AN INTEGRATED SOLUTION TO SOLID WASTE HANDLING AND SERVICE DELIVERY IN RUSTENBURG

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EXECUTIVE SUMMARY

The Rustenburg Local Municipality is currently experiencing various solid waste related problems affecting the environmental and socio economic sustainability of the whole municipal area. Various illegal waste disposal sites and borrow pits are being operated throughout the municipality.

BKS was approached by the Municipality to assist it the development of transfer stations throughout the municipal area to alleviate the environmental burden due to uncontrolled illegal dumping.

The solutions proposed were the environmental legislation requirements to be addressed, the integration of various specialist fields to obtain the optimum engineering solution and ensure maximum labour based opportunities to the local communities surrounding the identified sites.

The solutions had to reduce the waste stream to absolute minimum, as the distances to the landfill are more than 30km. The reclamation of recyclable material and safe storage and transportation are also of importance. These solutions were presented to the council and accepted as a feasible solution.

The optimum locations to develop the transfer stations are on private land and discussions were held to achieve a mutual understanding that benefitted the land owners and the Municipality. The Lonmin mining group have made a portion of land available to develop one of the transfer stations. The other two stations are located on land belonging to The Royal Bafokeng Nation; they have supported the initiative as it ensures service delivery to areas and villages under their care that previously had no solid waste facilities.

The financing of the projects are being facilitated in the Municipal Infrastructure Grants programme. The development in infrastructure to enhance service delivery is high on the list of priorities for Local Government and is supported fully by Rustenburg Local Municipality.

These transfer stations promote an integrated approach to solve solid waste management problem currently experience by various stakeholders, each with their own requirements, in using a multi-discipline solution to achieve a common positive outcome.

1. INTRODUCTION

How do you extend the life of a landfill? They were designed in the past with an expected lifespan, but population growth, lifestyle changes and the need for people to consume more things, means that landfills are rapidly filling up. And this is a national problem for municipalities. One such municipality is the Rustenburg Local Municipality (RLM). The RLM is currently experiencing a number of solid waste related problems affecting the environmental and socio-economic sustainability of the whole municipal area.

The RLM had identified the need for proper waste management practises to benefit the greater community. Several small and illegal waste disposal sites operate throughout the municipality and it was decided that these facilities would be closed and rehabilitated. However, to effectively control the waste generated, the need for a proper waste transfer facility was identified.

BKS (Pty) Ltd was appointed by the Municipality to assist with the development of waste transfer stations throughout the municipal area to alleviate the environmental burden due to uncontrolled illegal dumping. The basis for waste minimisation includes a Materials Recovery Facility (MRF) and buy back centre to ensure the amount of waste that gets sent to landfill for ultimate disposal is kept to a minimum.

BKS (Pty) Ltd was appointed for the planning, application for Environmental Authorization, design, preparation of tender documents, specifications and engineering drawings for a civil contract and construction monitoring of a contractor for the development of three Solid Waste Transfer Stations with Materials Recovery Facilities.

2. PURPOSE OF DEVELOPMENT

The facility will be built to manage the transfer of disposable waste from the communities around the transfer station to the Regional Waterval Landfill site. It also aims to recover as many recyclable waste products as possible and sell them on to stimulate the economy of the municipal region and to maximize landfill airspace.

The lack of landfill airspace is one of the largest problems facing the South African Municipalities. Land is expensive, there are competing needs, and management becomes more difficult as communities encroach on landfills.

The development of the Solid Waste Transfer Stations and MRFs will have the dual benefit of reducing the volume of waste that goes to landfill and keeping the community's waste in one manageable place for further transport and disposal.

3. ENVIRONMENTAL ASPECTS

The approach to develop the waste transfer station and MRF included addressing the environmental legislation requirements, the integration of various specialist fields to obtain the optimum engineering solution, and ensuring maximum labour-based opportunities to the local communities surrounding the identified sites.

3.1 LEGISLATIVE REQUIREMENTS

The development of a waste transfer station requires:

- a Waste Management Licence in terms of the Government Notice (GN) 718 of July 2009, published in terms of the National Environmental Management: Waste Act (No. 59 of 1998); and
- Environmental Authorisation in terms of GN 544 of June 2010, published in terms of the National Environmental Management Act (Act 107 of 1998).

Application for a Waste Management Licence and Environmental Authorisation requires a Basic Assessment (BA) process to be conducted in terms of the NEMA Environmental Impact Assessment Regulations (GN 543 of June 2010). An application was submitted to the North West Department of Economic Development, Environment, Conservation and Tourism (NWDEDECT) and a BA report was drafted. The BA report documents information on environmental and social features of the site and the surrounding areas, potential impacts of the proposed development, as well as measures for the mitigation of the impacts.

As part of the BA process, public and stakeholder engagement needs to take place to ensure that Interested and Affected Parties (I&APs) are aware of the proposed project and have an opportunity provide their comments. The project was announced to I&APs which included the public, all adjacent landowners, and residents, government officials from various departments and the local government officials. The I&APs were also given an opportunity to comment on the BA report. Comments received from I&APs were included in the BA Report which was submitted to the NWDEDECT for approval.

3.2 IMPACTS ON THE ENVIRONMENT

There were a number of potential direct, indirect and cumulative impacts identified that are likely to occur as a result of the proposed project:

- Surface water pollution
- Groundwater contamination
- Traffic impact
- Visual /Aesthetic impact

- Noise pollution
- Public safety
- Fauna displacement
- Habitat alteration/loss

Mitigation measures for the identified impacts have been prepared and carried over into the design and have been included in the Environmental Management Programme (EMPr)

3.3 FUTURE PROPOSED ENVIRONMENTAL DEVELOPMENTS

The Waste Transfer Station provides an opportunity to develop a multi-use centre. The future options will include:

- On-site development of produce growing areas (such as fruit orchards, vegetable garden);
- On-site development of education centres:
  - the public will be afforded an opportunity to learn of the complete waste cycle. The underlying message will be that waste is a resource.
  - the geology of the area is interesting. It is proposed that a 5m trench is cut whereby schools can see a cross section through the geology, showing the various layers and how aspects such as soil formation occur.

3.4 EMPr

An Environmental Management Programme (EMPr) was drafted and submitted with the BA Report for approval by the NWDEDECT. Thus, the EMP is a core product of the environmental process as this document includes all recommendations and mitigation measures for all the impacts identified in the BA process, for the construction and operational phases of the development. The EMP is a legally binding document and the recommendations therein must be adhered by the holder of the authorisations for the development (the Rustenburg Local Municipality), as well as its Contractor and anyone acting on its behalf on this development.

4. DESIGN ASPECTS

The design solutions needed to reduce the waste stream to an absolute minimum, as the distance to the existing landfill is more than 30km. Therefore the reclamation of recyclable material and safe storage and transportation were critical to the overall project development and could not be excluded from the waste transfer station. Consequently, this approach had to be presented to the Municipal Council for approval. The motivation was accepted by Council as the only feasible option.

The optimum locations to develop the transfer stations are on private land and discussions were held to achieve a mutual understanding that benefited the landowners and the Municipality. The Lonmin Mining Group has made a portion of land available to develop one of the transfer stations. The other two stations are located on land belonging to The Royal Bafokeng Nation (RBN), which supported the initiative as it ensures service delivery to areas and villages under their care that previously had no solid waste facilities.

4.1 INFRASTRUCTURE REQUIREMENTS

The following forms the basic infrastructural requirements for the transfer station.

- Access control and weighbridge
- Receiving and Compacting Building
- Materials Recovery Building
- Conveyor System
- Compactor
- Public Drop off Area
- Buy-Back Building
- Composting Area

4.1.1 ACCESS CONTROL AND WEIGHBRIDGE

Access will be controlled via a security guard operated boom gate at the entrance. Private and municipal vehicles will be advised on where to dispose their load depending on the nature of the waste they carry. Vehicles going to the MRF will be directed across the weighbridge where the weight of the vehicle will be recorded before and after the waste is disposed in order to determine waste volumes disposed of at the facility.

4.1.2 RECEIVING & COMPACTING BUILDING

The receiving building is where the discharging of waste takes place and is located within a superstructure enclosed on three sides and some 500m^2 in area. The floor of the receiving building is concrete and access to the building is through one side of the building, which is permanently open.

The incoming waste will be disposed of on the concrete floor from where it will be transferred to the conveyor belt by a front end loader. Even though the facility will not be permitted to receive hazardous waste, some hazardous waste or animal carcasses will inevitably find its way into the waste stream. There will be personnel at the receiving building that are specifically trained to handle waste of this nature if it arrives.

Purposely designed containers will be kept on the premises and the hazardous (medical waste included) waste placed in these containers for later pick up by qualified contractors. The receiving building will also house the compactors and balers. Waste will be baled or compacted and then transported to the buy-back building or to the regional landfill.

4.1.3 MATERIAL RECOVERY BUILDING & CONVEYOR SYSTEM

The facility will be a combination of a dirty MRF and a clean MRF meaning that all the collected material (100% of the waste) enters the MRF and is worked through.

The main aim of the Transfer Stations and MRF is the separation of re-usable and un-usable waste. Ideally waste should be separated at source as per the waste hierarchy but current trends in South Africa dictates that waste normally arrives at landfills and transfer stations unsorted.

The MRF is to receive waste from the public off loading area or from municipal waste trucks. Ideally the waste received at the MRF must contain recyclables only and the on site management of the transfer system plays an important role in the cycle.

When the waste is received at the MRF, it is temporarily stored on a concrete area (roofed) from where it is loaded onto a conveyor belt by machine. The conveyor belt transports the waste to a raised level where the conveyor belt passes through the roofed recycling area. The recycling area consists of dedicated personnel each given the task to pick a certain recyclable from the conveyor belt as it passes by (one person targets paper, another plastic etc.). The recyclers then drop the items into a dedicated bin through a chute located next to the conveyor belt. Once the various bins are filled with the recyclables they get transported to the baler where it gets compacted and baled for collection by approved buyers at the buy-back building.

Any material that has a market for re-sale can be recycled from the waste stream. General household waste streams contain only certain types of recyclables and thus the focus at the MRF will be on Plastics, Papers, Metals and Glass. All of these can be further divided into sub categories and the demand in the market needs to be established as is the case for recyclables like polystyrene and electronic waste.

Waste that is not recyclable exits the MRF via a conveyor belt and goes into the receiving compactor. The compacted waste will then be loaded onto Roll-On Roll-Off (RO-RO) containers for transport and permanent disposal on the landfill.

4.1.4 COMPACTOR

The conveyor system feeds the residual (non recyclable) waste to a single compactor located underneath the receiving building where it is immediately compacted into 28m^3 RO-RO type containers. Compaction will be controlled by monitoring pressure to prevent containers being overloaded, to comply with road regulations. The waste will then be transported to the regional Waterval Landfill.

4.1.5 PUBLIC DROP OFF AREA

The Public Drop Off area will be a raised concrete retaining wall lined area from where waste can be dropped into the skips on ground level. Any member of the public wishing to dispose of waste can do so here and some skips will be marked to only receive a certain waste type. Traffic at the public drop off will be controlled by utilizing a one way system whereby vehicles coming in do not have to turn around but can exit on the other end. The skips will be taken to the receiving shed area once they are full and loaded onto the conveyor belt or disposed of directly into the containers waiting to be baled.

4.1.6 BUY-BACK BUILDING

The buy-back building is a steel clad building 220m^2 in area that will be used to store the recycled goods once they have been sorted and baled. The floor of the building is concrete and it has roller shutter doors. The building also houses a 10m^2 administration office. Goods will be stored here until they are bought by recycling companies.

4.1.7 COMPOSTING AREA

It is estimated that the waste entering the transfer station will include approximately 20% garden waste (density 400kg/m^3). This waste can be processed and used as compost by inter alia chipping and spreading. The development of a composting facility at the transfer stations will be included and the garden waste entering the MRF will be taken to the composting facility for chipping, spreading and composting.

4.2 ENVIRONMENTAL DESIGN CONSIDERATIONS

The following environmental aspects were incorporated into the design to minimise the impact caused by the development:

Energy Efficiency:

- Increased length of roof overhangs in order to increase shading.
- Double glazed windows will be installed to mediate room temperature.
- Increased number of opening windows to increase ventilation as well as increase natural lighting.
- Roof tiling has been selected over corrugated iron roofing (at Administration Buildings) to increase insulation.
- Buildings are to be built out face brick which also increases insulation.
- Ventilation in the MRF will be enhanced through the use of air vent wind turbine (e.g. Whirly Bird), which does not require electricity.
- Translucent sheeting will be used in the MRF to increase natural lighting.

Materials:

- Paved surfaces will be reduced to a minimum.
- The use of face brick negates the need for painting of structures, thus reducing operating (maintenance) costs.
- A composting yard will be built and will be furnished with a chipper for garden waste.

Water Management:

- Increased length of roof overhangs in order to increase surface areas for collection of rain water, for use in landscaping and composting.
- Full separation of storm water falling on uncontaminated surfaces, water falling on contaminated surfaces and leachate that may be generated where waste is stored. Storm water will be directed to a storage tank and reused for landscaping and composting. Water falling on contaminated surfaces and leachate will be collected and used in the composting processes only.
- Stormwater that is not channelled to the storage tank will be directed into swales, which will encourage the infiltration of water.

Ecology and Community:

- In general, landscaping will be done using indigenous plant and tree species.
- Fruit tree orchards and a vegetable garden will be established. These will be maintained by the staff of the facility and any fruit or vegetables that are grown can be consumed by the staff.

4.3 DESIGN CHALLENGES

The design team consisted of a number of specialist teams within BKS (Pty) Ltd each with their own area of expertise: These included civils, mechanical, structural, roads, wet services etc. The design co-ordination to achieve the completed designs and tender documents were handled by the Rustenburg Office. The entire project liaison with the client is also handled by Rustenburg Office.

Tight co-ordination of all the disciplines was needed to obtain a deliverable that has acceptance from all the stakeholders in BKS and the Client. The integration of the different disciplines led to the development of a transfer station that caters for the requirements of the community and the client. By having an integrated system the efficiency of the facility will be increased and the overall input required to complete the design was vastly reduced by not redesigning part of the works complete.

Attendance of meetings with the client to show progress and give feedback to Municipal Project Management Unit ensured that the client was continually aware of progress made and challenges met. This also assisted in reducing misunderstandings and ensured the clients ideas were brought to fruition.

5. FINANCIAL ASPECTS

5.1 CAPITAL FINANCING

The financing of the projects is being facilitated through the Municipal Infrastructure Grants programme. The development in infrastructure to enhance service delivery is high on the list of priorities for Local Government and is fully supported by the Rustenburg Local Municipality.

The MIG programme can be a process that often leads to delays due to insufficient information given in the application forms. The motivation for the project must align to the regulations stipulated in the funding guidelines. The approval of the transfer stations were completed within three months from the submission date.

In addition to creating additional landfill airspace, the recovery of recyclable material has a significant effect on the economic impact of the development.

5.2 OPERATIONAL FINANCING

Running the MRF and Buy-Back facility creates jobs for at least 10 to 15 people and stimulates the economy of the area by enhancing and personalising the market for recycled goods in the area. Small and large companies exist that buy and sell recycled material and the buy-back facility at the Solid Waste Transfer Station and MRF will facilitate this process and thereby create an additional income for the RLM.

The amount of money that can be made depends on the volume and quality of recycled goods that the facility will produce and since this is the first facility of its kind in the area, these figures were not available. Good management of the MRF and buy-back facility will be of the utmost importance and will ensure sustainability of the facility.

6. SUMMARY

These transfer stations promote an integrated approach to solve solid waste management problems currently experienced by various stakeholders, each with their own requirements, in using the BKS multi-disciplinary solution to achieve a common positive outcome.

The construction phase of project has not started and the full impact on the community has not realised. The overall positive effect on the communities served will be carried forward and be a great asset to ensure service delivery to the greater Rustenburg and surrounding villages for many years to come.

DETERMINATION OF ADDITIONAL RESOURCES TO MANAGE POLLUTION IN STORMWATER AND RIVER SYSTEMS

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In the end, all water is stormwater
- A Parker, 2010
Whatever its origin or use, all water, whether from roofs, roads, wastewater treatment works, boreholes or bottles, becomes stormwater.

Abstract

The City of Cape Town has an extensive network of rivers and wetlands which fulfil diverse ecological, aesthetic, recreational and infrastructure network functions. Many of these watercourses have, however, been adversely impacted by pollution ultimately posing a significant threat to the benefits of good quality stormwater. The challenge, therefore, is to protect the inland waters from the impact of pollution, while current resources for this purpose are inadequate. In order to determine the additional resources required to improve inland water quality to an acceptable level, this project identified some of the key issues affecting inland water quality. These include Approach and Policy, Institutional Issues, Planning Issues, Technical Issues and Communication. Some of the major sources of pollution which stand out from the many types of point or diffuse sources include greywater and sewage from informal settlements, effluent from wastewater treatment works, blockages and overflows of sewers, and dumping of solid waste.

Proactive, sustainable measures to address these issues are recommended as far as possible to avoid costly, inefficient, after-the-event reactive measures. A rigorous prioritisation of catchments, rivers and wetlands was also undertaken to assist the City management with the allocation of resources. While the budget implications show that R675, 30 million in capital expenditure and R277,15 million in operational expenditure is required as additional resources to manage pollution of stormwater and river systems; the additional funding alone will not solve the current poor water quality in most rivers and stormwater systems in the City of Cape Town municipal area. It is imperative that the "soft issues" are addressed for optimal and sustainable outcomes.

There is a strong economically-motivated business case for investing, maintaining and improving the inland rivers and wetlands of Cape Town. A mere 1% reduction in health costs and a 1% increase in tourism revenue due to good stormwater quality, would justify an additional expenditure of over R110 million and R230 million per annum respectively for the City of Cape Town. Drawing on the lessons of the past in order to engineer better water quality into the future, rivers and wetlands should, as a matter of urgency, be protected and enhanced to create additional value to the economy and benefit to the people living in and visiting Cape Town.

Abbreviations

Chl-a	Algae
CSRM	Catchment, Stormwater and River Management
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs (previously DWAF)
DWAF	Department of Water Affairs and Forestry (now DWA)
EC	Electrical Conductivity
E. coli	Escherichia coli
IZS	Integrated Zoning Scheme
KPI	Key Performance Indicator
NH3	Ammonia
PDNA	PD Naidoo & Associates Consulting Engineers (Pty) Ltd
R&S	Roads and Stormwater
SABS	South African Bureau of Standards
SDF	Spatial Development Framework
SRP	Soluble Reactive Phosphorus
SWM	Solid Waste Management
TR&MP	Transport, Roads & Stormwater, now Transport, Roads & Major Projects
W&S	Water and Sanitation
WWTW	Wastewater Treatment Works

Glossary

- **Conductivity:** A measurement of the ability of an aqueous solution to carry an electrical current (ask.com), used as an indicator of how salt-free, ion-free, or impurity-free the solution is (Wikipedia).
- **Greywater**: Waste water resulting from the use of water for domestic purposes, but does not include human excreta (from DWAF Norms & Standards). However, in this report, and in keeping with the more recently acquired and commonly understood meaning of greywater, it may, and usually does, include human excreta.
- **Infiltration (to sewer):** The inflow of groundwater into a drain or sewer system through defects in pipes, joints or manholes. The infiltration consists of two aspects, one being the continuous inflow of groundwater contributing to the baseflow, and the other being the increase in infiltration in the wetter months due to a rise in groundwater or seepage water that enters the sewer system. This latter component of flow typically has an annual cycle (Advice on the Elimination of Ingress of Stormwater and Infiltration of Groundwater into the Sewer System).
- **Ingress**: Stormwater surface runoff, including runoff from roofs and paved areas, that enters a sewer through deficient manholes, illegal (unauthorised) connections, gullies and overflow pipes, etc. This is a short term phenomenon linked directly to rainfall (Advice on the Elimination of Ingress of Stormwater and Infiltration of Groundwater into the Sewer System).