Reinvent the Toilet Challenge Phase II

Data Acquisition and Field Support for Sanitation Projects

Sanitation Tour

Pollution Research Group, University of KwaZulu-Natal, Durban and eThekwini Water and Sanitation, Durban

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UNIVERSITY OF KWAZULU-NATAL

ETHEKWINI MUNICIPALITY

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List of Abbreviations

ABR	Anaerobic Baffled Reactor
BORDA	Bremen Research and Development Association
CAB	Community Ablution Block
DEWATS	Decentralised Wastewater Treatment System
EWS	eThekwini Water and Sanitation
LaDePa	Latrine Dehydration and Pasteurisation
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
PRG	Pollution Research Group
UDDT	Urine Diversion Dehydration Toilet
UKZN	University of KwaZulu-Natal
VIP	Ventilated Pit Latrine
WWTW	Wastewater Treatment Works

1. Introduction and Background

The "Sanitation Tour" aims to introduce the visiting researcher to the different types of sanitation technologies currently in place within eThekwini and the research being undertaken by eThekwini Water and Sanitation (EWS) and the Pollution Research Group (PRG) at the University of KwaZulu-Natal.

This document provides an overview of each type of technology, and provides a summary of each site that will be visited together with some photographs.

The types of sanitation solutions include the following:

- Ventilated improved pit latrines (VIP)
- Urine Diversion Dehydration Toilets (UDDT)
- Community ablution blocks (CAB)
- Decentralised wastewater treatment systems (DEWATS)

Research relation work includes:

- VIP emptying and characterisation of the pit contents
- Processing of VIP sludge through a pasteurising process
- Various designs of the UDDT to improve operation
- Processing of urine to recover nutrients

The reason for these different sanitation technologies is largely due to the nature of the challenges faced by eThekwini Water and Sanitation in providing adequate sanitation services and systems to people living in informal settlements within with the urban environment, as well as those living in areas (mainly rural) where there is no access to water borne sewerage systems.

1.1. Informal Settlements

One of the main challenges faced by eThekwini Water and Sanitation (EWS) is the provision of services to dense informal settlements which have formed due to the rapid and increasing migration of people into the city seeking job opportunities. There are currently an estimated 360 informal settlements spread throughout the city with between 45 and 75 dwellings per hectare (or 10 000m^2), and housing in the region of one million people. This comprises over 60% of the housing backlog in eThekwini. (A backlog refers to the number of people without access to basic housing, water and sanitation services, which is a constitutional right in South Africa). These settlements range in size from a few dwellings to almost 14 000 with an average settlement comprising 440 dwellings. In total there are approximately 227 000 families living in informal settlements. These dwellings (*shacks*) are typically built with mud, wood or corrugated iron and these areas are generally lacking in water, sanitation and electricity services.

Examples of informal settlements that will be visited include:

- Frasers
- Johanna Road
- Malacca Road
- Besters

1.2 Rural communities

In December 2000 the eThekwini municipal boundary was expanded from 1,366 km^2 with a population of 2.5 million people to 2,297 km^2 with a population of 3.5 million people. The newly included areas were predominantly rural and had little or no sanitation or water infrastructure. The eThekwini municipality had been providing Ventilated Improved Pit (VIP) latrines and 300 litre water tanks to the rural areas that were included in the municipal boundaries prior to the expansion. The newly included areas that were to be serviced by eThekwini municipality after the expansion resulted in a "backlog" for sanitation and water. The high cost of emptying VIPs and the inaccessibility of many rural settlements due to the topography led the eThekwini municipality to rethink the manner in which they would provide sanitation and water services to these areas.

The development and implementation of urine diversion dehydration toilets (UDDTs) in eThekwini municipality began in 2002; this was regarded as the most cost effective technology to begin addressing the sanitation "backlog". The prevention of further outbreaks of waterborne diseases among the population and the lowering of maintenance costs of the sanitation system for the municipality were the driving forces of the project.

Rural sites that will be visited include:

- Mzinyathi (Shongweni)

1.3 Ventilated Improved Pit Latrines (VIPs)

Ventilated improved pit latrines were provided in housing developments not served by a sewer. They have a solid top structure above a reinforced pit. In time (12 to 16 years) the pit fills and the contents need to be removed. After a number of pilot projects, the eThekwini Municipality emptied all 40 000 VIP pits over a three-year period. A range of suitable tools were developed. The preferences for disposing of the contents are:

(i) on-site disposal in a hole nearby the existing VIP if there is sufficient suitable ground adjacent to the pit;
(ii) deep row entrenchment;
(iii) lime stabilisation and disposal to solid landfill site;
(iv) deep marine discharge through a pipeline serving wastewater treatment works if sufficiently close to a suitable wastewater treatment works or associated sewer; and
(v) transport to a specially developed process for the dehydration and pasteurisation of the pit contents (LaDePa – Latrine Dehydration and Pasteurisation).

Teams of entrepreneurs were established to undertake the emptying service. Local people were employed within each area being served.

The LaDePa pellets are being tested for their use as an agricultural soil remediant.

A pit emptying programme has since been established by EWS which allows for each VIP to be emptied once every 5 years at no cost to the household as costs are borne by the Municipality. An understanding of the nature of the sludge in the pits is key to determining the most suitable method of emptying and disposing of the sludge. VIPs are

therefore generally classified as either "wet" or "dry" and a number of projects have been conducted into determining the characteristics of the sludge and the most appropriate treatment route.

These include:

- Determining the mechanical and chemical properties of the sludge (a project funded by the Bill and Melinda Gates Foundation (BMGF));
- The development of the **La**trine **De**hydration and **Pa**steurisation (LaDePa)pelletising machine by the EWS in partnership with a private organisation (Particle Separation Services) to process the sludge to prepare pellets for use in agriculture;
- Deep row entrenchment of the sludge (i.e. burial);
- Obtaining an understanding of the processes taking place within the VIP (a project funded by the SA Water Research Commission)

Examples of VIPs can be viewed at:

- Besters
- Malacca Road (CAB with VIPs)

The processing of the sludge in the LaDePa pelletising machine can be viewed at:

- Tongaat Wastewater Treatment Works (full-scale processing of pit sludge to produce pellets)
- Pollution Research Group (small-scale LaDePa for conducting trials).

1.4 Urine Diversion Dehydration Toilets (UDDTs)

The development and implementation of urine diversion dehydration toilets (UDDTs) in eThekwini municipality began in 2002; this was regarded as the most cost effective technology to implement towards addressing the sanitation "backlog" in the rural and peri-urban areas. The prevention of further outbreaks of waterborne diseases among the population and the lowering of maintenance costs of the sanitation system for the municipality were the driving forces of the project.

This rural water and sanitation project is unique in South Africa as it integrates the delivery of household water facilities (through the use of potable water yard taps and tanks) and appropriate sanitation services (UDDTs) as well as household hygiene education and operation and maintenance training as a single 'package'.

Separating urine from faeces leads to the inactivation of disease-causing pathogens found in faecal matter through the action of drying and time in storage. The toilet superstructure consists of two separate vaults (above or below ground level) each with an elevated vent pipe, a cover slab, and toilet housing with door. The two vaults are used, such that, while the content of one full vault continues to dry out (desiccate) during storage, the second vault is in use.

In South Africa, a sitting toilet is used, so the sitting pedestal of the toilet would be moved from the vault that is in long-term storage, over the second vault that is active and in use (this contrasted from locations of the world where people squat to use the toilet and the typical design is to provide two squat pans, one for each vault). Sand is

used here as cover and as the desiccant (ash, or dried leaves can also be used). Cover material serves two purposes:

- Disease-causing pathogens require a moist environment to persist and be active in their ability to transmit diseases. Thus, by not moistening by mixing with urine, and covering with a desiccant to facilitate drying, most pathogens are inactivated. Further, pathogens only persist for a period of time, so storage time during desiccation is part of the treatment technology of the UDDT.
- Covering the faeces reduces the opportunity for vector contact (for example, flies) that can transmit disease-causing pathogens to humans.

Flies are prevented through the design and construction of the elevated vent pipe that allows sunlight in to attract flies that are caught behind a fly screen, and also prevents them from entering into the vault. After storage, the dried solid contents can be buried in a pit onsite. Provision is made for the manual emptying of each vault once the material is safe to remove. The diverted urine from UDDTs presently is directed to a soak pit onsite. Possible collection and processing of urine into fertilizers is being researched.

The toilet is provided to the householder at no cost but the responsibility for the manual emptying of each pit from time to time is that of the householder. A programme for the delivery of UDD toilets commenced in 2002 and has delivered some 80 000 toilets to date. The delivery was conducted in a series of project areas which has now covered all the rural area. Planning is in place for the construction and delivery of around 300 new toilets per month, thus eliminating the backlog in some 5 to 6 years. The influx into the municipality and internal movement requires new sanitation facilities to be installed continually.

EWS continues to investigate methods of improving the design of the UDDT, such as the construction materials, access to the vaults, retrofitting pour-flush pedestals; the possible collection of urine for processing into fertiliser; the use of vermiculture to process the excreta; and the use of a ceramic super hydrophobic coated pedestal to prevent "sticking". All of these can be viewed on the sanitation tour at the following sites:

- Mzinyathi
- Malacca Road
- Newlands Research and Development Site (different test structures – the UD toilets used by EWS have been supplied by Atlas (www.atlasplastics.co.za) and Envirosan (www.envirosan.co.za)).

1.5 Community Ablution Blocks

The large number of informal settlements with the Municipality has resulted in the need for a novel approach to dealing with the provision of sanitation services. The use of community ablution blocks (CAB) was found to be the most effective solution as it provided each household with access to basic sanitation services, pending the formal re-housing programme of the city, which aims to eradicate informal dwellings over the next decades and relocate people in fully serviced houses.

Within EWS, these CABs consist of two modified converted shipping containers (one for males and one for females) each consisting of two showers, three toilet cubicles (males two + two urinals), two wash hand basins and two external laundry troughs.

The main criteria are:

- One facility per 75 dwellings (average occupancy is 4 to 5 people per dwelling), or a radius of 200 m.
- Free access
- Caretaker in attendance for four hours per day (paid by municipality)
- Toilet paper, facility cleaning materials and maintenance provided by the municipality

Sites that will be visited include:

- Frasers informal settlement - CABs coupled to DEWATS
- Johanna Road – CAB coupled to sewer
- Malacca Road – CABs coupled to VIPs

1.6 Decentralised Wastewater Treatment Systems (DEWATS)

The decentralised approach to wastewater involves the treatment and disposal of wastewater close to the source it was generated. These treatment systems vary in scale from individual households to communal systems. DEWATS plants are increasingly becoming popular in developing countries, especially South East Asia, as on option for sanitation in densely-populated areas. One of the more recognised DEWATS treatment process is the one implemented by the German non-profit organisation *Bremen Overseas Research and Development Association* (BORDA).

The use of DEWATS is being investigated by EWS as an alternative to septic tank systems for the treatment of household wastewater where connection to the central sewer system and conventional wastewater treatment system is not possible. Various configurations are being trialled and monitored in order to identify operational issues and effectiveness.

Sites that will be visited where DEWATS are in use include:

- Frasers informal settlement – CABs linked to DEWATS
- Sarasvati School – school ablutions linked to DEWATS
- Newlands Research and Development Site – DEWATS test site

1.7 Research facilities

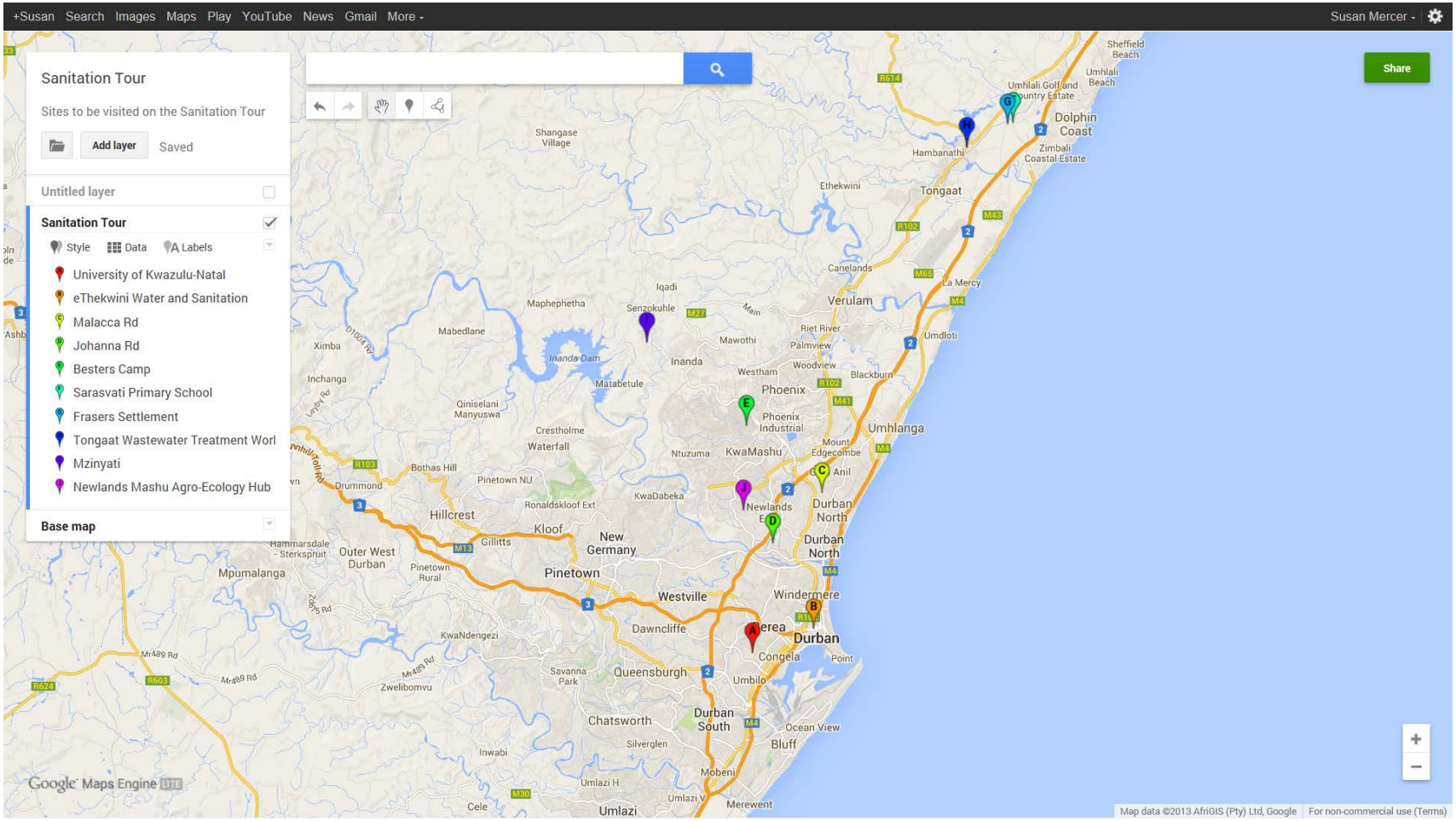
eThekwini Water and Sanitation have a close working relationship with a number of tertiary educational organisations in order to undertake research into various sanitation and wastewater treatment technologies.

Sites that will be visited are:

- The Biochemical processing laboratory at the University of KwaZulu-Natal (Pollution Research Group)
- Newlands Research and Development Site

2. Map of the area

Each of the sites that can be visited has been marked on the Google map below in order to provide an indication of their location.)https://mapsengine.google.com/map/edit?mid=zMl0sXwzx6y0.k1xhcZ0UlJCk).



3. Site Visits

This section provides an overview of each of the sites mentioned in Section 1 together with more detailed information on the sites, their location and some photographs. The names of the "Tour Guides" are also provided as these are the people responsible for these areas and who either work for the Municipality (EWS) or the Pollution Research Group.

3.1 Frasers Informal Settlement

Location:	Frasers informal settlement, Tongaat (29.53; 31.12)
Type of sanitation system/facility:	Decentralised Wastewater Treatment & Community Ablution Block
Tour Guides	Lucky Sibaya (EWS) and Tina Velkushanova (PRG)

Description:

During 2011 and 2012 EWS piloted the provision of Community Ablution Blocks (CABs) in an informal settlement using decentralised wastewater treatment (DEWATs). The settlement, Frasers, is geographically located near Tongaat, in the northern section of eThekwini. This peri-urban informal settlement cannot economically be provided with a sewerage connection. The settlement has a population of 397 households. The CAB effluent is treated by a combination of anaerobic baffled reactors (ABRs) or septic tanks (for primary-treatment), and evapotranspiration fields (for secondary treatment). The design of the ABRs and septic tanks was based on previous in-house guidelines and are being piloted in this area.

Monitoring of the end-use water demand is achieved by measuring the water consumption of each type of fitting (toilets, showers, laundry, hand wash basins, urinals) in the male and the female containers using domestic water meters (9 water meters in total for the CAB facility).

The quantitative understanding of the end-use demand patterns will provide guidelines which will enable optimisation of the design of these decentralised treatment facilities for communal water and sanitation facilities.

References:

P Crous1, J Haarhoff and CA Buckley (2013), Water demand characteristics of shared water and sanitation facilities: Experiences from community ablution blocks in eThekwini Municipality, South Africa, Water SA.

P Crous, J Haarhoff, CA Buckley, L Tavener-Smith, E Roma (2012), Towards understanding the effect of distance on shared water and sanitation provision, WISA conference, Cape Town

P Crous1, J Haarhoff and CA Buckley (2013), Can shared facilities be sustainable? Experience from communal ablution blocks in eThekwini, South Africa; 36th WEDC International Conference, Nakuru, Kenya

Multi-chambered ABR under construction

3.2 Sarasvati School

Location:	Frasers, Tongaat (29.53; 31.17)
Type of sanitation system/facility:	Decentralised Wastewater Treatment; School toilet School garden; Rain water harvesting
Tour Guides	Lucky Sibaya and Tina Velkushanova



Description:

Sarasvati Primary School is situated in Frasers Informal Settlement situated in the north of Durban about 10 km from Tongaat. The school currently caters for about 350 learners from this community and other surrounding poor communities. Although the school is funded by government it is generally under-resourced and poor.

In 2010, and MOA was signed between Hering GmbH & Co. KG Verwaltungsgesellschaft (a German based family owned company), eThekwini Water and Sanitation (EWS), the University of KwaZulu Natal (through the Pollution Research Group), and BORDA (Bremen Research and Development Association) in Germany, to develop a sustainable sanitation solution for schools. Sarasvati School was chosen as the pilot site for this project.

Prior to the project, the sanitation facilities at the school consisted of 3 toilet blocks for the learners with 14 toilets in total. All toilets were flush toilets, connected to septic tanks and soak-aways. Only two toilets were operational while the other toilets could not be used due to broken equipment, broken or missing doors and problems with overflowing septic tanks. The overflowing septic tanks caused pollution of the areas around the toilets and bad odours.

The school toilets consist of predesigned and prefabricated sanitation modules. Water saving devices was used for the toilets and the wash basins. Plumbing fittings are hidden thus reducing the possibility for breakage and vandalism. Wastewater treatment is carried out by means of an "advanced septic tank" (or Anaerobic Baffled Reactor - ABR) and a soak-away situated behind the biodigester. Rainwater tanks were installed to collect rainwater for flushing the toilets and for use in the school garden.

References:

DES (2012), Sarasvati School fact sheet; ***www.des-za.org***

E Roma, AOkem and C Buckley (2012); Sarasvati school study - Before and after case control evaluation Progress report (internal report prepared for Hering International)

Herring SA - www.heringinternational.co.za

3.3 Joanna Road Informal Settlement

Location:	Johanna Road (29.798; 30.995)
Type of sanitation system/facility:	Informal settlement; Community Ablution Block linked to sewer
Tour Guides	Lucky Sibiya

Description:

Johanna Road informal settlement forms part of the larger Kenville informal settlement located outside of Durban near the Northern Water Treatment Works. The settlement consists of about 75 shacks with approximately 300 people.

In 2011 EWS provided communal ablution block as an interim solution for the provision of Water and Sanitation to the settlement. The CAB is connected to the existing sewer line.

The settlement caught fire in 2012, after which it was converted to a transit camp.

There are two CABs in the settlement – one block built and one container. Both have separate facilities for male and female residents consisting of toilets (and urinals), wash basins, showers and an outside laundry facility.

Two caretakers, who are residents of the settlement, are employed for each CAB on a part-time basis by EWS to take care of the cleaning, guiding residents in the proper usage of the facility and reporting of defects to EWS. EWS provides consumables such as toilet papers and cleaning agents (e.g. germatol), and also takes care of the maintenance of the facility.

References:

Elisa Roma, Chris Buckley, Bruce Jefferson and Paul Jeffrey (2010); Assessing users' experience of shared sanitation facilities: A case study of community ablution blocks in Durban, South Africa Water SA Vol. 36 No. 5 October 2010

Nancy Maksimoski and Anthony Waterkeyn; The community health club approach in informal Settlements: case study from Ethekwini Municipality, KZN, South Africa (paper by AfricaAHEAD)

http://www.susana.org/lang-en/case-studies?view=ccbktypeitem&type=2&id=792

3.4 Malacca Road Informal Settlement

Location:	Malacca Road, Durban (29.766; 31.031)
Type of sanitation system/facility:	Informal settlement & Community Ablution Blocks with pit latrines
Tour Guides	Lucky Sibiya

Description:

The area consists of about 80 informal dwellings housing approximately 250 people. In 2008, the Malacca Road settlement was provided with two block built community ablution blocks (one for each area) which are not connected to the sewer, but make use of pit latrines. These pits are emptied regularly by the municipality. These CABs have toilets, showers and a washing area. One caretaker takes care of both facilities in terms of cleaning and reporting of faults.

References:

http://www.susana.org/lang-en/case-studies?view=ccbktypeitem&type=2&id=792

3.5 Mzinyati Rural Area

Location:	Inanda (29.6713789,30.9042379)
Type of sanitation system/facility:	Urine Diversion Toilets and Yard water tanks
Tour Guides	Lucky Sibiya and Tina Velkushanova

Description:

Mzinyati is situated in Inanda just outside of Durban with approximately 7 500 households. This is mountainous rural area, making access to household toilets difficult. Based on EWS policy, water and sanitation services are delivered as a package with the supply of 300 litres of water per day indicating the need for dry sanitation such as the Urine Diversion Dehydration Toilets (UDDT). Education forms a key aspect of the programme.

The structure for the UDDT is provided free of charge through national funding, while households responsible for operation and maintenance.

Projects aimed at improving the design of the UDDT and investigating the collection of urine for extracting nutrients is currently taking place.

References:

www.susanna.org: Case study of sustainable sanitation projects: Large-scale peri-urban and rural sanitation with UDDTs eThekwini Municipality (Durban) South Africa

Teddy Gounden, Bill Pfaff, Neil Macleod & Chris Buckley (2006); Provision of Free Sustainable Basic Sanitation: The Durban Experience; 32nd WEDC International Conference, Colombo, Sri Lanka.

3.6 Besters Informal Settlement

Location:	Bridge City, Durban (29.723; 30.976)
Type of sanitation system/facility:	Wet and dry VIP; Pit emptying
Tour Guides	Lucky Sibiya and Tina Velkushanova

Description:

Besters informal settlements has around 4000 households. It's a semi developed area with low cost houses, free 300 litres basic water connection and VIP toilets. There is no drainage system in place since the area became linked to the sewer system and grey water disposal is a challenge. The VIP's are about 20 years old and there is a huge engineering challenge in terms of putting sewer reticulation in the area.

Current municipal policy is to empty the pits on a regular five-year cycle.

A six-person pit emptying team empties two pits per day. Workers undergo stringent pre and post-employment medical examinations. Strict health and safety protocols are enforced by an external auditor. The householder signs off for each emptying service. The location of all VIPs is registered on the municipal GIS system.

References:

Dave Wilson and John Harrison: eThekwini pit emptying programme (FSM2, Durban 2102); http://www.susana.org/images/documents/07-cap-dev/b-conferences/12-FSM2/c7.2-fsm2-wilson-harrison-ethekwini-municipality.pdf

3.7 Latrine Dehydration and Pasteurisation (LaDePa)

Location:	Tongaat wastewater treatment works, Durban (29.548; 31.137)
Type of sanitation system/facility:	LaDePa Pelletising Machine (Full-scale)
Tour Guides	Dave Wilson and John Harrison

Description:

There are six major technical challenges associated with pit latrine sludge management:

1) Space and Access – prevents relocation of pit latrines in dense settlements and access for large scale mechanical equipment. In addition space is required for the final disposal of the sludge.
2) Human pathogen transmission.
3) Detritus disposed with the human faecal matter.
4) Material handling difficulties associated with the "stickiness" of sludge.
5) Added transport costs associated with mass of excess water.
6) Disposal of sludge.

From an environmental perspective, phosphates are a scarce non-renewable resource found in urine and therefore deposited in pit latrine sludge. The current sludge disposal methods, not only wastes the phosphate and other nutrients, but also takes up air space on the landfill sites. Disposal of sludge at sewerage treatment works is not a viable option as it creates problems with the nitrification process and organically overloads the digesters.

LaDePa (**La**trine **De**hydration and **Pa**steurisation) is a machine that provides a containerised system for producing a nutrient rich soil conditioner that is workable and improves sustainability on a number of fronts, by removing the detritus, and pasteurising and drying the sludge to beyond the sticky phase. Due to its use of low technology, LaDePa relates well to the social environment where pit latrines are usually encountered in the developing world urban areas as it provides both business and work opportunities for the poorly skilled.

The operation of the pilot LaDePa in Durban and the Municipality's pit emptying project, together with tests done on the product from the machine, indicate that LaDePa should significantly shift the Pit Latrine sludge management paradigm towards sustainability.

This process converts what was previously a waste into a saleable product, which off-sets some of cost associated with other disposal methods, thereby further enhancing the potential for commercialisation of this technology.

Capacity: 2 500 kg/day at 70% solids (8 h/d); Services population of 62 000 (8 h/d, 365 d/y); Diesel consumption 100 l/d (i.e. 1 l diesel /25 kg dried sludge (70% solids); 0,6 l diesel/person/annum)

References:

www.parsep.co.za

Dave Wilson and John Harrison: Towards sustainable VIP sludge management through LaDePa (FSM2, Durban 2102); http://www.susana.org/images/documents/07-cap-dev/b-conferences/12-FSM2/a7.4-fsm2-harrison-ethekwini-water-sanitation-south-africa.pdf

3.8 Newlands Research and Development Site

Location:	Durban North (29.773; 30.974)
Type of sanitation system/facility:	Decentralised wastewater treatment; Field-site located laboratory Pilot struvite reactor for urine precipitation (for phosphate recovery) Moving bed biofilm reactor (MBBR) to nitrify and recover all nutrients from urine Vermiculture composting and agriculture
Tour Guides	Björn Pietruschka; Max Grau and Sara Rhoton

Description:

The Newlands Research and Development Site has been chosen for integrated research on sanitation, decentralised waste water treatment, nutrient recovery and recycling, and agriculture. The Newlands Research Site provides a controlled environment where sanitation systems, resource recovery, and agricultural recycling of recovered resources can be evaluated and developed. Trials at Newlands are part of the eThekwini Municipality's long-term strategy relative to sanitation systems for both existing and new housing projects. The research focus encompasses several important life cycle considerations that support planning for services that extend beyond a single goal of providing sanitation.

Currently, there are three main focus areas of research at the Newlands Research Site:

1) sanitation systems of various types
2) technologies to recover valuable resources from sanitation systems
3) agricultural trials investigating the recycling and reuse of resources to the soil.

Sanitation systems currently being evaluated at the Newlands Research Site include a decentralised wastewater treatment system (DEWATS) and on-site urine diversion dry sanitation toilet systems. Valuable resources can be recovered from sanitation systems, and when properly treated and hygienised, can be reused and recycled into agricultural projects. These resources include nutrients that are formed into fertilisers, purified water, soil amendments, and energy.

The VUNA (valorisation of urine nutrients in Africa) Project is a collaborative research project between Eawag in Switzerland, eThekwini, and PRG that is funded by the Bill & Melinda Gates Foundation. One aim of the VUNA project at the research site is to evaluate two process treatment units that recover valuable nutrients from urine, including phosphorus and nitrogen. The struvite process generates a phosphorus-rich solid fertilizer. The biological nitrification MBBR produces a nutrient-rich liquid fertilizer that contains most of the nutrients initially present in the urine. Agricultural trials are underway to evaluate the use of these sanitation-derived fertilizers, funded under a Water Research Council project.

References:

DEWATS: www.borda-net.org; VUNA: www.vuna.ch

Grau, M.G.P., Rhoton, S.L., Brouckaert, C.J., Buckley, C.A. (2013) Development of a fully automated struvite reactor to recover phosphorus from source separated urine collected at urine diversion toilets in eThekwini WEF/IWA Nutrient Removal and Recovery 2013, 28-31 July 2013, Vancouver, Canada.

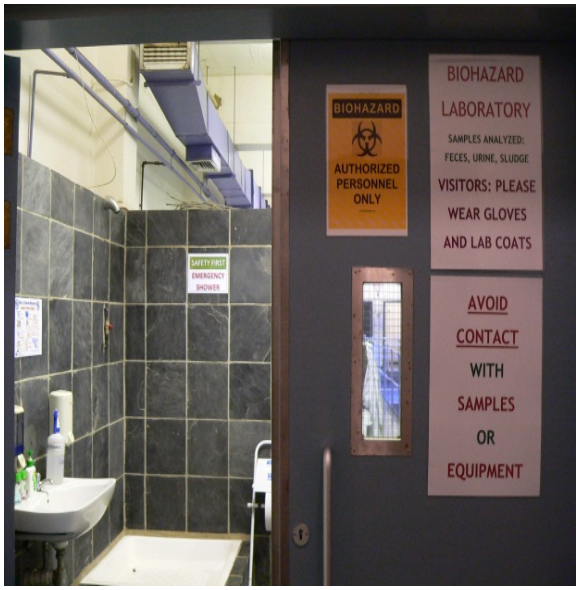
Various presentations on VUNA project: ***http://www.susana.org/images/documents/07-cap-dev/b-conferences/12-FSM2***

3.9 Pollution Research Group Bioprocessing Engineering Laboratory

Location:	University of KwaZulu-Natal, Durban (29.867506,30.980939000000035)
Type of sanitation system/facility:	Laboratory instruments for sludge and urine testing
Tour Guides	Merlien Reddy and Tina Velkushanova

Description:

The Bioprocess Engineering Laboratory is occupied and managed by the Pollution Research Group. The laboratory is mainly used to investigate human excreta and sewage from the perspective of obtaining design and process data for on-site, decentralised and conventional wastewater treatment facilities. Major sources of funding are the Bill and Melinda Gates Foundation, eThekwini Water and Sanitation, the South African Water Research Commission and Sasol.



This group supervises undergraduate students undertaking final year laboratory projects as well as postgraduate students undertaking research work. The facilities are used by Gates Foundation Grantees involved in sanitation related projects.

Some of the equipment/apparatus that can be found in this laboratory include an Oxygen Uptake Rate (OUR**)** set up, microwave extraction method for Chemical Oxygen Demand (COD), Total Kjeldhal Nitrogen (TKN), Total Suspended Solids (TS), a Spectroquant, a Gas Chromatograph, calorimeter, thermal conductivity and heat capacity measurement etc.

Pilot plant equipment includes membrane filtration, nitrification, evaporation and drying rigs, and a laboratory scale LaDePa pelletising machine.

Satellite laboratories are operated in conjunction with eThekwini Water and Sanitation at various municipal installations such as Newlands Mashu and Amanzimtoti Wastewater Treatment Works.

References:

Chris Buckley – an overview of FSM research in Durban (FSM2, Durban 2012)

http://www.susana.org/lang-en/conference-and-training-materials/materials-of-conferences/2012-conferences/243-2012-conferences/781-fsm2-durban-south-africa-october-2012

4. Tour Guides

eThekwini Water and Sanitation

Lucky Sibiya

Lucky is the Senior Education and Capacity Building Officer within the Education and Community Liaison division at EWS. He has been employed by EWS for 23 years. His main responsibilities are to supervise staff in carrying out the education/awareness to schools and communities and ensuring that the community facilitation is effectively effected on the rolling out of the Water and Sanitation programmes e.g. Rapid roll out of community ablutions in the informal settlement and the provision of services in the Rural areas. Lucky also assists in taking out the delegates to sites where projects are being carried out.

Contact info: Tel: + 27 (0) 83 232-3037; email: Lucky.Sibiya@durban.gov.za

Dave Wilson

Dave a registered Civil Engineering Technologist and has been employed by the Ethekwini Municipality for approx. 34 years. He spent 16 years in the Sewer Design office and 16 years as the Area Engineer of Wastewater Networks Operations Northern Branch. Dave is currently Acting Snr manager for Ethekwini Wastewater Networks Branch. In operations he was responsible for the VIP emptying program in the Ethekwini region and has been instrumental in developing the LaDePa sludge processing plant in conjunction with John Harrison and Rein Buisman.

Contact info: Tel: + 27 (0) 83 269-4276; email: Dave.Wilson@durban.gov.za

John Harrison

John is a Civil Engineer working in the Planning Section of eThekwini Water and Sanitation who has concentrated mainly on the sanitation field and has 30 odd years of experience.

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Max Grau

Maximilian Grau studied environmental engineering in Stuttgart and finished his degree as Dipl.-Ing. (equiv. to MSc) in 2010. He worked as a Researcher on household drinking water system at Eawag in Switzerland until beginning of 2011. Afterwards he joined the collaborative VUNA project between Eawag, University of KwaZulu-Natal and the eThekwini Municipality to develop reactors for nutrient recovery from source separated urine in Durban, South Africa. In May 2013 he started to work for the eThekwini Municipality as Project Engineer in the Reinvent the Toilet Challenge project.

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Pollution Research Group

Chris Buckley

Prof Buckley is a chemical engineer and has spent his career as a contract researcher in the field of urban and industrial water and effluent management at the University of Natal and currently the University of KwaZulu-Natal. The primary funding sources are the South African Water Research Commission, eThekwini Municipality, the Bill & Melinda Gates Foundation, Sasol and Umgeni Water. He has partnerships with many international research groups.

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Tina Velkushanova

Tina Velkushanova has a background in Environmental Management and Engineering. Since April 2012 Tina has been working in PRG as a Post-doctoral Research Fellow and a project leader of water and sanitation research projects. Recently she was appointed as a Research Engineer on the Reinvent the Toilet Challenge, phase 2 (a grant funded also by the Gates foundation).

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Merlien Reddy

Merlien Reddy is responsible for overseeing and facilitating all research activities and analysis in the Biochemical Engineering Laboratory in Chemical Engineering. This includes organisation and supply of lab equipment, operational supervision of researchers and students and issues related to health and safety.

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Sara Rhoton

Sara Rhoton is a licensed professional engineer, and holds a BS in civil engineering and an MS in environmental engineering. Sara is pursuing her PhD, studying technologies to recover nutrients from source-separated urine as part of the VUNA project (www.vuna.ch)

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Björn Pietruschka

Björn Pietruschka is a PhD student investigating the microbiological transformations in an anaerobic baffled reactor. His project is funded by BORDA. He holds a Master's degree from the Technical University of Dresden and has 5 years' experience in a biochemical research laboratory.

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