



Kraaifontein Waste Management Facility

JOINT WINNER – Technical Excellence Category

KEY PLAYERS

Client

City of Cape Town

Professional team

Jeffares & Green / GJA JV

Main contractor

Haw & Inglis Projects

Main sub-contractors

Amandla Civil Contractors,
Frankipile, Anchor Steel

OVERVIEW

The R230 million multi-purpose Kraaifontein Waste Management Facility (KWMF) is the first large-scale 'green-fields' refuse transfer station (1 000 tonnes/day) in South Africa that is integrated with a mechanised materials recovery facility (100 tonnes/day), receiving co-mingled recyclables separated and collected at source. As a fully integrated waste management facility it also encompasses a public drop-off, a greens management facility, offices, a workshop, wash-bays and provision for future 'energy-from-waste' technologies.

A key focus for this facility was to move waste management towards a more sustainable municipal service – one that meets new national waste regulatory requirements, reduces waste transportation costs, provides meaningful employment, effectively diverts waste from landfill and enhances the beneficial use of waste.

The facility was designed to allow waste to become a resource, and incorporated green initiatives. The success of the facility is attributed to excellent teamwork and foresight by the City of Cape Town's Solid Waste Management Department,

and the high degree of civil engineering quality and excellence of the design, construction and project management.

BACKGROUND TO THE FACILITY

Arising from a study conducted by USA Consultants, Wright-Pearce (1999), it was recommended that the City develops a single regional waste disposal (landfill) facility, and as the existing landfills reach their capacity, they would be replaced by satellite refuse transfer stations, with waste being compacted into containers and transported by road or rail to the proposed regional landfill. Typical waste collection (compactor) vehicles are not suitable or cost-effective for transporting waste over long-haul distances. In developing its Integrated Waste Management Policy (IWMP) and Plans in 2005/2006, the philosophy of a regional landfill and associated transfer stations was endorsed by the City.

In April 2007 the City of Cape Town's Solid Waste Management Department commissioned Jeffares & Green (Pty) Ltd, in joint venture with GJA Consulting Engineers, to undertake the civil, mechanical and electrical design

and construction management of the proposed Kraaifontein Refuse Transfer Station and Materials Recovery Facility.

DESCRIPTION OF THE FACILITY

The KWMF is located in Kraaifontein, in the Cape Metropole, and covers approximately 15 ha. The facility involves the integration of a range of various operations, such as the refuse transfer station (RTS), a compaction hall, container handling operations, chipping operation, material recovery facility (MRF), workshop, wash bays, diesel storage, drop-off centre for recyclables and a public drop-off, security building, entrance building, weighbridges, etc.

The facility reduces the impact of waste in our society by directing waste away from landfill and facilitating economically viable recycling operations. The layout has been planned for a containerised bi-modal transport system (i.e. road and/or rail), although initially the transfer of containers will be by road only.

Jeffares & Green, as the lead consultant, undertook the project management, civil, structural, rail, roads and transportation designs, as well as construction monitoring and contract management duties. GJA (project joint-venture partners) were responsible for the electrical and mechanical duties. There were many other multi-professional consultants involved, including surveyors, architects, quantity surveyors, a landscape architect, mechanical plant consultants, etc. The civil and building construction was undertaken by Haw & Inglis Projects (Pty) Ltd, with Amandla Construction providing a main civil engineering sub-contractor role. The Akura/Petrel Engineering JV designed and installed the mechanical plant.

EXCELLENCE, INGENUITY AND INNOVATION IN ENGINEERING

The need for this facility arose as a result of changes to environmental regulatory requirements which led to the City having to close four of its seven operating landfills, with the Bellville South landfill required to close in 2013. The Kraaifontein facility will allow a substantial reduction in the cost of transporting waste to a planned regional/central landfill, and will allow enhanced waste diversion from landfill for the purposes of recycling and re-use. This in turn increases the lifespan of the City's remaining landfill sites.

Built to enhance sustainability

The layout and design were developed to promote sustainability and versatility to allow the operations to adapt to change, as legislation and social awareness are forcing a re-think of waste handling and waste disposal. The project was further developed in response to the City's decision to introduce a separate kerbside co-mingled recyclables collection service, which has now been implemented in many residential areas.

Integration of operations

The innovation of providing a variety of facilities at one location, centralising the integrated management of the solid waste, is a first such large-scale greenfields development for South Africa.

A new type of loading magazine that handles the closed roll-on, roll-off reinforced steel containers, not previously used in South Africa, was designed and constructed to allow three containers to be loaded simultaneously per compactor line. These magazines also allow live-weighing so that the operator of the facility can see immediately (before the containers are taken away) whether the containers have been optimally filled for transporting.

The facility allows the integration of activities, to avoid unnecessary (costly) transportation and handling of

waste, and to divert waste from landfill, thereby indirectly supporting the growth and employment opportunities in a growing and sustainable recycling industry.

Green engineering

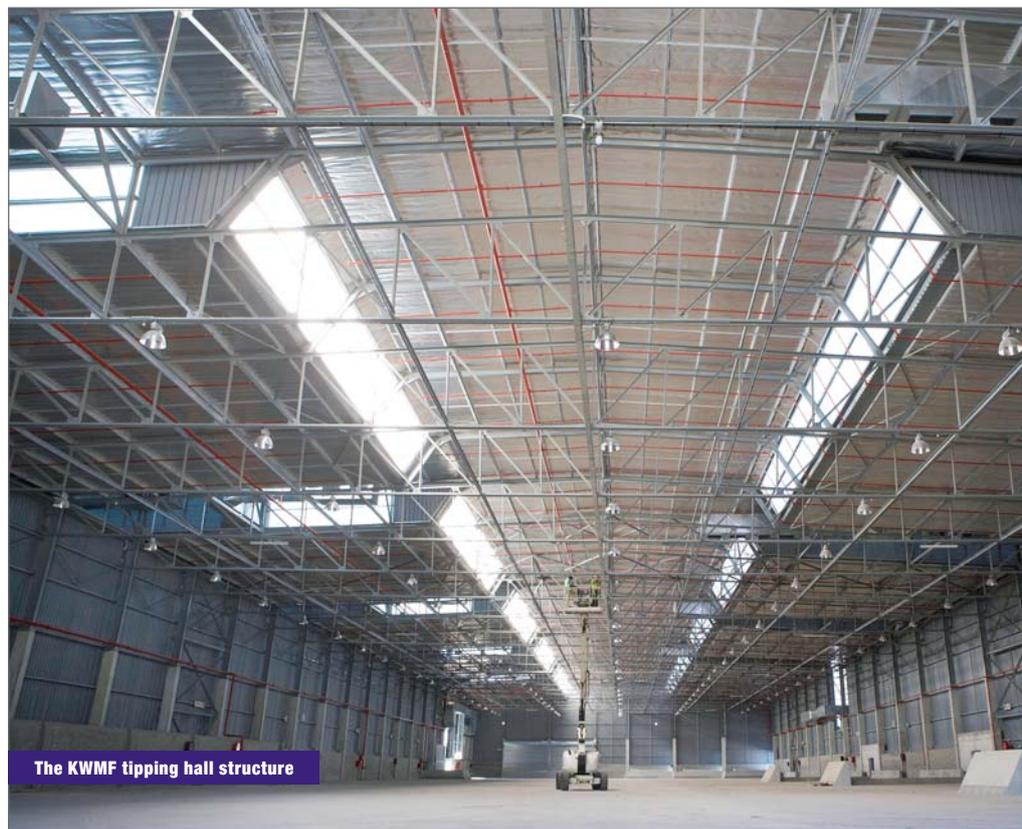
Over and above the extensive engineering input into the design of this facility, the design team focused attention on 'green engineering', such as:

- Supplementary supply of water harvesting
- Low-energy lighting and ventilation
- Water-wise, indigenous greening of the area
- Specially designed oil traps for pollution prevention
- Special litter and silt traps (a design that will be used by the City of Cape Town for research and future use)
- Special bio-swale designed to control and treat polluted stormwater.

Reduced greenhouse gas emissions and carbon footprint

The purpose of the facility is to reduce the impact of transportation of waste and to optimise transportation operations, thus directly reducing carbon emissions.

This facility allows (and promotes) the diversion of waste landfilling and allows waste to become a usable material, returned to industry for re-use.



The KWMF tipping hall structure



Slave vehicle loading container magazine



Loading magazine operation at the KWMF



The compaction hall at the KWMF

Recycling material also uses less energy than making products from raw materials, which in turn reduces the carbon footprint of the products, as well as the demand for raw natural materials. In addition, diverting waste from landfill also reduces the volume of methane gas emissions from landfill sites, further reducing greenhouse gas emissions.

Bi-modal transport design

Extensive transportation economic modelling was undertaken to confirm the location and size of the facility in the context of the City’s waste collection and management areas. The facility was designed to transport waste either by road or rail. Hence, the levels and layout of the facility needed to be designed to respond to either or both modes of transport, which required a rail siding design to be undertaken, whilst ensuring that the current road transfer of compacted waste in containers is optimised. This is a key versatility requirement of the facility.

A study was furthermore undertaken of waste handling systems employed nationally and internationally, including visiting appropriate facilities overseas.

Magnitude of the various components in constructing such a facility

A focal point and challenge was the design of the 148 m x 122 m x 18 m (length x width x height) refuse transfer station structure, integrated with the similarly-sized materials recovery structure, both founded on piles, designed by the Jeffares & Green Structures section.

The design and construction of the facility required the incorporation of specialised mechanical components, including odour control systems, air curtains, the supply and installation of waste compactors, impact conveyors, container-loading magazines; and for the Materials Recovery Facility, bag splitters, multiple-deck-star screens, balers, magnetic separators, etc.

MANAGERIAL COMPETENCE, TIMEOUS COMPLETION AND MEETING BUDGET CONSTRAINTS

The project, which commenced in April 2007, has straddled a period of five years, including an initial period of intensive research (nationally and internationally), planning and analysis to optimise such a facility, developing the

detailed design involving a wide range of expertise, including mechanical, electrical, civil, structural, industrial architecture, process design, greening initiatives, etc, all of which required close coordination.

Construction was completed within the required timeframes and allowed extensions of time. The main civil works (and related structural, mechanical equipment etc), the mechanical infrastructure (compactors etc) and bulk electrical works were completed early in 2011, with the finishing works, and commissioning of the plant undertaken during 2011 to mid-2012.

The financial management of the project led to a significant final cost saving to the tendered civil and mechanical components of the works.

Considerable attention to detail and interaction/communication between the civil/structural engineering designers and contractors were key to the successful outcome of the project. The design needed to accommodate a complex arrangement of mechanised

waste-handling systems and the site layout had to ensure that the containerised handling and the turning movements for long-haul truck-and-trailer

combinations functioned seamlessly and efficiently, with containers loaded to optimal waste payloads. High quality of workmanship and construction was



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essential to overcome the geotechnical constraints of the site and the specific technical demands of the waste facility.

CONCLUSION

The facility is a licenced/ permitted facility. The process for obtaining such a

licence/ permit involved a comprehensive EIA process including public involvement.

The KWWMF facilitates a more sustainable approach to waste management by directing waste from landfill and making large-scale source separation and material recycling financially more feasible.

Another benefit of this facility is employment creation. Approximately 150 new jobs will be directly generated once all the facilities are fully operational.

Aesthetics

Careful consideration was given to the aesthetics of the building. Architects were engaged to create a pleasing 'green' aspect to the buildings to meet the City's aesthetic requirements to "lift the quality of the area". A landscaped access roadway and vegetated green berms were developed, combined with extensive planting. An auditorium and viewing platforms within the facility were developed to accommodate visiting students, scholars and other groups. The public waste drop-off facility was designed to facilitate and attract residents.

ACKNOWLEDGEMENT

Jeffares & Green hereby acknowledge the client, City of Cape Town: Solid Waste Department, for their vision, valued input and support. □



Joint Winner: the justifiably proud team from the Kraaifontein Waste Management Facility with SAICE president Martin van Veelen at the awards function



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