Electron Road site in Durban at the start of construction in March this year

Durban's Electron Road Waste Transfer Station – efficient cost-effective transportation of waste material

THE eTHEKWINI MUNICIPALITY is busy constructing a 1 200 tonnes/day Waste Transfer Station to serve the Durban area. This new waste management facility will provide a modern and mechanised means of transferring municipal general solid wastes to landfill sites efficiently and cost-effectively.

Jeffares & Green (engineering and environmental consultants) were appointed to design a modern, mechanised Waste Transfer Station (WTS) at Electron Road in Springfield Park, an industrial and commercial area north of Durban, near the banks of the Umgeni River.

The main structure, a refuse transfer station and compaction hall, will be built on a site roughly 4 ha in size. This is where waste will be off-loaded, compacted and containerised for bulk transportation. The objective of the facility is to reduce the expense of having to transport solid waste to landfills, which are sited further and further away from the point of generation.

At present, most of the waste in Durban City is disposed at the Bisasar Road landfill site in Springfield Park, but this site is reaching full capacity. When capacity is reached, waste collection vehicles would have to travel to the Buffelsdraai landfill site approximately 33 km away, which is more than double the distance (15 km) that is considered an economic travelling cost for collection vehicles. These prohibitive transport costs have made the provision of a WTS financially viable, particularly since the Electron Road site is less than 1 km from the Bisasar Road site. The reduced travelling will also reduce fuel consumption and wear and tear on roads, and will hence contribute to reduction in carbon emissions.

DESIGN

The Electron Road WTS will comprise a main four-storey building and some 4 290 m^2 in plan, in which waste will be off-loaded into compaction units, compacted into purpose-made containers for bulk transportation, and then transported to the new Buffelsdraai landfill site. Associated infrastructure will include a three-storey office block adjacent to the main compaction house, as well as an auditorium for education and training purposes.

The upgrading of Electron Road itself entails, amongst others, providing dedicated access to the site, and access roads to the various handling areas within the site. The full contract involves the construction of the refuse transfer station, a compaction hall, container-handling operations, offices, weighbridge infrastructure, and mechanical equipment and plant, in addition to a workshop, wash bay, diesel storage facility, security facilities, and the entrance building.

The design also includes the maximum use of natural lighting and ventilation, stormwater treatment, and pollution control by means of litter traps, silt traps and oil traps. Specific stormwater treatment processes have been designed to control pollution and allow discharge of an acceptable effluent from the site.

A unique feature of this project is the compaction process that will be used for the first time in South Africa. This system was accepted as an alternative design proposed by the successful bidder, Aveng Construction. The Husmann Compaction System, imported from Germany, does not use conveyors, and provides an extremely quick and clean answer to waste compaction.

CONSTRUCTION

Construction on this R140 million project started on 12 March this year and will continue for 78 weeks, although the contractor is targeting an earlier completion date. Piling and layer works are currently in progress. According to Brad Wyatt, senior contracts manager, Aveng will be using a unique approach to the required 156 concrete columns: "Instead of doing 7.5 m columns in the conventional way, we will be pre-casting them on the ground and then lifting them into place," he says. "This will result in outstanding quality, plus a safer and quicker method than the conventional way."

Another innovative construction approach will be the tilt-up wall system which will be erected fully-formed on site. Instead of conventional brickwork needing to be laid layer by layer, these walls are cast in proprietary moulds that have the same face-brick finish as a conventional wall and will then be erected as complete units.

GEOTECHNICAL ENGINEERING

As mentioned above, piling is currently under way, but in founding conditions that are less than ideal, as the site is underlain by deep alluvial deposits which are typical of the low-lying areas in and around Durban. These harbour beds comprise unconsolidated sediments of sand, silts and clays in variable layer thicknesses which extend to considerable depths. The soft-clay horizons have a high organic content and are highly compressible, resulting in long-term settlement of the clays once an imposed load is applied.

Specialist piezocone testing was undertaken across the footprint of the structure.The piezocone equipment is a modification from the original cone penetration test (CPT). The results of the piezocone testing indicated that a competent founding medium of dense coarse sand was encountered only at a depth of about 25 m below ground level.

Several piling options were investigated and the precast driven pile was the one most suited to the site, as it is capable of extending to significant depths and is relatively quick to install. The final design includes more than 400 No 350 mm x 350 mm

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A similar stormwater bio-swale as this one at the Kraaifontein Waste Management Centre in Cape Town will be built at the Electron Road site

precast driven piles to depths between 25 and 29 m, and even beyond. Some recently driven piles have reached a depth of 39 m.

LANDSCAPING

DSW Cleansing & Solid Waste will apply the same award-winning environmental approach at Electron Road as was used at the Mariannhill Landfill Conservancy Site, just outside Durban, which is today considered a best-practice ecosystem restoration project.

An example of the materials recovery process

The successful process is driven by PRUNIT (Plant Rescue and Relocation Unit), headed up by Richard Winn, a horticulturalist and rehabilitation specialist. This unit applies the philosophy of moving plant species once only, and uses a rehabilitation nursery only as a backup when direct relocation is not possible. The basic principles are:

- To try and relocate species to an environment as close to the original as possible.
- To import no foreign soils.
- To relocate grasslands together with original topsoil.
- To relocate original watercourse species to wetland nurseries for future utilisation.
- To create similar habitat to what originally occurred.
- To only relocate species within 50 km, as per international biodiversity protocol, but preferably closer.

This ecosystem restoration project has created a large holding nursery for storage of indigenous vegetation, which has been "hardened-off" to withstand rigorous conditions with little or no maintenance. For example, a nursery of wetland plants has been grown for the future establishment of "leachate through wetland" processes of returning water back into the environment, and these plants have been specifically hardened-off for contaminants found in the waste industry.

Very little plant material could be salvaged from the Electron Road site and DSW, PRUNIT and Jeffares & Green worked closely together to develop an Autocad design of what could be provided by the holding nursery.

Clearly this is not a "plant by numbers" landscaping process, but rather an attempt to create a sustainable ecosystem where every plant is selected and planted to fulfil a specific purpose.

The engineered stormwater swales, rainwater harvesting and stormwater ponds have been designed to interlink, and are to be planted with indigenous vegetation selected to help provide functional solutions to issues identified on site.

Street furniture, lighting, signage, benches, tables and water points have been incorporated into the landscape design, together with habitat creation opportunities, including bird totem poles, structures for fly traps, and bat and owl houses, linked to the rodents, insects and reptiles that are likely to establish themselves along with the operational activities of the site. A deck area has also been included on the western stormwater attenuation pond, linked to the office building on site. The project is indeed an attempt to soften the environmental impact with natural, green solutions.

OTHER GREEN ENGINEERING INITIATIVES

Various other green elements have been considered, over and above those already mentioned. One such carefully designed aspect is the bio-swale, which is a landscaped open stormwater system (channel) to enhance the removal of solids, metals, and the like.

Other initiatives are, for example, stormwater inlets designed to effectively remove litter and sediment before these reach other systems. Rainwater, too, will be captured for beneficial use and for the washing of floors, containers and vehicles on site. Visual aids to monitor energy consumption on site, are also being considered.

▶ INFO

Charmagne Denny
Marketing and Communications Manager
Jeffares & Green (Pty) Ltd
dennyc@jgi.co.za

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