council also want to move its waste management operation service and the waste enterprise zone out to the new proposed landfill site. To achieve both the processing of bio-waste, landfilling and operational service, as well as an enterprise zone, the minimum size site needed would be 10 acres to support the service over the next 25 years, at a growth rate of 3%. For best practice, the minimum area needed to process the bio-waste would be one hectare with some 240,000 cu ms of void space for the disposal of the residual waste. This should include the excavation to 4 m depth in each cell and raising the waste above the ground level a minimum of 10 ms ensuring side slopes not steeper than 1:5.



Kenema present waste dump on banks

Discussions with the Mayor of Kenema, have highlighted the need to discuss the opportunity of leasing or to buy the a further 5 acres with land owners to create the minimum 10 acres necessary to accommodate the predicted waste volumes over the next 25 years. Mayor confirmed that he would endeavour to secure a meeting with all land owners within the next two weeks.

Other observation of the cleansing service in the city show the council and its staff are committed to improving the overall service level. The centre of the market area looked really clean and the new skips and skip lorry are being well used.

We also had the opportunity to visit the new public toilets and wash rooms. We were shown the usage book from when the unit open last month and the usage by residents has been increasing day on day and feel sure that the facility will be well used in the months to come.

Bomeh Rehabilitation

We were asked to give our advice on the present draft plans for converting the present central dump in Bo City into a multi-disciplined public open space with leisure provision. It is with a great deal of pleasure that we learnt that the closure and rehabilitation of central dump project was to start straightaway. This project has been proposed by Bo City Council for many years.

Informal meetings were held with us and the WHH Engineer and Maada on 7th May. Based on the draft plan, a number of suggestions were made by Derek and Glenn. To maximise the available space of the 3+ acres site, the first big win would be to build a multi-purpose sport pitch that can be marked up for a number of the sports proposed to maximise the space available for other recreational facilities and to reduce the construction costs. It would also be recommended that the multi-purpose pitch should be placed away from the residential areas and close to the boundaries with the business sector. This will reduce the noise impact on local residents during sporting events.

Makeni City Council

The proposed Makeni waste management facility is 7 acres in size and the authority will need to manage some 22,000 tonnes of waste per year. The waste analysis shows that some 72% of this material is bio-waste, 8% being residual material. The present 7 acres will be sufficient to achieve both composting and residual waste

disposal over the next 25 years, at a growth rate of 3%. For best practice, the area needed to process the bio-waste would be three quarters of a hectare. The site would also need some 78,000 cu ms of void space for the disposal of the residual waste. This should include including the excavation to below ground level to 4 ms depth and rising above the ground to a minimum of 10 ms ensuring that side slopes do not exceed 1:5. There is a water course some 200 ms away from the site which is not expected to impact on the development or the ongoing operation of the site. Site inspection took place 11th May with WHH and the site seems to be well placed to accommodate all the facilities needed at the site, including weighbridge, site office, recycling material and transport shed. The biggest issues on water entering the site, comes from the wet waste processing facility presently managed by SALWACO , which has both emergency overflow pipes and surface water drainage coming out of their facility and running across the landfill. This needs to be diverted into the proposed water lagoon for the composting pad.



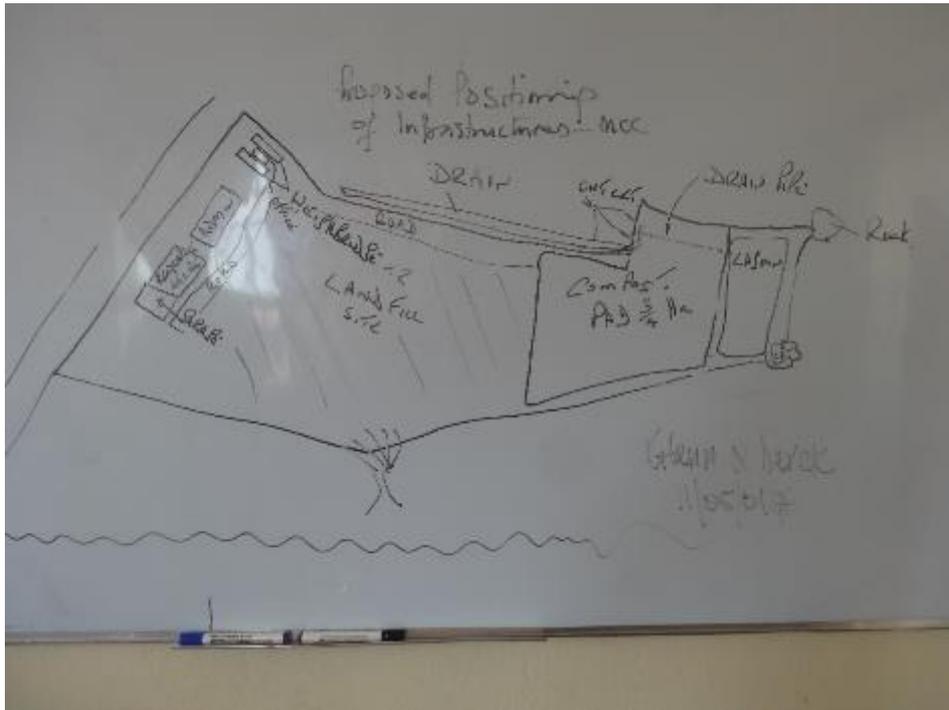
Makeni proposed landfill site

In the afternoon of 11th May, a draft design of the landfill site waste prepared by Harrison, Derek, Maada and Glenn, encompassing all the facilities needed and addressing the discharge issues from the SALWACO land.



Overflow ducts from SALWACO site

WHH Engineer is to prepare Auto CAD draft site plan using the outline below.



Draft plan of proposed new landfill site for Makeni

Further advise to promote best practise for managing the landfill site is contained within appendix A.

Section 3 - Recommendations

1. That Kenema City Council takes immediate action to secure an alternative site that addresses the minimum requirement of 10 acres to accommodate all the facilities needed The site should be as level as is possible and not in close proximity to watercourses or water bodies.
2. That Makeni City Council start discussions with SALWACO to see if there are synergies with the existing infrastructure to allow for the joint occupation of buildings and vehicle storage space, thus reducing overall cost of new landfill site infrastructure.
3. That Makeni City Council progress the development of their waste management site as soon as the funding is approved by UKAid while ensuring that the overflow pipes from SALWACO site are addressed within the design.
4. Consideration be given to the potential for using the deposited waste at mile 5 to provide perimeter bunding thus facilitating the opportunity to increase the overall capacity by land raising.

5. Consideration be given to establishing designated waste transfer area at the landfill site, to reduce damage potential to smaller vehicles going to the landfill cell, like the present small vehicles currently being used by the young groups.

Appendix A

Best practice advice on managing landfill and composting sites

Site Roads

Road access is a vital part of landfill operation and must be appropriately planned and budgeted for. It is imperative that landfill site roads are adequate for their intended use in providing safe and unhindered access to and from the tipping face at all times. Access for landfill equipment also needs to be considered and often this needs to be on separate roads or equipment tracks.

Prevention of damage to vehicles and quick turnaround times are essential in maintaining good customer relations at a landfill site. In addition, maintaining continuous access to the tipping face reduces reliance on emergency tipping areas, and minimises the risk of forced site closure due to the tipping area becoming inaccessible.

All landfill roads need to be well graded, and kept mud and debris free to the extent practicable, and with adequate drainage. Maintenance must be given high priority as early action in addressing road problems will usually minimise the need for major repairs over the long term. Use of a graded running course on main site roads is usually essential to ensure all weather access – sometimes waste materials (either as-received or re-processed), can be used for this purpose.

ROAD TYPES

Landfill roads can be divided into four types:

- Approach roads and entrances (with approach roads usually part of a regional road network)
- Primary Access roads – Internal roads to reception / weighbridge and internal site road junction
- Secondary Access roads – Main internal roads to operational area
- Tertiary Access roads – Temporary roads within the operational area

Where possible, all main access routes should allow for two-way traffic flow. However, where this is not possible the provision of passing bays must be considered and is usually essential at other than very small sites. The design standard for each of these road types will vary according to need. Primary access roads would normally be hard surfaced whereas the secondary roads would be constructed from hardcore. Tertiary roads will be of such construction that allows for the efficient movement of waste vehicles in and around the tipping area and would normally consist of waste material.

THE USE OF DAILY COVER

The regular application of daily cover soil (Figure 1), or an alternative such as tarpaulins or an artificial (alternate daily cover) material is perhaps the most

fundamental control on direct effects arising from waste landfilling. Sites with poor daily cover practices are often subject to bird, odour, vermin, litter and surface water quality problems.

The most fundamental control to achieve good landfill performance is to regularly and completely cover the waste and to ensure it remains covered in all areas other than the active working area, which should be kept as small as practicable.



Figure 1. Application of daily cover

OBJECTIVES OF DAILY COVER

The key objectives of placing daily cover are to:

- Minimise windblown-litter
- Control odours
- Prevent birds from scavenging
- Prevent unauthorised scavenging by humans
- Prevent infestation by flies and vermin
- Reduce the risk of fire
- Provide a pleasing appearance
- Shed surface water and minimise contamination of runoff.

BIRD CONTROL

Birds frequenting a landfill site do so mainly for food. They are seen as noisy and messy, and commonly they can be carriers of pathogens or they can be the cause of local nuisance through fouling of roofs and roof-water supplies. If birds are given a dependable food supply and a safe environment (suitable resting or roosting areas) their abundance will increase, as it is shown in Figure 2 below thus attracting more birds from a greater distance from around the landfill site.



Figure 2. Birds at the landfill

BACKGROUND

Before bird numbers can be controlled at a landfill, it is important to have an understanding of the requirements that birds have and what makes a landfill site attractive to them. All birds have three key drivers: food supply, rest, and the ability to breed. Landfill sites can offer a suitable environment for all of these, depending on the type of bird.

When a bird infestation issue is to be dealt with, it must be taken into account that birds can become quickly accustomed to the usual methods of bird control that are used. The method of control must therefore be varied, as required, to provide an effective overall control strategy. Provided that birds can be identified by species it is often possible to use their instinctive and learned behaviour against them to minimise their level of nuisance. It is possible to keep disturbing accumulations of birds and to progressively remove their food sources, resting and roosting places, until the birds find the landfill site no longer attractive. This process is the key to an effective bird control strategy.

HIERARCHY OF CONTROLS

- Operational Practices
- Direct Shooting
- Heli-kites and Balloons
- Bird Distress Calls
- Warning Pistols and Cartridges
- Wires and Screens

LITTER CONTROL

A frequent cause for concern for waste management on landfill sites is the control of litter. Litter is unsightly, can result in water pollution and can be a nuisance to surrounding property. Hence issues related to wind-blown litter are a common topic for discussion and complaint, during the planning process for new landfills, and with regulators.

Depending on site conditions, litter can be difficult to control and manage. However, in almost all cases there are methods available that can keep the offsite impact of litter to a minimum. A site-specific strategy should be drawn up to manage the impact of litter. Importantly, whatever strategy is introduced, it is noted that this will only be as good as its implementation. To reduce the risk of opposition or complaints from neighbours, effective litter control, achieved via a hierarchy of measures, routinely and thoroughly applied, is an essential site management tool.

HIERARCHY OF CONTROL MEASURES

A hierarchy of litter control measures is available, based firstly on load containment, load handling and tipping, and moving through to secondary measures such as mobile litter screens, nets and litter picking at site boundaries. Each is expanded on from the overall range of controls that comprises:

- Load control
- Waste handling
- Portable litter screens
- Semi-permanent fencing
- Bunds
- Litter fencing
- Select tipping areas
- Netted areas
- Designated waste transfer areas
- Methods for handling for lightweight waste
- Restricting operating hours

It is unlikely that any single control measure will be sufficient to combat litter escape at a site, and it is essential to develop and refine an effective set of control measures for each situation. These may also vary with location on the site, or seasonally.

VECTOR CONTROL

At a landfill “vectors” can include rats and other rodents and dogs, insects, birds and other animals, each of which can carry disease agents and be a threat to public health. Birds require special techniques of control and have been addressed above. Each type of vector can live and multiply at a landfill and is potentially of concern to site operators, regulators, public health professionals, and the general public. Fortunately, vectors are controllable and should rarely, and even then only intermittently, be present on a well managed landfill.

BACKGROUND

Vector control involves avoiding vectors from living and becoming established on the landfill by not providing sources of food and water, and/or shelter. The only vectors that should be observed in any significant numbers at landfill sites

should be those that happen onto the landfill - they cannot be allowed to establish on the site and so should only be observed intermittently.

HIERARCHY OF CONTROL

Vectors are controlled by a hierarchy of control methods, all aimed at eliminating vectors to the greatest practical extent. This hierarchy includes:

- Operational Practices
- Monitoring
- Eradication

MANAGING THE WORKING FACE

The working face is the focus of activity at an operating landfill. It is the area where waste is deposited by trucks, levelled and compacted, and where daily cover is applied. It involves waste transport vehicle movement in a potentially congested area, heavy landfill equipment movement to work the waste and cover, and personnel to operate equipment and where necessary those directing trucks. It is the one location at the landfill where waste is loose, uncontrolled and exposed. It follows that good working face management is critical to achieving a good overall standard of landfill operation, and minimised long-term impact. Conversely, poor working face management has the potential to result in blowing litter and debris, greater potential for accidents, inefficient use of airspace, aesthetic problems, traffic movement problems, uneven or increased long term waste settlement and vector problems.

WASTE COMPACTION

BENEFITS OF WASTE COMPACTION

It is essential at any landfill site that the waste be compacted. First and foremost this will ensure that the available void space is maximized, but effective compaction has a range of other benefits, as follows:

- Compacted waste provides a stable surface for vehicles to move on and on which to establish access roads and tipping areas.
- Birds and rodents find it more difficult to dig into the waste to access food.
- Compaction helps to prevent litter escape from the site surface.
- Well compacted waste inhibits odour release.
- Well compacted waste reduces fire risk.
- A compacted surface aids storm water run-off and provides a good base for applying cover soil.
- Well compacted waste consumes less airspace.

A thoroughly compacted waste pile is the first sure sign of a well-managed operation.

Compaction is typically achieved using a bulldozer or a specialist waste compactor, as shown at Figure 3. However at sites receiving small volumes of waste typically a wheeled loading shovel together with the weight of the vehicles delivering the waste will lead to in place densities at or near to 0.8 t/m^3 should be readily achievable. Densities less than $0.6 - 0.7 \text{ t/m}^3$ significantly reduce landfill efficiency and will increase the risk of landfill fires.



Figure 3. Wastes compacted by bulldozer/compactors

STORM WATER AND SEDIMENT CONTROL

Landfills are engineering structures that generally result in a new landform being developed as an infill (trench landfill) or mound. Invariably this occurs within a surface water catchment and the landfill needs to be designed to cater for rainfall and storm water runoff during development, filling and for the permanent condition following closure.

With few exceptions, landfills are also significant earthworks projects. Landfill development typically requires earthworks for cell formation. All such materials have the potential to generate sediment during rainfall events that result in runoff and this sediment can impact on downstream waterways if not adequately controlled.

Poor control of storm water can have very significant impacts not only on receiving waters downstream of the site (e.g., due to entrained litter, sediment and chemical contaminants), but also on the practicality and cost of site operations.

Providing adequate surface water drainage is therefore a critical component of any Landfill facility design and in many situations is a key driver of overall facility design.

WASTE CONTROL AT LANDFILLS

Control of waste accepted into a Landfill requires the use of protocols to routinely screen waste inflow and / or criteria to assess the admissibility of waste for handling and disposal. These criteria are aimed at determining

whether particular waste should be accepted or rejected. All acceptable wastes are classified as *permitted waste* and those rejected are classified as *prohibited waste* in relation to the operating criteria for the facility.

Prohibited wastes can include specified waste categories such as tyres, sludge that has not been dewatered, recyclable materials or hazardous waste. Other associated controls may include the specification of maximum allowable water content in sludge, and maximum allowable amounts of waste per annum for specific waste categories.

Waste control processes for a Landfill should be considered during the risk assessment process, before the development of operational procedures. The reason for this is that if the waste protocols are not adhered to waste deposited could result in the generation of leachate and landfill gas generation leading to sophisticated control measures which will no doubt incur high costs and undesirable environmental impacts. Therefore waste control protocols need to be established before any design and risk assessment can be conducted for a particular facility.

Waste control processes are also important in recording information about waste types that are subject to control, including:

- Establishing accurate information about deposited waste (quantities, timing).
- Recording the location of waste placement and issues around the potential environmental risk of the facility.
- For charging purposes.

ODOUR CONTROL

Odour can occur at landfilling and composting facilities as a result of the biodegradation of wastes. The emphasis when considering odour control in landfill design and operation should be on utilising efficient operating and management practices, backed up by robust environmental management systems.

ODOUR CONTROL MEASURES

The key odour control measures at a waste management facility are:

- Effective waste input controls.
- Properly covering the waste
- Limiting the size of the working (tipping) face
- Using odour masking sprays where appropriate
- Use of buffer zones (maximising separation distance)
- Careful planning of working face location.

SITE SAFETY AND SECURITY

Commonly, a waste management facility will be separated from surrounding properties by fences and/or other barriers, i.e. ditches, bodies of water, extensive open space etc. and these to some extent provide a degree of security at a landfill site. However, 'site security' generally means achieving much more control than is represented by a simple fence or barrier. Site security includes controlling access onto the site and supervising the activities of all persons on-site.

Thus site security includes:

- Restricting entry to the site by using a fence or barrier all around the site and having one gate through which all vehicles and persons enter and leave.
- The employment of appropriately trained staff to control access to the site by vehicular and pedestrian traffic.
- The maintenance of physical access control features and components such as gates, fences, bridges, moats and streams.
- The surveillance and control of all on-site visitors, site users, and employees.



What not to do!

Site safety, is maintained and/or achieved through careful planning, the provision and utilisation of appropriate equipment, and through personnel training. Site plant and all structures should be equipped with fire extinguishers. A well-stocked first aid kit should be available on-site and first aid training should be considered essential for one or more of the operating personnel who spends the majority of the working day on the site. At least one person properly trained in first aid should be on site at all times.

All of these procedures, as well as emergency response procedures, should be documented in an operational management plan and should be the focus of regular training of site staff.