

**A NATIONAL WASTE RESEARCH, DEVELOPMENT (R&D) AND
INNOVATION ROADMAP FOR SOUTH AFRICA:
PHASE 1 STATUS QUO ASSESSMENT**



**Skills for an Innovative Waste Sector:
Current waste HCD initiatives in South Africa**



**science
& technology**

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

Document to be referenced as:

Department of Science and Technology (2012). A National Waste R&D and Innovation Roadmap for South Africa: Phase 1 Status Quo Assessment. Skills for an Innovative Waste Sector: Current waste HCD initiatives in South Africa. Department of Science and Technology: Pretoria

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DST/CSIR Waste R&D and Innovation Roadmap, Phase 1, Output 1.2

Cover photographs courtesy of Linda Godfrey (CSIR)

Date: September 2012

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DOCUMENT INDEX

Reports as part of this project include:

REPORT NUMBER	REPORT TITLE	AUTHORS
CSIR/NRE/SUSET/ER/2012/0045/A	Phase 1 - HCD: Skills for an Innovative Waste Sector: Workshop Report (11-12 July 2012)	Lombard, R.K., Lombard, J., Godfrey, L. and Roman, H.
CSIR/NRE/PW/ER/2012/0052/A	Phase 1 - HCD: Current waste HCD initiatives in South Africa	Lombard, J., Lombard, R.K. Godfrey, L. and Roman, H.
CSIR/NRE/SUSET/ER/2012/0053/A	Phase 1 - HCD: Core waste management skills and implementation modalities	Lombard, J., Lombard, R.K., Godfrey, L. and Roman, H.
CSIR/NRE/SUSET/ER/2012/0063/A	Phase 1 - Institutional framework: Current and required institutional mechanisms to support waste innovation	Schoeman, C., Mapako, M., Kalan, S., Godfrey, L. and Roman, H.

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1 BACKGROUND

This report presents the findings of a review of currently available Human Capital Development (HCD) programs in South Africa that promote capacity development, at a tertiary level, in the field of waste management. The audit forms part of the development of the National Waste Research, Development and Innovation (RDI) Roadmap of the Department of Science and Technology (DST) and seeks to support innovative, solutions-driven projects by identifying both current and required HCD programs in waste management (DST 2011a, 2011b, 2012). A phased approach is being adopted for the broader Waste R&D and Innovation Roadmap as follows:

- Phase 1 (2012) consists of two components, one determining HCD and the required skills in relation to a Waste Innovation Program (Sub-task 1), and the other determining enterprise/innovation opportunities and constraints (Sub-task 2).
- Phase 2 (2012/13) is the formulation of a Waste R&D and Innovation Roadmap
- Phase 3 is the implementation of the 10-year Waste R&D and Innovation Roadmap.

This report is the deliverable, Output 1.2, of the HCD component of Phase 1:

- It reports on the findings of a review of current waste management courses and training programs at tertiary level in SA;
- It identifies leading programs and research in waste management at SA universities and Science Councils, and the institutional capacity for developing waste-related skills; and
- It provides a brief overview of some international programs for HCD in waste management.

At a waste HCD workshop held in July 2012 (DST, 2012), stakeholders identified the need for a waste management professional skills development program at university level that would:

- (i) enable graduates of tertiary institutions to enter the waste industry (both the public and private sector) well-versed and prepared to contribute effectively, and
- (ii) up-skill persons already working within the waste sector.

The findings presented in this HCD report fed into a second follow-up workshop in August 2012, that was to define more specifically the goal and objectives of a waste innovation HCD program going forward; propose the most appropriate modalities for its implementation; and identify a suite of core and elective skills and related learning modules necessary to bridge the skills gaps that were identified in the July 2012 workshop.

2 APPROACH

Current research initiatives and HCD at tertiary level were identified as far as possible from the inputs of the participants at the first stakeholder workshop; from a questionnaire survey and telephonic follow-up interviews (where possible); and from an internet search on university/tertiary institutions' websites.

2.1 Initial scoping

An initial scoping workshop held in May 2012, determined that for optimal effectiveness, the waste HCD program should focus on National Qualifications Framework (NQF) level 6¹ or higher, i.e. tertiary level qualifications. This was informed by a similar, successful process in the biodiversity sector (SANBI, 2010). This focus would however not preclude a consideration of linkages to HCD at other skills levels even though these would not be the priority of this particular project, given the mechanisms available to DST (e.g. studentships, bursaries).

2.2 Database

Invitations to participate in the DST's National Waste R&D and Innovation Program for South Africa were circulated widely to a database in excess of 450 stakeholders². These included role players in government (national, provincial and local); the waste industry; environmental and waste management professionals and academics; Non-Governmental Organizations (NGOs) and Non-Profit Organizations (NPOs); and relevant public entities such as Eskom, etc.

2.3 Stakeholder workshop

The first 2-day stakeholder workshop was held on 11 - 12 July 2012 to identify current activities and new approaches in the solid waste sector in South Africa, particularly in terms of HCD aspects. Participants shared information through brief presentations on their respective organisations, small group participatory sessions and plenary discussions. The findings from this July workshop (DST, 2012) have informed the waste HCD audit on which this report is based.

2.4 Questionnaires and follow-up interviews

Key role players and those who expressed an interest in participating in this process were contacted individually and requested to fill in a questionnaire either independently or during a telephonic interview. The questionnaire consisted of two parts, one for individuals and one for institutions (Appendix 1) and respondents could choose the part they deemed most appropriate to themselves.

A total of 106 questionnaires were sent out, initially to respondents who indicated a willingness to contribute and subsequently to additional participants identified during the process of networking that followed. In some cases the questionnaire was sent out more than once to certain key role players with follow up calls (some promised responses are still awaited). Respondents are listed by organisation in Table 1 below. There was a general reluctance from respondents to commit to a telephonic interview, especially as it required approximately an hour to go through the questionnaire. This approach was modified to informal discussions based on questions similar to those that had been posed to the participants of the first workshop in preparing their presentation inputs (DST, 2012). Due to a general lack of willingness to participate in the interviews, this approach was not pursued further. Five interviews were conducted – the interviews were with the

¹ Equivalent to the recently proposed Higher Education Qualifications Framework (HEQF) level 8 or higher, i.e. tertiary level qualifications (RSA, 2011).

² The DST Global Change Grand Challenge database was used as a starting point, this was updated with stakeholders' recent information. Invitations were also sent to all IAIA (environmental sector) and IWMSA (waste sector) members.

following organisations: CSIR; University of Cape Town, Chemical Engineering (x2); World Wildlife Fund; and the Use-It, the non-profit organisation that manages the eThekweni Waste Materials Recovery Industry Development Cluster.

Several key role players were also spoken to telephonically on a less formal basis e.g. Prof Heila Sisitka (Rhodes University, Murray & Roberts Chair of Environmental Education and Sustainability); Prof Eureka Rosenberg (Green Matters); Prof Di Scott (UKZN, School of Development Studies); and Prof John Ledger (UJ, Environmental Management and Energy Studies).

The interviews were particularly useful in identifying modalities being applied in tertiary learning in the broader environmental field and in bridging the gap between university and the workplace. Their referrals to additional key role players working in the area of HCD were also valuable.

It should also be noted that the information provided by workshop participants in the brief presentations on their organisations, included in the previous workshop report (DST, 2012), has also been borne in mind for this output.

2.5 Internet search

2.5.1 South African Tertiary Institutions

The websites of all 23 universities (public institutions) in SA were accessed during July - August 2012 to determine what waste-related programs and waste-related research were currently in place. Where available online, the programs and prospectuses for the relevant faculties were examined. The following universities were included:

- **Traditional Universities (11)**
Cape Town, Fort Hare, Free State, KwaZulu-Natal, Limpopo, North-West, Pretoria, Rhodes, Stellenbosch, Western Cape, Witwatersrand
- **Comprehensive Universities (6)**
Johannesburg, Nelson Mandela, Unisa, Venda, Walter Sisulu, Zululand
- **Universities of Technology (6)**
Cape Peninsula, Central, Durban, Mangosuthu, Tshwane, Vaal

2.5.2 SAQA Unit Standards-based qualifications

The SAQA website was also searched for waste-related Unit Standards at the on (old) NQF Level 6 (= new NQF level 8)³ and higher (i.e. post graduate level) that might form part of a unit-standards-based qualification (www.saqa.org).

³ Equivalent to the recently proposed Higher Education Qualifications Framework (HEQF) level 8 or higher, i.e. tertiary level qualifications (RSA, 2011)

2.5.3 International waste-related programs

A brief internet search was also carried out to gauge the nature of international approaches to waste education and research programs. This was by no means comprehensive but included a few countries known to be leaders in the waste management training field including UK, Australia, New Zealand and USA.

2.6 Other initiatives

During the process of networking and interacting with the role players in the waste and education fields, some interesting initiatives came to light that could be considered during the next phase of this investigation, when core waste management skills and implementation modalities will be considered. These initiatives have been listed in Section 3, but also should not be viewed as being exhaustive.

2.7 Verification and further inputs

The summary of waste-related HCD and research programs was circulated to the relevant institutions with a request for them to verify or correct the information that appeared in the draft version of this report, particularly Appendix 2.

Further inputs were also solicited from the participants at a second workshop in August 2012. Although the main aim of this follow-up workshop was to define a more specific goal and objectives for the waste HCD program, it also provided an opportunity for the participants to verify and augment the information presented in the draft HCD status quo report. The draft report was also made available online and publicised to the database of those parties who had indicated an interest in the process.

3 FINDINGS: CURRENT WASTE HCD INITIATIVES IN SA

3.1 Questionnaires and follow-up interviews

Of the 106 questionnaires sent out, 26 were returned. This represents a response rate of 24.5 %, which although low, is in line with self-administered postal/email questionnaires (Rea & Parker, 1992).

Although it is not possible to make broad generalisations from the limited number of responses to the questionnaire, there appear to be relatively few focused waste management courses in tertiary institutions. Waste management is usually included as a subset of broader environmental or engineering courses. At the same time, however, there appears to be growing interest in waste-related research projects, particularly in the waste minimization, beneficiation and waste-to-energy fields. This is discussed in more detail in Section 3.3.

Table 1 shows the sector categories and organisations of those who returned the questionnaire. The majority of respondents (85 %) filled in the questionnaire for individuals rather than for an entire organisation and, although this gave personal details on their qualifications and research, it also gave some information about the respondent's organisation or unit within which they are active (Table 1). It was understandably not always possible for one individual within a large institution to know what was happening in all the other departments.

3.1.1 Sector

Looking at the respondents by sector: 18 of the 26 were Academic/Research; 4 were Business; 2 were NPOs; 1 was a Donor Organisation and 1 Local Government.

3.1.2 Institution

Figure 1 gives a breakdown of the type of organisations represented by the respondents.

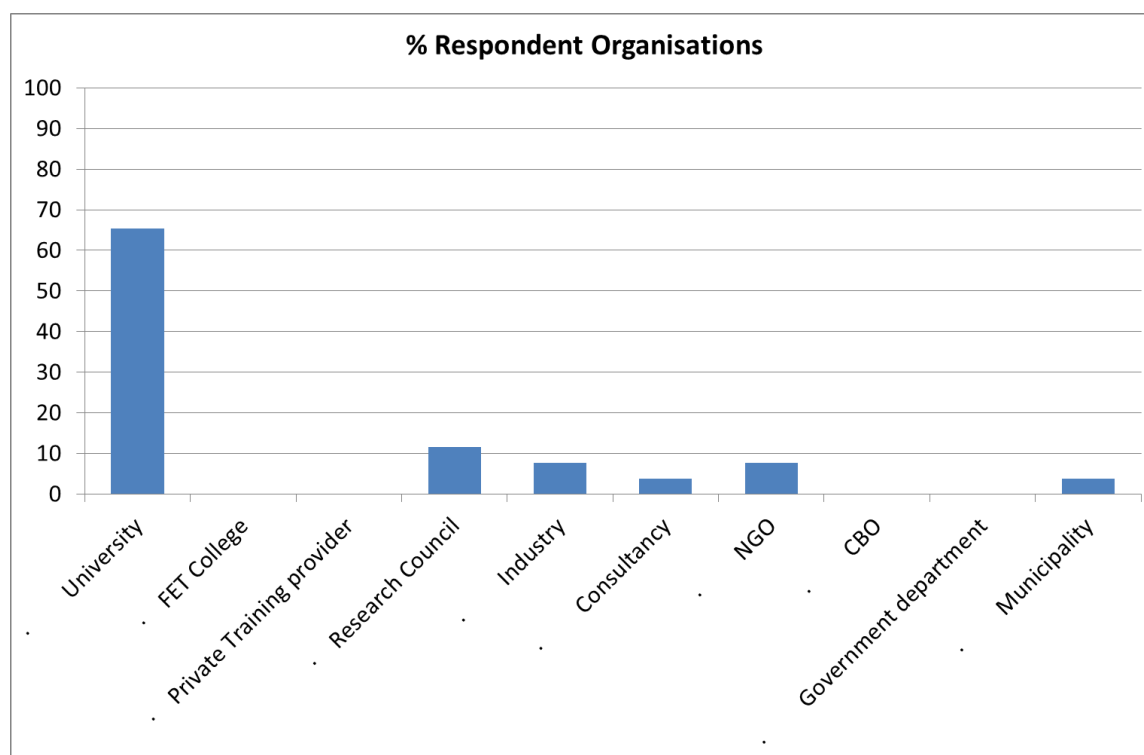


Figure 1: Respondents to Questionnaire by Organisation

The majority of respondents were from academic and research institutions, which was to be expected. Although all the major waste companies were sent invitations and follow up requests for information relating to waste R&D, the response from industry was poor. Nevertheless, some waste industry role players did participate in the other components of this Phase 1 study, i.e. Sub-task 2 which looked at enterprise/innovation opportunities and constraints.

Table 1: Respondents to questionnaire on HCD aspects

	Sector	Company/Organisation	Department /Unit	Quest Individ.	Quest Organis.	SWM modules/ courses	SWM Research
1.	Academic/ Research	CSIR	Natural Resources & Emt, Pollution & Waste Group	x			x
2.	Academic/ Research	CSIR	Natural Resources & Emt, Pollution & Waste Group	x			x
3.	Academic/ Research	Cape Peninsula University of Technology	Chemical Engineering	x		1	Post Grad
4.	Academic/ Research	Central University of Technology	Agriculture & Environmental Sciences	x		Unspecified	
5.	Academic/ Research	North West University	Centre for Environmental Management		x	2 short WM courses at L6	
6.	Academic/ Research	Rhodes University	Environmental Education	x			Post Grad
7.	Academic/ Research	Tshwane University of Technology	Science: Water, Environment and Earth	x			Post Grad
8.	Academic/ Research	University of Cambridge	Program for Sustainability Leadership		x	Indirect	
9.	Academic/ Research	University of Cape Town	Chemical Engineering	x	(x)	1 at 4 th yr	Post Grad
10.	Academic/ Research	University of Cape Town	Chemical Engineering	x			Post Grad
11.	Academic/ Research	University of Johannesburg	Geography, Environmental Management and Energy Studies	x		Indirect	Post Grad
12.	Academic/ Research	University of KwaZulu Natal	Engineering: Pollution Research Group	x			Post Grad
13.	Academic/ Research	University of KwaZulu Natal	School of Engineering: Civil	x		5	Post Grad
14.	Academic/ Research	University of Limpopo	Geography & Environmental Studies	x		2 modules at 3 rd yr & Hons	Post Grad
15.	Academic/ Research	University of Venda	Ecology and Resources Management	x		1 Undergrad	Post Grad
16.	Academic/ Research	University of Western Cape	Chemistry	x			Post Grad
17.	Academic/Research	University of Western Cape	Social Work				Post Grad
18.	Academic/Research	Technology Innovation Agency		x			
19.	Business	EnviroServ	Human Resources: Training & Development	x		Internal	

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	Sector	Company/Organisation	Department /Unit	Quest Individ.	Quest Organis.	SWM modules/ courses	SWM Research
20.	Business	P D Naidoo & Associates	Consulting Engineers	x			
21.	Business	Packaging Council of SA			x		
22.	Business	Private Individual	ex-National Cleaner Production Centre & DTI	x			
23.	Donors, Funders	Ex DBSA (Retired)	Advisor to DBSA	x			
24.	Government	Stellenbosch Municipality	Solid Waste Management Dept, Guest Lecturer	x		3 WM modules at UCT & CPUT	
25.	NGO/NPO	Use-It	Project Managers for eThekweni Waste Materials Recovery Industry Development Cluster	x			Technology Pilots
26.	NGO/NPO	WIEGO	Waste Pickers Africa	x			x

3.1.3 Funding

The sources of waste R&D funding are illustrated in Figure 2.

While there is no rand value of the total investment in waste R&D in South Africa, it is noteworthy here that the large majority of respondents indicated that they funded their learning programs and research partly or wholly through their own or their organisation's resources. Other significant sources of funding included the NRF and industry, and, to a lesser extent, other waste-related government departments.

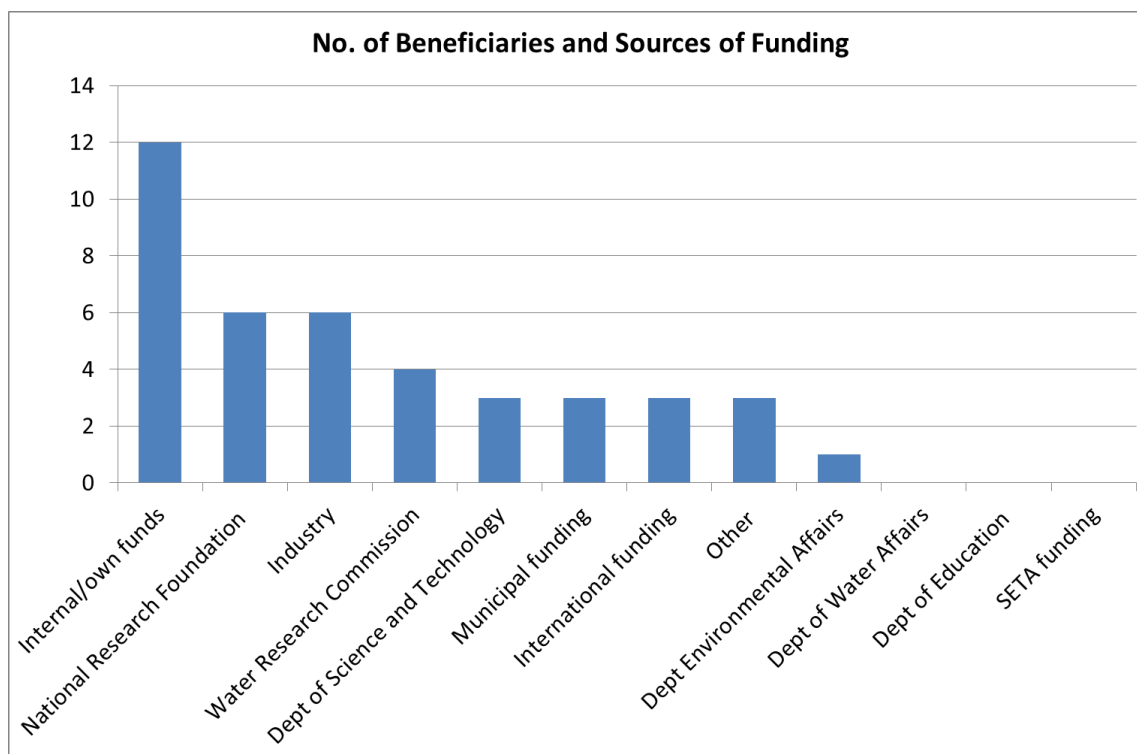


Figure 2: Sources of Funding for Waste-related R&D

3.1.4 Challenges and Frustrations

The challenges and frustrations hampering waste R&D and which therefore would need to be overcome for waste innovation HCD to thrive are shown in Figure 3.

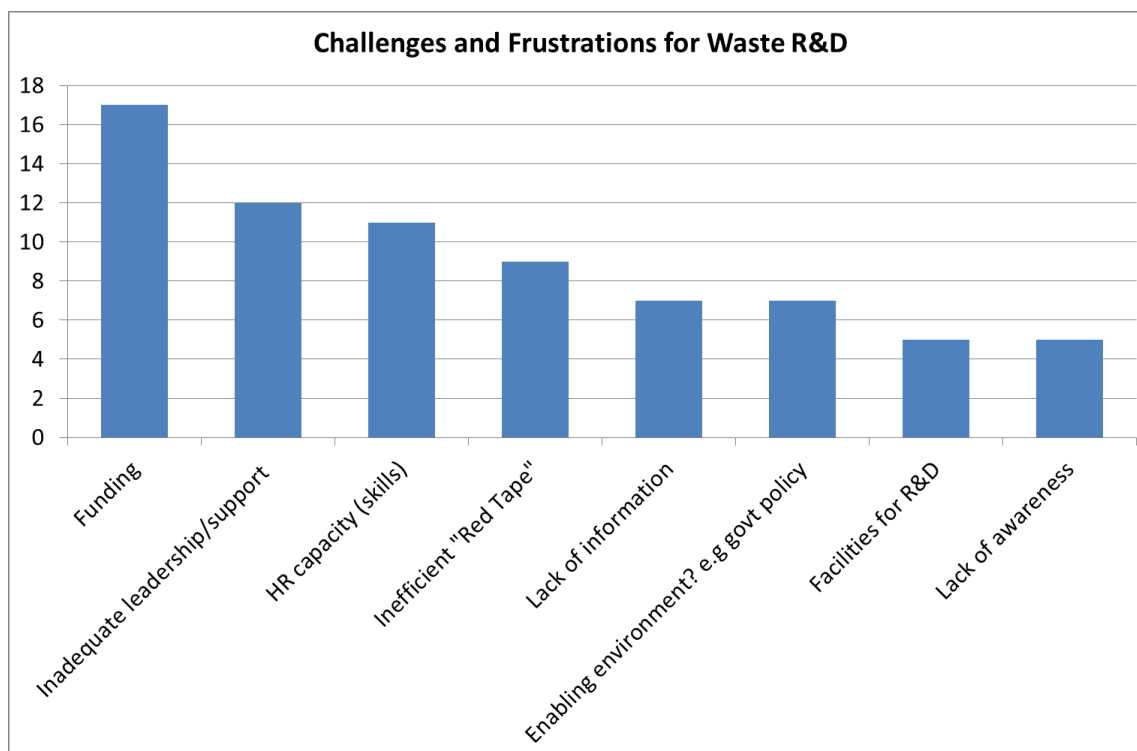


Figure 3: Challenges and frustrations experienced by respondents in their immediate education and/or research environment

Not surprisingly, taking the results from the previous Figure 2 into account, funding is identified in Figure 3 as the biggest challenge hampering waste research and development. The next most pressing challenge is inadequate leadership and support from more senior echelons within an organisation or government department. This is understandable, given the current lack of a national waste R&D strategy to guide research and research investment. It also ties in with the need identified at the first workshop for a well-informed waste professional, able to advocate for waste R&D and provide the requisite leadership to promote waste innovation.

Inadequate human resources to undertake waste R&D was also listed as a critical constraint; as were too much bureaucratic 'Red Tape'; unreliable or incomplete waste information to support research; and an environment (e.g. government policy) that does not foster waste innovation. Refer to the DST report on opportunities and constraints to waste innovation in South Africa for more detail on these issues (DST, 2012a).

These challenges echo those identified in the Environmental Sector Skills Plan for the broader environmental sector, which includes waste management (DEA, 2012). In this plan, one of the most significant gaps in human resource capacity was the inadequate number of technologists qualifying from tertiary institutions. These numbers apparently dropped when the mergers between the erstwhile technikons and universities took place in the early 2000's (DEA, 2010 p.31): this impact is also felt in the waste sector where technical skills are required for activities such as routine environmental monitoring (water, soil and air sampling), chemical analysis of waste samples, and bioremediation of contaminated sites. If waste R&D is to gain momentum, there will be further demand for such technical skills as well as accredited laboratory facilities. Some questionnaire respondents, too, identified the lack of specialized waste research facilities such as laboratories, as

well as a general lack of awareness of what waste management is about, as being additional constraints to waste R&D and innovation.

3.2 Internet search

This activity yielded interesting results; however, the websites of universities varied significantly in quality and the amount of information that could be accessed, which placed constraints on the completeness of this data. The findings of this desktop study were incorporated into the table provided as Appendix 2.

3.3 Summary of results for SA tertiary institutions

Appendix 2 summarises the information gathered from the various sources and shows waste-related programs currently on offer at tertiary institutions in South Africa. This summary was made available to all included institutions via the project website⁴, with a request for them to verify, correct or augment the information that appeared in the report.

From the information provided in Appendix 2, currently there are no pure waste management qualifications offered at any of the universities investigated. The general finding was that, in learning programs within traditional and comprehensive universities, the topic of waste was usually included as a module or subset of the broader environmental management, environmental science or engineering course material. Scattered waste management modules or courses and waste-related research were to be found in the faculties of science (which would include the environmental, geographical and earth sciences); engineering (including chemical, environmental and civil engineering); and, indirectly, in faculties of social science and even commerce (environmental economics, management).

The most well-developed and standardized solid waste management learning programs in existence appear to be found within the environmental health departments of the universities of technology (Appendix 2) as part of the National Diploma: Environmental Health and the B Tech: Environmental Health. Therefore, existing institutional capacity for waste management programs at NQF Level 6 that would immediately be available to produce a professional waste manager, capable of supervising waste operations in a practical sense or of continuing in a learning pathway that would allow specialization at post graduate level, is probably greatest in the universities of technology.

In addition to this, however, the model of multidisciplinary centres of specialization/excellence where institutional capacity is aligned and consolidated for cross-cutting fields, such as environmental studies, already exists at several traditional universities, e.g. the Environmental Evaluation Unit at University of Cape Town; Centre for Environmental Management at North West University; Pollution Research Group at University of KwaZulu-Natal; Centre for Environmental Management at University of the Free State; Centre for Environmental Studies at University of Pretoria; Environmental Biotechnology and Research Unit at Rhodes University; BMW Chair of Sustainability at University of Witwatersrand; Environmental and Nano Sciences Research Group at University of Western Cape (Chemistry Department), among numerous others. A multidisciplinary

⁴ http://www.csir.co.za/nre/pollution_and_waste/waste_innovation.html

waste management centre along similar lines may well be best positioned to offer post-graduate level waste HCD and to foster the potential for exponential progress in waste innovation.

Regarding research programs, current waste research at universities trends towards exploring treatment technologies that minimize and benefit waste, particularly in the waste/biogas-to-energy and biotechnology fields, driven strongly by the global and national imperative to grow the green economy⁵ (DEA, 2012 p 13). The research programs reported in the questionnaires also reflected this tendency (Table 3). In another direction altogether, there is growing interest in research into the socio-economic aspects of waste management, particularly around job creation and poverty alleviation with a special focus on waste pickers, as seen in responses from the University of Johannesburg Department of Geography Environmental Management and Energy Studies and Department of Economics and Econometrics; the University of Western Cape Department of Social Work; and NPOs including Asiye eTafuleni and WIEGO. The two abovementioned universities also collaborate on research on waste pickers.

Table 2: Some Research Programs Reported in Questionnaires

Institution	Department /Unit	SWM Research Programs
CSIR	Natural Resources & Environment, Pollution & Waste Group	Evidence based decision-making (NRE) for policy and strategies Technology development & Implementation – waste treatment and beneficiation (NRE) Cleaner production in industries (NCPC) Marginal and waste materials for building construction (BE) Waste and novel materials for transport infrastructure (BE)
Cape Peninsula University of Technology	Chemical Engineering	Waste to energy conversion
Central University of Technology	Agriculture & Environmental Sciences	Waste handling practices at abattoirs, waste handling and alternative methods of HCW
Rhodes University	Environmental Education	A dialectical understanding of environmental learning pathways - articulation and access in a differentiated NQF. The aim is to review the systems of provisioning for environmental learning pathways - enabling and constraining factors
Tshwane University of Technology	Science: Water, Environment and Earth	Treatment of industrial effluents and sulphur rich solid and gas wastes
University of Cape Town	Chemical Engineering	Energy from waste via biogas; metal recovery from minerals processing waste deposits
University of Johannesburg	Geography, Environmental Management and Energy Studies	Role of private households, private sector and government in recycling Waste to energy
University of Johannesburg	Economics and Econometrics	Waste pickers, in collaboration with UWC Department of Social Work

⁵ “A Green Economy (GE) can be defined as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. A GE is characterized by substantially increased investments in economic sectors that build on and enhance the Earth’s natural capital or reduce ecological scarcities and environmental risks. These sectors include renewable energy, low carbon transport, energy-efficient buildings, clean technologies, improved waste management, improved freshwater provision, sustainable agriculture” UNEP, Driving a Green Economy, 2010.

Institution	Department /Unit	SWM Research Programs
University of KwaZulu-Natal	Engineering: Pollution Research Group	Water research; process engineering; sustainability; sanitation; pulp and paper; anaerobic digestion; life cycle analysis; waste minimisation; municipalities
University of KwaZulu-Natal	School of Engineering: Civil	Bio-Energy Map for the potential of biogas-to-energy projects in KZN/SA to contribute towards Green Economy (funded by KZN-DEDT); Waste-to-Energy/ Zero Waste Models/AD Technology (NRF/THRIP); Nitrate removal from high-strength leachates using garden refuse and compost (eThekweni/Wasteman/NRF); Control and quantification of GHG emissions from waste through improved waste management in Africa/South Africa (NRF/THRIP/eThekweni); Waste Treatment (eThekweni)
University of Venda	Ecology and Resources Management	Waste recycling, waste disposal
University of Western Cape	Chemistry	Ash handling and disposal, sustainable salt sinks, acid mine drainage treatment, metals recovery
University of Western Cape	Social Work	Waste pickers, in collaboration with UJ Department of Economics & Econometrics
Use-It	Project Managers for eThekweni Waste Materials Recovery Industry Development Cluster	Piloting of sustainable waste beneficiation and alternate energy technologies
WIEGO	Waste Pickers Africa	Integrating Waste Pickers into SWM; Producing value out of waste

Regarding the general structure of learning programs, there is a need for post graduate students to be able to undertake their studies on a part time basis. There are several successful models for structuring courses to make them more accessible which should be taken into consideration in the discussion on HCD modalities for the waste management sector. They range from short intensive courses; to combinations of block contact sessions/modules of varying duration and frequency interspersed with assignments and research projects; to a fully-fledged distance learning format. Some examples are cited here, but there are many more:

- **North West University: Short Courses in Environmental and Waste Management**

The Centre for Environmental Management (CEM) is a Centre of Excellence, attached to the School for Environmental Sciences and Development at the Potchefstroom Campus of the North-West University, Potchefstroom. It focuses on building capacity in environmental management through formal and informal training and advisory services. Training is provided formally at undergraduate and master's degree levels but also informally by means of numerous short training programs that are presented on a regular basis at the CEM training centre in Potchefstroom. They can also be run onsite at a client's premises to meet specific needs.

The depth of training varies from awareness-raising interventions and introductory courses, to structured, more in-depth skills transfer programs⁶. It is these accredited skills transfer programs (short courses of 4 to 6 days duration) that offer an easily accessible model for HCD in the environmental and waste sectors. Such courses are available on all aspects of environmental

⁶ <http://www.nwu.ac.za/cem/coursesoffered>

management. Two of these are waste management courses at NQF level 5 or 6 (new level): candidates are given a theoretical foundation supported by appropriate practical assignments, site visits and exposure to best practice case studies. Practical assignments are conducted in dedicated, small, syndicate groups that report back to plenary. In specific courses an examination is taken at the end of the course. Course participants completing the course satisfactorily receive a Certificate of Successful Completion⁷.

- **University of Johannesburg: BSc Honours Program in Energy**

This program is run on a part-time contact basis and demands a high level of commitment and independent study. The course duration is two years part-time, with the course consisting of five modules plus a research project. Three modules are covered in the first year, with the remaining two modules and the project in the second year. The course is taught on a monthly block basis, each contact session comprising a Thursday evening lecture; a Friday guest lecture and field excursion; and a Saturday session for a seminar, assignment submission and monthly review. Candidates are also expected to attend other relevant meetings and public lectures as required during the course of the year. The minimum requirement for admission is an appropriate B.Sc. degree or equivalent relevant work experience may be considered in accepting applicants⁸. This course attracts students from as far afield as Swaziland and Kenya (Pers. com. Prof John Ledger).

- **University of Free State: Masters in Environmental Management**

This program consists of four semesters, spread over a period of two years. The first year starts with an intensive, two-week contact period in January 2010 at the University of the Free State. During this time environmental science (geology to ecology), computer competency and academic writing are covered. This is followed by five assignments and a written examination in June. The second semester starts with a two-week contact period in July, covering corporate environmental management (policy, law, social aspects, planning, auditing, project management systems etc.). This is followed by three assignments and a written examination in November. The third semester starts in January 2011 with Environmental Impact Assessment in the first week of the two-week contact period and a choice between two courses in the second week (Water, Pollution and Rehabilitation Management or Conservation and Biodiversity Management). This is followed by three assignments and a written examination in June. During the fourth semester that starts in July, students present their mini-dissertations orally, and submit their written mini-dissertations by the end of the year. Research for the mini-dissertation is already initiated during the first year of study. This course attracts students from all nine South African provinces and the entire Southern African Development Community (SADC) region and beyond, because the format of the program is convenient for students in Southern Africa: attendance is confined to just four block periods, while examinations are written at centres close to the home of the student⁹.

⁷ <http://www.nwu.ac.za/cem/service>

⁸ <http://www.eepublishers.co.za/article/uj-part-time-honours-course-in-energy-studies.html>

⁹ http://natagri.ufs.ac.za/dl/userfiles/Documents/00000/741_eng.pdf

- **Rhodes University Education Department: Environmental Learning Research Centre (ELRC):**

Rhodes offers a range of studies in environment and sustainability education and is recognised as an international leader in environmental education¹⁰.

Rhodes University: Advanced Certificate in Environment and Sustainability Education.

This ACEE course offers teachers or educators who already have a three year post-schooling qualification an opportunity to specialise in the field of environment and sustainability education in a range of educational contexts. The courses attract educators from conservation organisations, community education contexts, workplace learning contexts, as well as schools, colleges and universities. It is a two year, part-time, semi-distance accredited course which runs from January in the first year until December in the second year of study. It is a 120 credit course at NQF Level 6 (as per the outgoing Higher Education Qualifications Framework). Successful completion of the ACEE enables environmental educators to apply for further study at B.Ed Honours level.

The ACEE course is structured into five teaching blocks per year, each block being six days long. Between teaching blocks students are required to complete assignments, including work-based projects. During Year 1, four inter-related modules introducing the principles, policies and practices of environmental education as well as contemporary environment and sustainability challenges must be completed. During Year 2, students are required to implement a small-scale action research project in their workplace which includes the development and implementation of an environmental learning program. The course is assessed through examinations and assignments which include practical, work-related projects¹¹.

Rhodes University: Master's Degree in Environmental and Sustainable Education

This master's course is suitable for educators, trainers and social learning facilitators interested in environment and sustainability education, social change and learning in a diversity of contexts, including communities, workplaces, schools and universities. The course develops critical thinking, educational theory and practical expertise, as well as an understanding of the links between environment, social justice, education and more sustainable futures. The course is offered in the following configurations: full time - full thesis; part time - full thesis; full time - coursework and research; or part time - coursework and research. Coursework and research options run over a two year period, involving attendance of five one week block sessions each year to accommodate working professionals.

- **Unisa: Distance learning**

Unisa is a leading open distance learning institution which offers comprehensive, flexible and accessible open distance learning and internationally accredited qualifications. Learning takes place without lectures and classes, with the exception of some tutorials and discussion classes, and mostly via study guides and tutorial letters over the internet, which requires access to a computer and to the internet. Unisa offers a full range of undergraduate and postgraduate degrees, and also offers short learning programs to meet the growing needs of a knowledge-based society.

¹⁰ <http://www.ru.ac.za/elrc/courses/>

¹¹ <http://www.ru.ac.za/media/rhodesuniversity/content/education/documents/Advanced%20Certificate-Enviro%20Education-2011-12.pdf>

Unisa: Short learning programs: These “short courses” are a means of imparting new knowledge as it becomes available. Unisa runs many of these short courses in partnership with government, NGOs and communities. For example, the short course which trains Environmental Management Inspectors (‘green scorpions’), is run by Unisa’s School of Environmental Sciences in partnership with the School of Law and DEA¹².

The Short Learning Program in Environmental Management, Enforcement and Prosecution consists of five Advanced Short Courses (ASCs all on NQF level 8, offered through Open Distance Learning Mode. Four courses must be successfully completed for a person to be designated an Environmental Management Inspector. ASC 1, 2 and 5 are compulsory with ASC 3 or 4 being electives. The student chooses the fourth ASC from these electives. Advanced Short Courses 1-4 focus on theory while the Advanced Short Course 5 is a practical course of approximately 2 weeks’ duration. Admission to the practical course is contingent on enrolment and/ or successful completion of the mandatory three theoretical advanced short courses. Students receive a certificate for each advanced short course successfully completed and may enroll for the number of courses they can manage within their available time and capacity. Each Advanced Short Course has separate modes of tuition and assessment. Short course 1 is assessed through an assignment, portfolio and a formal 2-hour written examination. Short courses 2, 3 and 4 are assessed through assignments and portfolios only. The practical short course (ASC 5) is offered through Contact Mode and assessed continuously throughout the practical session, culminating in a 2 hour written examination.

Unisa: BSc Honours: Environmental Management

The Honours curriculum comprises **five** papers, four of which are compulsory core modules and one an elective module. One of the elective modules, **HESFES-Y: Fundamentals of Environmental Sciences**, deals with waste-related aspects among other topics:

- Environmental science and ecological principles
 - Energy budgets, energy flow, material cycles
- Ensuring environmental quality
 - Air, water and soil pollution, land use, waste

Unisa: Research and coursework master's degrees

At Unisa, the majority of master's qualifications are full research degrees, with a research proposal module and a full dissertation. In some instances, a coursework master’s option exists, with a combination of modules and a smaller research component (for example, a dissertation of limited scope or short dissertation). All master's degree students must first pass the research proposal module before registering for the dissertation component. For a coursework master’s, two modules must first be successfully completed before the student is eligible to register for the research proposal module.

¹² http://www.unisa.ac.za/contents/colleges/col_agriculture_environ_sciences/school_env_science/docs/Brochure2011.pdf

- **Other**

In the review of this draft report, readers were encouraged to share other successful models for structuring learning programs in a practical and accessible way.

3.4 SAQA Unit Standards-based qualifications

There are some SAQA qualifications that contain waste-related unit standards; however none of these are at NQF level 6 or higher. All of the qualifications in Environmental Practice at NQF levels 1 to 5 contain waste-related Unit Standards:

- Level 1: General Education and Training National Certificate in Environmental Practice (SAQA ID 49552)
- Level 2: National Certificate: Environmental Practice (SAQA ID 49605)
- Level 3: National Certificate: Environmental Practice (SAQA ID 49752)
- Level 4: Further Education and Training Certificate: Environmental Practice (SAQA ID 50309)
- Level 5: National Certificate in Environmental Management (SAQA ID 66789)

One qualification at Level 5 in Environmental Education, Training and Development Practice contains a unit standard related to assessing and controlling pollution that includes solid waste as a source of pollution i.e. National Certificate: Environmental Education, Training and Development Practice (SAQA ID 22901). There are also some unit standards relating to transport of waste, operation of landfill plant, and cleaning in the hospitality industry, but again these are all at levels lower than NQF Level 6.

Although not at Level 6 as prioritized for this investigation, it will be these Unit Standards that will be useful when it comes to designing occupationally-based learning pathways in waste management and for feeding into tertiary level programs.

3.5 International approaches

The examples below are by no means exhaustive and are just a few samples of what is done internationally.

UNITED KINGDOM

Chartered Institution of Waste Management

The CIWM is a professional body, based in the United Kingdom, which represents waste and resource professionals working in the sustainable waste and resource management sectors worldwide. CIWM sets the professional standards for individuals working in the industry and has various grades of membership determined by education, qualification and experience¹³.

CIWM, as the professional body for the waste industry, can accredit formal qualifications and academic courses for any or all of the following purposes:

¹³ <http://www.ciwm.co.uk/CIWM/CIWMHome.aspx>

- To formally recognise programs that help to facilitate the professional development of members of the Chartered Institution through the promotion of knowledge and experience of the principles and practices of waste management.
- To promote waste management as a recognised profession and as an academic discipline.
- To promote research into topics of interest to the waste management industry.
- To clearly identify programs that offer opportunities for Continuing Professional Development (CPD) for Corporate Members, or Structured Learning and Development (SLD) activities for graduate members of CIWM.

CIWM accreditation may be sought for complete programs such as a HNC, honours degree, and postgraduate diploma or degree. In addition, CIWM may accredit individual modules in waste management that form part of a more general course, as well as short courses. There is a well-developed system of professional qualifications in waste management that supply the sector with professional waste managers specializing in different waste management skills. Details of the academic programs currently supported or accredited by CIWM may be found on the CIWM website¹⁴.

There is a program of training courses supported and quality-assured by the CIWM and the Environmental Services Association (ESA). A list of these courses may also be found on the website¹⁵.

Historically, South Africa's own Institute of Waste Management (IWMSA) structure and modus operandi were based on the UK model, and consequently there are still many parallels between the two. IWMSA is therefore already in a position where it could advance the professionalization of the waste industry by taking its membership and training initiatives to the next level, as has been done by the CIWM in the UK.

The Waste Management Industry Training and Advisory Board (WAMITAB)

WAMITAB is the vocational training organisation for the waste management industry in the United Kingdom. It operates according to the Qualifications and Credit Framework (QCF), which is a new framework for recognising and accrediting qualifications in England, Wales and Northern Ireland. It also links with the Scottish Qualifications Authority (SQA). In the QCF, learners are awarded credit for qualifications and units, and the design of the QCF enables people to gain qualifications at their own pace along flexible routes. WAMITAB determines and advises on policy and standards of education, qualifications and training for all employees in the Waste Management Industry. It is the awarding body for the waste management industry in England, Wales and Northern Ireland and joint awarding body, with SQA, for qualifications in Scotland¹⁶. This QCF framework and award system has strong parallels with the SAQA NQF and SETAs in South Africa.

UK Universities offering waste management training

A waste industry directory of all waste-related training can be found on the website of the Local Authority Recycling Advisory Committee¹⁷. Excerpts from this directory are shown in Table 3 which

¹⁴ <http://www.ciwm.co.uk/CIWM/ProfessionalDevelopment/Qualifications/Qualifications.aspx>

¹⁵ <http://www.ciwm.co.uk/CIWM/TrainingandEvents/ESAandCIWMCourses.aspx>

¹⁶ <http://www.wamitab.org.uk/>

¹⁷ <http://www.larac.org.uk/links.htm?linkpage=Training>

illustrates that, unlike in SA, there exist many qualifications for waste management as a discipline in its own right as well as those for the broader environmental field. The full list includes environmental engineering and environmental management/sustainability programs, which are not shown here.

Table 3: Waste focused qualifications and programs at UK Universities

Institution	Waste related program
Brunel University	Offers MSc Environmental Science: Pollution and Monitoring - full time. Modular. And other courses.
CIWM	CIWM Training and Education provides many and various courses in wastes management: NVQ, VRQs and HLAs; certificates; under- and post-graduate courses; continuing professional development and the Defra New Technologies Education and Training program.
Cranfield University	MSc Integrated Waste Management (CIWM accredited). Full and Part time. Many courses - very flexible. Modular.
De Montfort University	MSc Waste and Environmental Management. Part time. Contact
Energy and Utility Skills	Vocational Qualifications. Working to put National Occupational Standards into a framework which provides a flexible system for employers to use. Making NOS easier to understand and simpler to use in a variety of ways. Supporting work based learning packages, such as apprenticeships and developing career progression routes within the wastes industry.
Glasgow Caledonian University	BSc Environmental Management and Planning. Full time. Modular. Post grad/MSc Wastes Management. Part time.
Huddersfield University	The Resource Management Program - an innovative program focusing on delivering training for employees in the Waste and Recycling sector. It has a stand-alone module structure, meaning a learner can focus on one specific topic area or mix and match to gain a broader breadth of knowledge. Includes both technical and managerial topics. Intensive modular approach minimises staff time out of the office. The course is industry-specific, with delivery by trainers who are industry experts in the topics, using real-life case studies. The practical approach makes a tangible difference to day-to-day performance.
Lauder College Dunfermline	HNC in Wastes Management
Loughborough University	PGC/PGD/MSc Waste and Environmental Management (And others)
Middlesex University	Recycling for sustainability. Work-based training program for business managers to achieve long-term and financial and environmental benefits. Funded by Wastepack Ltd and scholarships also available from Wastepack.
Open University	BA/BSC Environmental Studies. Part time. Modular. Diploma in Pollution Control. Part time. Modular.
Swansea University	MRes in Recycling Technology.
University of Central Lancashire - uclan	MSc in Sustainable Waste Management - program designed to enhance students' career prospects by the application of scientific and managerial expertise to practical business situations. Modular. Various courses: PGD/MSc Waste Management PGD/MA sustainable Waste Management CIWM and various university certificates in Waste Management, Minimisation, Reclamation and Recycling (and others).

Institution	Waste related program
University of Gloucestershire	Postgraduate Integrated Waste and Environmental Management. Full time. Modular. And others.
University of Leeds	Postgraduate Certificate in Sustainable Waste Management. Course material presented entirely online. Modular syllabus. Each module can be taken as an element of continuing CPD for waste managers and the course provides the underpinning knowledge and skills required for WAMITAB Certificate of Technical Competence. Also opportunity to transfer to the MSc course, among others).
University of Northampton	Well-funded courses in waste management. On the website go to Applied Sciences, and then Environmental Science and then Wastes Management. They offer home-based HNC, Foundation Degrees or BSc using your previous experience and qualifications - no need to take time off work. They also offer a basic Waste Awareness Certificate developed in partnership with CIWM
University of Reading	MSc Soils and Environmental Pollution. Full time.
University of Salford	PGC/PGD/MSc Water, Energy and Waste. Full and Part time. Modular. (And others)
University of Wales Institute	HNC in Waste Management - Part time.
WARMNET	Waste and Resource Management Network. A network of universities involved in wastes management education and research.
WRAP	The Waste and Resources Action Program. Workshops and professional development courses.

The Cambridge Sustainability Practitioner Program

The University of Cambridge's Program for Sustainability Leadership is made available in South Africa and other countries. It is designed for middle managers in the private or public sector who have been appointed to take responsibility for the environmental, social, communications, corporate affairs, new business development or supply chain dimensions of their organisation. Its purpose is to equip participants with a high-level understanding of sustainability as well as exposure to some of the best practical approaches to understanding critical social and environmental pressures, assessing their impact on organisations, developing systems for responding creatively to them, and integrating these systems into their organization's operations and strategy. The course is adaptable to almost any level of waste manager, from the worker level up to research level, and the aim is to empower participants to convey to their executive/ line managers the business logic of placing sustainability at the core of their strategy.

The Use-it initiative of eThekweni Metro promotes this course in support of building capacity amongst municipal and industry decision-makers around the significance and need for innovative and sustainable waste beneficiation technologies.

AUSTRALIA

Australia, as in the UK, offers qualifications in waste management as a discipline in its own right as well as in the broader environmental field.

Griffith University: Graduate Certificate in Waste Management

The Graduate Certificate in Waste Management is offered in external mode, which means that there is no requirement for on-campus attendance. It takes 6 months full-time or 1 year part-time (40 credit points). Students may enrol in the Graduate Certificate in Waste management either in Semester 1 (February) or Semester 2 (July).

The Graduate Certificate in Waste Management is unique because it is the only program of its sort offered in Australia¹⁸.

Students who have successfully completed the Graduate Certificate in Waste Management will be permitted to continue into the Master of Engineering offered by the Griffith School of Engineering. This program is also available to international students applying to study in Australia at Griffith University.

University of Queensland: Industrial Wastewater and Solid Waste Management Course¹⁹:

This course is run in the School of Chemical Engineering at undergraduate level and covers the design of sustainable technologies for liquid and solid waste management: conventional domestic wastewater treatment plants, sanitary landfills and destruction processes for hazardous wastes; advanced reuse technologies, including wastewater nutrient removal, energy recovery from liquid and solid wastes; product recovery from oily wastes, solvents and abattoir wastes. It is aimed at third and final year engineering (particularly environmental, civil and chemical engineering) students who have an interest in water, solid waste and environmental process technologies. A good background understanding of process engineering principles and basic chemistry is an advantage.

Course description:

- The delineation between solid waste and wastewater management is an operational definition rather than a definition based on the waste itself. Landfills, incineration and tailings dams are all technologies that are clearly in the realm of solid waste, yet municipal solid wastes and mining wastes contain free moisture that must be managed.
- Conversely, wastewater treatment plants receive waste that flows in through the sewerage system or directly from an industrial process. This waste will predominantly be water contaminated by dissolved constituents, but this stream will also contain solids. In fact, the basis of the treatment of domestic wastewater is to convert the dissolved constituents to microorganisms (biosolids) that can then be concentrated, separated and reused or disposed of as a solid waste.
- With this in mind, the topics in this course have been broadly categorised along technology lines rather than the physical state of the waste stream.

¹⁸ <http://www.griffith.edu.au/engineering-information-technology/engineering/programs-courses/graduate-certificate-waste-management>

¹⁹ http://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=46322

Course structure:

5 contact hours per week:

- Wastewater management: delivered in semester weeks 1 to 6 inclusive
- Solid waste management: delivered in semester weeks 7 to 12 inclusive

NEW ZEALAND

EXITO Industry Training Organisation²⁰

EXITO was formed in 1996 to help companies in the extractive industries improve productivity and performance through industry training. It is funded by industry and through the government's Industry Training Fund which is administered by the Tertiary Education Commission. There is also a membership fee for companies engaging in industry training with EXITO. EXITO helps around 4000 people each year work towards nationally recognised qualifications, increasing their skills and knowledge through competency-based training²¹.

Most of the learning is done on-the-job, so employees are building competency while they are working, which helps to meet the skills needs of industry, leading to continual improvements in productivity and performance. They work in seven different industries: drilling; energy and chemical plant; extractive; gas; petrochemical; protective coatings; and resource recovery.

EXITO's Resource Recovery qualifications cover five different sub-sectors of the Resource Recovery industry:

- The **Composting Qualification Pathway** offers a progression from Level 2 to Level 5, covering Core Skills through to the management level National Diploma.
- The **Resource Recovery and Zero Waste Qualification Pathway** offers a progression from Level 3 to Level 5, starting with Principles for Implementation, through to Operations and the management level National Diploma at Level 5, which also offers an optional strand in Cleaner Production.
- The **Scrap Metal Recycling Qualification Pathway** offers a progression from Level 2 to Level 5, starting with Introductory Skills, followed by Operations, Administration and Nonferrous Purchasing.
- The **Solid Waste Qualification Pathway** offers a progression from Core Skills at Level 2 through to Landfill Entry Control, Landfill Operations and Landfill Management at Levels 3 and 4. Trainees can specialise further by choosing strands specifically related to their role and industry including Gas Extraction, Hazardous Waste, Leachate Removal and Tiphead Control.
- The **Hazardous Waste Qualification Pathway** offers a progression from Level 2 to Level 5, covering skill development in Processing and Disposal.

EXITO provides administrative and financial support to companies who are committed to up-skilling their staff through industry training. Financial support is provided in the form of a rebate, on completion of qualifications within their stated duration. The value of the rebate varies according to

²⁰ <http://exito.org.nz/>

²¹ <http://exito.org.nz/about>

the qualification signed into and the [Service Level Agreement](#) that EXITO has with the company.

UNITED STATES OF AMERICA

SWANA Solid Waste Management Association of North America²²

SWANA is an approved training and continuing education provider and recognised as the leading source of information and training programs for solid waste professionals in the USA. The organisation has seven technical divisions made up of professionals dedicated to networking and learning from colleagues to keep abreast of new developments in their respective fields. Each division is led by volunteers who work on everything from setting the technical sessions at their division's annual symposium, to making sure that their voices are heard by elected officials.

SWANA certifies its members by means of a Certification Exam. SWANA certification ensures that members are kept updated with the latest information, and affords them networking opportunities with fellow professionals and recognition in the workplace. Attending SWANA training gains credits and CEUs for continuing professional development. Training and certification in the following certification disciplines are offered²³:

Bioreactor and Leachate Recirculation Landfills

- Construction and Demolition Materials Management
- Transfer Station Systems
- MSW Collection Systems
- MSW Management Systems
- Recycling Systems
- Composting Programs
- Landfill Operations
- HHW/CESQG Collection Operations

SWANA Offers Three (3) Different Levels of Certification:

- Certified Manager
- Certified Technical Associate
- Certified Inspector

INTERNATIONAL

International Solid Waste Association (ISWA)²⁴

The International Solid Waste Association is an international, independent and non-profit making association, working in the public interest to promote and develop sustainable and professional waste management worldwide. Its objectives are to achieve:

- Efficiency in terms of environmental practice
- Social acceptability and efficiency in terms of economic viability

²² <http://swana.org/tabid/53/Default.aspx>

²³ http://swana.org/portals/Training/2012_TrainingBrochure_Final.pdf

²⁴ <http://www.iswa.org/>

- Advancement of waste management through education and training
- Support to developing countries through ISWA Development Program
- Professionalism through its program on professional qualifications.

ISWA is the publisher of the dedicated waste management journal, Waste Management and Research, and keeps its members updated with its publications and newsletters. It participates in global waste research through its working groups and it also manages a job exchange platform for its members. There are ten working groups which provide technical information and assistance, undertake basic and applied research, hold professional meetings, and gather and disseminate information about solid waste management:

- Working Group on Biological Treatment of Waste
- Working Group on Climate Change and Waste Management
- Working Group on Collection and Transportation Technology
- Working Group on Communication
- Working Group on Energy Recovery
- Working Group on Hazardous Waste
- Working Group on Healthcare Waste
- Working Group on Landfill
- Working Group on Legal Issues
- Working Group on Recycling and Waste Minimisation

Regarding training in waste management, ISWA runs an International Waste Manager Certification Program. The program is designed to provide an internationally-recognized certification for individual professional waste managers based on their academic achievements and their practical work experience. This certification is awarded at four levels:

- International
- Advanced
- Intermediate
- Technical

Those that qualify are placed on a database which ISWA manages.

ISWA maintains a Knowledge Base on its website²⁵ that allows its members to access information on

- Conferences and workshops
- ISWA papers, reports and guidelines
- ISWA projects
- ISWA working group material
- Reports and articles
- Training material
- Videos
- Web resources
- ISWA publications
- Non-ISWA publications

²⁵ http://www.iswa.org/en/525/knowledge_base.html

This is a very useful source of information. IWMSA is already a member of this organisation.

3.6 Other initiatives

Several other initiatives have been identified as potential models and experience to feed into the next phase of this project - of determining the way forward for the waste HCD process.

3.6.1 Technology Innovation Agency (TIA)

The Technology Innovation Agency (TIA), an agency of DST, is a public entity and innovation funder. It has links to institutions within the National System of Innovation (NSI) such as CSIR, HRSC and NRF, and universities to conduct research and bring about the development and growth of technological industries in South Africa. TIA's services include Innovation Skills Development (ISD), technology strategies and financial assistance. In terms of the NSI, TIA has a role to play with ISD while the NRF is seen to have a role to play with HCD (universities).

There is a role for TIA funding to assist in bridging the gap between technical workplace ISD and the HCD as provided at academic institutions. An example cited by TIA (pers. com Dr Linda Godfrey) is the case of an aerospace company which found that university graduates were not suitably skilled to immediately and productively enter their company. The industry established its own training academy to bridge university learning with the skills needed in the workplace. It involved training by in-house engineers who were familiar with the business and the problems experienced. Similar needs exist in the waste sector where practical experience is extremely important in the development of a waste management professional. Although the agreed level of focus for this study is on higher education HCD, it would be useful to keep this concept in mind as a platform for exploring further core waste management skills and implementation modalities in the round of consultation following the present phase.

3.6.2 Green Matters

There is a workplace-based up-skilling project which addresses a two-fold need for improving the skills of technicians and professionals currently employed in biodiversity organisations, and helping improve biodiversity organisations' ability to provide relevant and effective training to employees. It has an online Organisational Strengthening Community Group that operates as a community of practice around biodiversity issues.

The need for a vibrant community of practice around waste management has already been identified by stakeholders (DST, 2012). Two bodies that are currently partially fulfilling this role are the Institute of Waste Management of Southern Africa, which is generally regarded as being the voice of the professional waste sector in the country, and the national Department of Environment in its hosting of the South African Waste Information Centre (SAWIC) website as a source of information on policy, laws and, to some extent, being a repository for waste data for the country (www.sawic.org). The approach by the biodiversity practitioners could be considered as a way of strengthening the role played by a body such as the Institute of Waste Management of Southern Africa (IWMSA) in becoming a hub of a community of practice around waste management.

3.6.3 WWF Environmental Leadership Program

The WWF-SA Environmental Leaders Program aims to support the development of a 'new' cadre of current and future leaders for the environment, conservation and natural resource management. The program is structured to develop graduates through a mentoring process that bridges the gap between their theoretical knowledge gained at university and the experience that they need to pursue their interests and careers in the workplace. There is a rigorous selection process to identify the graduates. Each graduate intern is then allocated a mentor and placed in a WWF program that suits their interests and career aspirations. They are exposed to working within the organisational mandate; managing work flow; developing relationships and communication skills; and building their professional as opposed to technical competence. At present there are seven interns and seven mentors under the guidance of a supervisor (Pers. Com. Dr Glenda Raven) and the program is funded by equal contributions from the corporate sector and an international foundation.

3.6.4 Institute of Waste Management of Southern Africa

The Institute of Waste Management of Southern Africa (IWMSA) has recently conducted research through the Centre for Environmental Management (CEM) of the North-West University (NWU) on the feasibility and possible modalities available to the IWMSA to establish quality assurance arrangements for the waste management sector in South Africa.

Such a quality assurance program would be established in collaboration with DEA, as well as with institutions such as the South African Qualifications Authority (SAQA) to establish unit standards for key qualifications; the South African National Accreditation System (SANAS), should any of the quality assurance arrangements require formal SANAS accreditation; or the Southern African Auditor and Training Certification Association (SAATCA), should waste management auditors and training service providers require to be certified.

This would enable IWMSA to ensure the quality of training service providers, the curricula of training courses and continuing professional development in the waste management field.

4 CONCLUSIONS

The findings of the waste HCD audit can be summarized as follows:

- There are currently no diploma or degree qualifications purely concerned with waste management at a tertiary level in South Africa. Typically, waste management is addressed as part of courses handling environmental studies; engineering, whether chemical, civil, mechanical or environmental engineering; and, more indirectly, via faculties of social science and commerce (environmental economics, management). This differs from what is found internationally, where both dedicated waste qualifications and inclusion of waste courses in other qualifications are evident (e.g. UK, Australia, New Zealand, USA).
- Internationally, there are industry training organisations that coordinate, accredit and quality assure waste management skills development where most of the learning is done on-the-job. Employees are able to build competency while they are working, which helps to meet the skills

needs of industry, leading to continual improvements in productivity and performance (e.g. UK, USA, New Zealand). Despite being at a lower NQF level than is the focus of this study, the current South African unit standards for waste management that fall under broader environmental practice qualifications would form part of a waste learning pathway that would prepare students for postgraduate study.

- There is a need for additional engineering, technical and biotechnical skills and facilities for waste RDI. This includes laboratory facilities with specialised technicians.
- Skills required for innovation are not only technical - there is growing interest in research into the socio-economic aspects of the waste sector, particularly around modalities for sustainable job creation and poverty alleviation. This speaks to the trans-disciplinary opportunities available in the waste sector and the need to have multiple departments contributing towards the development of waste courses and competencies.
- A strong need was also identified for waste practitioners to have a holistic understanding of environmental economics, business and social sciences. A multidisciplinary waste management centre would be best positioned to offer post-graduate level waste HCD and to foster the potential for exponential progress in waste RDI.
- There is a need for postgraduate students to be able to undertake their studies on a part time basis. Structuring of postgraduate learning should accommodate part-time study and could draw on examples of successful models that range from short intensive courses; to combinations of block contact sessions/modules of varying duration and frequency interspersed with assignments and research projects; to a fully-fledged distance learning format.
- The CIWM, as professional statutory body for the waste industry in the UK, can accredit formal qualifications and academic courses, while SWANA in the USA certifies its members by means of a Certification Exam, ensuring continued professional development. Currently in South Africa there is little involvement in formal tertiary level skills development programs by industry and waste sector associations, unlike international organisations (CIWM, SWANA, ISWA), although the opportunity is believed to exist in South Africa too.
- IWMSA is exploring the feasibility of becoming a legally recognised quality assurance body for the waste sector, where it could advance the professionalisation of the waste industry, taking its membership and training initiatives to the next level, following suit with the CIWM in the UK.
- To accelerate innovation, mentorship and practical experience are needed to bridge the gap between highly theoretical knowledge acquired at a tertiary institution and the acquisition of practical experience in the workplace. There are several successful examples of qualifications structured to accommodate this interface, as discussed under Section 3.3.
- There is a growing research interest in pioneering waste technologies to minimise or benefit waste economically; sustainable management of resources and energy (e.g. biotechnology, waste-to-energy); and the socio-economic aspects of managing waste, particularly at community level.
- Funding was identified as the most pressing challenge hampering waste research and development. A large majority of the questionnaire respondents indicated that they had to fund their learning programs and research partly or wholly through their own or their organisation's resources. With the current limited investment in waste research in South Africa, the development of a national waste R&D strategy is imperative to ensure that available resources are distributed to address key research priorities of government, industry and society in a sufficiently focused and systematic way.

- Inadequate leadership and support from more senior echelons within organisations or government departments featured high on the respondents' list of challenges to waste RDI: this is seen by respondents as a symptom of the current lack of a national waste R&D strategy to guide research and research investment. Leadership in the public sector is crucial for successful implementation of policy to drive research, new products, processes and markets, i.e. the green economy. This is unlikely to be achieved unless decision-makers themselves have a sound knowledge and appreciation of waste management and the opportunities it provides.
- The modalities considered for HCD for innovation in waste R&D should deliver professional waste Managers, via recognised learning pathways, who hold appropriate qualifications and certification in waste management.

At the second consultative workshop in August 2012, the discussion's aim was to focus on how to build on current academic systems and determine the most effective ways to grow a critical mass of skilled, innovative thinkers to steer traditional waste management towards more sustainable, pro-active waste beneficiation and resource management. The details of current waste HCD initiatives in SA listed in this report form an essential backdrop to the current discussions around existing capacity, as well as modalities to achieve these aims, such as university programs, research chairs, studentships, internships and centres of excellence.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

QUESTIONS FOR INDIVIDUALS

- 1 This section is about YOUR OWN SCIENTIFIC AND WASTE MANAGEMENT PROFILE and is basically an extract from your CV. The information will be entered into the National Research Database and will form the basis for further communication between the DST and yourself on waste management education and/or research-related matters

1.1	Name:	
1.2	Surname:	
1.3	ID:	
1.4	Gender:	
1.5	Population Group:	
1.6	Highest Qualification:	
1.7	Year Obtained:	
1.8	Contact number (Landline):	
1.9	Mobile:	
1.10	Fax:	
1.11	Email:	
1.12	Are you currently registered for study at a Higher Education Institution?:	Yes No
1.13	If registered, which degree are you pursuing? (Write in)	
1.14	How many years until graduation (ideally)?	#
1.15	Where are you registered? (Write in)	
1.16	Name of your institution (employer):	
1.17	Type of institution: (please tick)	
	<ul style="list-style-type: none"> University 	
	<ul style="list-style-type: none"> FET College 	
	<ul style="list-style-type: none"> Private Training provider 	
	<ul style="list-style-type: none"> Research Council 	
	<ul style="list-style-type: none"> Industry 	
	<ul style="list-style-type: none"> Consultancy 	
	<ul style="list-style-type: none"> NGO 	
	<ul style="list-style-type: none"> CBO 	
	<ul style="list-style-type: none"> Government department 	
	<ul style="list-style-type: none"> Municipality 	
	<ul style="list-style-type: none"> Other (please specify) 	

- 1.18 Please specify the Unit, Department or Section within the institution where you are employed

--

- 1.19 Please identify your role within your institution (choose one or more)

Researcher	
Lecturer / Instructor	
Consultant	
Scientist / Technologist / Engineer	
Manager	
Educational Course Designer	
Advisor / Mentor	
Student (drop down list if student is selected)	
<ul style="list-style-type: none"> Post Doc 	
<ul style="list-style-type: none"> PhD 	
<ul style="list-style-type: none"> Masters 	
<ul style="list-style-type: none"> Honours 	

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• Degree	
• Other (please specify)	

1.20 Please indicate the types and numbers of your research outputs / products in the last 7 years

Books	#
Published Papers	#
Patents	#
Licences	#
IP disclosures (e.g. software programs, models, etc)	#
Keynote addresses	#
Conference papers / presentations	#
Waste Management modules/courses	#

Other (specify)

In order to do a gap analysis, DST needs to understand the current situation regarding South African waste management education and/or research-related skills (people), infrastructure (e.g. facilities) and technological capability and capacity. The following questions relate to this need.

2 Please provide a few keywords that describe your specific skill / expertise (e.g. waste manager; environmental scientist; environmental management practitioner; engineer; planning professional; technologist; researcher; environmental educator; business professional, etc.)

3 Please provide a few keywords that relate to the specific technologies, facilities, methodologies that you use in your education and/or research (e.g. cleaner production/ lean work practices, recycling, waste treatment, materials and/or energy recovery, waste disposal, etc.)

4 Please provide a title and a few keywords on your education and/or research programmes aligned to waste management

4.1 Existing Education and/or Research Programmes

4.2 Potential Future Education and/or Research Programmes

4.3 Are any of your programmes accredited with any body/ies? If so, please provide details.

5 Demographics of your education and/or research team/s:

Please indicate the demographic spread and number of people that you involve in your Waste Management-related education and/or research activities

Population Group (In alphabetic order)	Gender	
	M	F
Black		
Chinese		
Coloured		
Indian		
White		
Total (gender)		
	M	F

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5.2	Nationality		
	South African		
	African		
	Other		

6 What is the spread of education and/or research funding sources you receive? Please distribute as a % and ensure that it totals 100%

Dept of Science and Technology (DST)		
Dept of Water Affairs and Forestry (DWAF)		
Dept Environmental Affairs and Tourism (DEAT)		
Dept of Education (DoE)		
National Research Foundation (NRF)		
Water Research Commission (WRC)		
SETA funding		
Municipal funding		
Internal institutional funds (own funds)		
Industry		
International funding (please specify below)		
Other (please specify below)		

Please type in relevant specifics

--

7 Please elaborate on any lost opportunities with regard to the sourcing of funding, joint education and/or research or collaboration initiatives you are aware of.

--

8 Which of the following Education and/or Research Themes are relevant to your work?

Theme	Currently	Planned	Indicate specific areas (if possible)
Waste management projections and planning (waste quantities, types, modelling, energy use)			
Waste management technology (storage, collection, transport, transfer, treatment, processing, disposal systems)			
Impacts of waste management activities (biophysical, social, economic e.g.: groundwater quality; air quality; land contamination; health and safety; aesthetics)			
Risk and Uncertainty			
Vulnerability and daptation (e.g socio-economic aspects of waste management, ecological aspects)			
Mitigation/technological interventions			
Cleaner Development Mechanisms (CDMs)			
Materials and/or energy recovery			
Policy/decision-making			
None			

Other (specify)

--

9 Please provide info (or a few keywords) relating to your education and/or research partners involved in waste management research.

9.1 Local (South Africa)

--

9.2 Regional (Southern Africa)

--

9.3 Continental (Africa)

--

--

9.4 International

--

9.5 Other

--

10 What challenges / frustrations do you commonly experience in your immediate education and/or research environment?

Funding	
Lack of information	
Lack of awareness	
Human resource capacity issues (skills)	
Enabling environment? e.g government policy	
Facilities e.g training and research institutions	
Inefficient processes and procedures ("Red Tape")	
Inadequate leadership and support	

Other please specify

--

Please ignore the following 4 questions if you completed the questionnaire for INSTITUTIONS

11 What specific actions do you suggest can be taken to address these issues? (Provide specifics or just keywords)

--

12 What kind of opportunities do you foresee for waste management education and/or research in South Africa?

--

13 What would you recommend be done to create a more suitable national education and/or research environment for an effective response to waste management challenges?

--

14 Would you be prepared to participate in a further web-based surveys, face-to-face discussions or focus workshops to obtain more detail on issues that you have raised?

Choose YES or NO

--

Thank you for participating in this important national survey.

Please feel free to complete the survey on INSTITUTIONAL capabilities and capacity too.

Please pass this survey on within your own networks

CONTACT: ROSEMARY LOMBARD: rosemary@icando.co.za, Cell 076 312 9069, Fax 031 7633664.

QUESTIONS FOR RESEARCH INSTITUTIONS

- 1 This section is about your **EDUCATION/RESEARCH INSTITUTION**. The information will be entered into the National Research Database and will form the basis for further communication between the DST and your institution on waste management education and research related matters

- 1.1 Representative's name:
 1.2 Representative's surname:
 1.3 Position / role in the institution:
 1.4 Contact number (Landline):
 1.5 Mobile:
 1.6 Fax:
 1.7 Email:
 1.8 Name of your institution (employer):
 1.9 Type of institution: (please tick)

<input type="checkbox"/> University	
<input type="checkbox"/> FET College	
<input type="checkbox"/> Private Training provider	
<input type="checkbox"/> Research Council	
<input type="checkbox"/> Industry	
<input type="checkbox"/> Consultancy	
<input type="checkbox"/> NGO	
<input type="checkbox"/> CBO	
<input type="checkbox"/> Nat/Prov Government department	
<input type="checkbox"/> Municipality	
<input type="checkbox"/> Other (please specify)	

- 1.10 Please specify the Unit, Department or Section within the Institution where you are employed

- 1.11 Please indicate the types and numbers of waste management courses/ research outputs / products delivered by your institution on average per year

Books	#
Published Papers	#
Patents	#
Licences	#
IP disclosures (e.g. software programs, models, etc)	#
Keynote addresses	#
Conference papers / presentations	#
WM modules/courses	#

Other (specify)

To do a gap analysis, DST needs to understand the current South African situation regarding waste management education and research related skills (people), infrastructure (e.g. facilities) and technological capability and capacity. The following questions relate to this need.

- 2 Please provide a few keywords that describe the disciplines/areas of expertise within your institution that align to waste management education and research

- 3 Please provide a few keywords that relate to the specific technologies, facilities, etc. available for training or research at your institution (e.g. cleaner production/lean work practices, recycling, waste treatment, materials and/or energy recovery, waste disposal etc.)

4 Demographics:

Please indicate the demographic spread and number of people in your institution that are involved in waste management-related education and/or research activities

	Gender		Population Group				
	M	F	Black	Chinese	Coloured	Indian	White
Researchers							
Lecturers / Instructors							
Students doing PhDs							
Students doing MScs							
Students doing Honours							
Undergraduates							
Research support staff (Lab technicians)							
Research Technologists							
FET learners							
Totals							

5 What is the spread of education and/or research funding sources for your institution? Please distribute as a % and ensure that it totals 100%

Dept of Science and Technology (DST)	
Dept of Water Affairs and Forestry (DWAF)	
Dept Environmental Affairs and Tourism (DEAT)	
Dept of Education (DoE)	
National Research Foundation (NRF)	
Water Research Commission (WRC)	
SETA funding	
Municipal funding	
Internal Institutional Funds	
Industry	
International funding (please specify below)	
Other (please specify below)	

Please type in relevant specifics

6 Please elaborate on any lost opportunities with regard to the sourcing of funding, joint education and/or research or collaboration initiatives of which you are aware.

7 Which of the following waste management themes are relevant to your institution's education and/or research strategy?

Theme	Currently	Planned	Indicate specific areas (if poss.)
Waste management projections and planning (waste quantities, types, modelling, energy use)			
Waste management technology (storage, collection, transport, transfer, treatment, processing, disposal systems)			
Impacts of waste management activities (biophysical, social, economic e.g.: groundwater quality; air quality; land contamination; health and safety; aesthetics)			
Risk and uncertainty			
Vulnerability and adaptation (e.g socio-economic aspects of waste management, ecological aspects)			

Mitigation/technological interventions			
Cleaner Development Mechanisms (CDMs)			
Materials and/or energy recovery			
Policy/decision-making			
None			

Other (specify)

8 Please provide info (or a few keywords) relating to your institution's education and/or research partners involved in waste management education or research.

8.1 Local (South Africa)

8.2 Regional (Southern Africa)

8.3 Continental (Africa)

8.4 International

8.5 Other

9 What challenges/frustrations do educators and/or researchers commonly experience at your institution?

Funding	
Lack of information	
Lack of awareness	
Lack of experienced people	
Difficult to attract students	
Enabling environment? e.g government policy	
Facilities (please be specific)	
Inefficient processes and procedures ("Red Tape")	
Inadequate leadership and support	
Other (type in below)	

Please type in relevant specifics

Please ignore the following 4 questions if you have completed the questionnaire for INDIVIDUALS

10 What specific actions do you suggest can be taken to address these issues? (Provide specifics or just keywords)

11 What kind of opportunities do you foresee for waste management education and/or research in South Africa?

12 What would you recommend be done to create a more suitable national education and/or research environment for an effective response to waste management challenges?

- 13 Would you be prepared to participate in a further web-based surveys, face-to-face discussions or focus workshops to obtain more detail on issues that you have raised?

Choose YES or NO

Thank you for participating in this important national survey.
Please feel free to complete the survey for INDIVIDUALS too.
Please pass this survey on to your own networks

CONTACT: ROSEMARY LOMBARD: rosemary@icando.co.za, Cell 076 312 9069, Fax 031 7633664.

APPENDIX 2: TABLE OF TERTIARY INSTITUTIONS OFFERING WASTE-RELATED PROGRAMMES

List of Waste Management-related courses at Universities in South Africa. Information not available at time of publication has been indicated.

Traditional universities

Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
University of Cape Town	Engineering and Built Environment	Chemical Engineering	WM and Recycling Module Sustainable Urban Systems Research programme on Energy from Waste via Biogas		4 th year BSc (Chem Eng)	Masters	Prof Harro von Blottnitz	http://www.ebe.uct.ac.za/departments/chemeng/
University of Cape Town	Science	Dept of Env & Geographical Science	Sustainability	36 credits	BSc Level 7		Assoc. Prof. Merle Sowman	http://www.egs.uct.ac.za/
University of Cape Town	Science	Dept of Env & Geographical Science	Env Management	1 yr 160		Honours Level 8	Dr P Anderson	http://www.egs.uct.ac.za/
University of Cape Town	Science	Dept of Env & Geographical Science	Env Management	2 yrs 180 credits		Masters	Dr P Anderson	http://www.egs.uct.ac.za/
University of Cape Town	Science	Dept of Env & Geographical Science	Environment, Society and Sustainability	2 yrs 180 credits		M Phil Coursework and dissertn	Dr P Anderson	http://www.egs.uct.ac.za/

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
University of Cape Town	Science	Dept of Env & Geographical Science	Others as well			Masters	Dr P Anderson	http://www.egs.uct.ac.za/
University of Cape Town	Science	Environmental Evaluation Unit	Research				Assoc. Prof. Merle Sowman	http://www.eeu.org.za
University of Fort Hare	Faculty of Science & Agriculture, School of Science & Technology	FOSST Discovery Centre	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Thozama Dyonase Youth Service Volunteer	http://www.fosst-dc.ufh.ac.za/
University of the Free State	Economic and Management Sciences		INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Free State	Natural and Agricultural Sciences	Centre for Environmental Management	Environmental Management	2 years; Part time study possible		Course Masters and mini dissertation	Prof Maitland Seaman Marthie Kemp	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Free State			Environmental Geography (4364) 49					INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of KwaZulu-Natal	Economics	Economics	Sustainable Resource Usage in SA	16 credits		Honours level		Optional module in 128 credit honours programme
University of KwaZulu-Natal	Engineering (Chem Eng)	Chemical Engineering	Pollution Research Group			Research based Masters qualification; PhD	Prof Chris Buckley	Currently all WM related qualifications are research based; courses for post grads are being designed
University of	Engineering	Civil	Coursework Masters in			Research	Prof Cristina Trois	

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
KwaZulu-Natal	(Civ Eng)	Engineering	Environmental Engineering			projects on WM	(coordinator)	
University of KwaZulu-Natal	College of Agriculture, Engineering and Science, School of Agricultural, Earth and Environmental Sciences	Geography	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION	3 year	BSc Geog and Env Science	Honours	Prof Brij Maharaj	http://ses.ukzn.ac.za/Geography.aspx INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of Limpopo	Science and Agriculture, School of Agricultural and Env Sciences	Dept of Geog and Env Studies	Solid waste management module		3 rd yr BSc		Ms Josephine Letsoalo	http://www.ul.ac.za/index.php?Entity=agri_geo_environ
University of Limpopo	Science and Agriculture, School of Agricultural and Env Sciences	Geography and Environmental studies Staff	Solid waste management module			Honours	Ms Josephine Letsoalo	http://www.ul.ac.za/index.php?Entity=agri_geo_environ
North-West University		Centre for Environmental Management	Integrated Waste Management	2 Short courses for WM			Mr Theunis Meyer Ms Claudine Roos	http://www.nwu.ac.za/p-cem/index.html
University of Pretoria	Natural and Agricultural Sciences; School of Geography, Geoinformatics and Meteorology	Geography	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Prof Hannes Rautenbach	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of	Engineering, the	Town &	INFORMATION NOT				Jacques du Toit	INFORMATION NOT

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
Pretoria	Built Environment and Information Technology, School for the Built Environment	Regional Planning	AVAILABLE AT TIME OF PUBLICATION					AVAILABLE AT TIME OF PUBLICATION
University of Pretoria	Natural and Agricultural Sciences, Centre for Environmental Studies	Zoology and Entomology	Coursework and research degrees Env Economics Life Cycle Assessment Env Business			Graduate training programme with internship		http://www.up.ac.za/centre-environmental-studies Multidisciplinary masters degrees
University of Pretoria	Natural and Agricultural Sciences	Department of Agriculture	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Ghian du Toit	http://www.up.ac.za/
Rhodes University	Rhodes Research and Scholarship Entities	Institute of Environmental Biotechnology Research Unit http://www.ru.ac.za/eburu/aboutebru	Research in bioremediation and biotechnology			Training of post grads And research	Keith Cowan	The research focus of EBRU has targeted the advancement of sustainability through remediation and the beneficiation of saline, domestic and industrial wastewater for high value products and bio-fuels, and the exploitation of solid waste for use in agriculture and industry.
Rhodes University	Env Education	Environmental Learning Research Centre, Murray & Roberts Chair	Research			Research	Prof Heila Sisitka	Social change processes with an emphasis on educational quality and curriculum transformation; educational responses to poverty, risk and vulnerability; and critical

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
		of Environmental Education and Sustainability						research methodologies. Research into learning pathways Part time courses based on contact time and independent study and assignments.
Rhodes University	Rhodes Business School	Environmental Economics	Certificate in Environmental Economics	Short course		L9 http://www.ru.ac.za/businessschool/aboutus/	Ms Nicole Craig Phone: 046-603 8852/8617 or 046 603 8617 Fax: 046-603 8613 Email: n.craig@ru.ac.za	The course aims to introduce environmental practitioners and business managers to the integration of environmental concerns, management and economic issues. The course will cover the fundamental concepts of economics, benefit-cost analysis, environmental economic impact analysis, valuation of natural resources, as well as the economic implications of pollution, waste and water management.
Rhodes University	Commerce	Environmental Economics	3 rd yr course Env Ecos		ECO 317 - ENVIRONMENTAL ECONOMICS * Scope and development of environmental economics			

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
					<ul style="list-style-type: none"> * A model of the economy and the environment * The economics of pollution * Measuring economic impacts on the environment * Resource economics * Sustainable development * Issues and applications 			
University of Stellenbosch	Arts and Social Sciences	Dept of Sociology and Social Anthropology and DST-NRF Centre for Excellence for Invasion Biology (CIB)	Research			Postgrad research	Heidi Prozesky	Research into stakeholder perceptions of various environmental and conservation issues, such as water quality, invasive alien species, ecosystem services, sustainable natural resource management, rural livelihoods, and human impacts on biodiversity
University of Stellenbosch	Engineering	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION					INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
University of the Western Cape	Community and Health Science	Dept of Social Work	Research				Ms Rinie Schenk	Works on research in tandem with UJ Department of Economics
University of the Western Cape	Science	Dept of Chemistry: Environmental Nanoscience					Prof Leslie Petrik	Ash handling and disposal, sustainable salt sinks, acid mine drainage treatment; metals recovery from waste; zeolite production from ash; geopolymer production; biodiesel production from waste cooking oil; catalysts for flue gas treatment; brine treatment; etc
University of the Western Cape			Research				Head: Research Office Ian Burns And several others	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Witwatersrand	Sciences, Engineering and Technology; School of Geography, Archaeology and Env Studies	BMW Chair of Sustainability					Coleen Vogel and several others	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Witwatersrand	Sciences, Engineering and Technology; School of Geography, Archaeology and Env Studies						Dr Emma Archer	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Witwatersrand	Engineering and the Built	Centre of Excellence in					Prof Lesley Cornish	INFORMATION NOT AVAILABLE AT TIME OF

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Institution	Faculty/College	Department /Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
	Environment	Strong Materials						PUBLICATION
University of the Witwatersrand	Humanities, School of Human and Community Development						FRC Brendan Barnes	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of the Witwatersrand	Humanities, School of Education	Education Policy Unit					Director Peliwe Lolwana	Wozani Block; WM11 University of the Witwatersrand 27 St. Andrews Road, Parktown, 2193, Johannesburg, Gauteng, South Africa Tel: +27 (0) 11 717 3076/ 3355 www.wits.ac.za

Comprehensive universities

Institution	Faculty/College	School	Department/Unit	Course/ Programme/ Research Topics	Course length	Undergrad	Postgrad	Contact	Description
University of Johannesburg	Science		Geog, Env Management and Energy Studies	Env Management Geography				Thea Schoeman	Research Some waste issues in courses
University of Johannesburg	Science		Geography, Env	Energy Studies course	2yrs		Honours Energy	Associate Professor John	Part time study.

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Institution	Faculty/College	School	Department/Unit	Course/Programme/Research Topics	Course length	Undergrad	Postgrad	Contact	Description
			Management and Energy Studies				Studies honours course Postgraduate degree	Ledger	
University of Johannesburg	Economic and Financial Sciences		Economics and Econometrics	Development economics			Masters	Kotie Viljoen	Research – links with Rini Schoeman UWC
Nelson Mandela Metropolitan University	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION		Admin	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Director of Research Management – Dr Pieter van Breda	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of South Africa	Science	College of Agriculture and Env Sciences:	Dept of Env Sciences	Env Management and Env Science Research			Honours	Roelien du Plessis	Distance learning – waste is indirectly included Integrated Environmental Management Impact Mitigation & Management Integrated Environmental Management Systems & Auditing Ecological & Social Impact Assessment Environmental Risk Assessment and Management

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Institution	Faculty/College	School	Department/Unit	Course/Programme/Research Topics	Course length	Undergrad	Postgrad	Contact	Description
									Fundamentals of Environmental Science Environmental Remote Sensing and Modelling Eco-toxicology Conservation Ecology Research Methodology Project Management Community engagement projects at schools
University of South Africa	College of Science, Engineering and Technology	School of Engineering	Mechanical and Industrial Engineering	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Chair of Department, Prof Moses Strydom	Jaco from NECSA informed that Prof Strydom is wanting to put together a MSc on plasma technology in the engineering department. Jaco has been doing research at NECSA on the use of plasma technology in the waste sector, and already they have a few patents around it. They have developed together with WITS the technology to use waste as a feed source for the production of diesel.
University of Venda		School of Environmental Sciences	Geography and Geo-Information Sciences	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Virginia Mudau	http://www.univen.ac.za/environmental_sciences/dep_geography_geo_sciences.html
University of Venda		at the	Department	INFORMATION NOT				Dr Mugera	Course codes from ERM 4740

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Institution	Faculty/College	School	Department/Unit	Course/Programme/Research Topics	Course length	Undergrad	Postgrad	Contact	Description
		University of Venda where my Colleague is involved in delivery of	Ecology and Resource Management	AVAILABLE AT TIME OF PUBLICATION				Wilson Gitari	to ERM 5740 relating to waste management
University of Venda	Science, Engineering & Technology	School of Mathematical and Natural Sciences	Dept of Physics	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Dr David Tenarwo	Renewable Energy Technologies and Rural Sustainable development, Climate Change and Carbon Trading.
Walter Sisulu University			Admin	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Vice Chancellor, Research Administrator, Vice Principal Academic Affairs, Interim Director Research, Research Secretary	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
Walter Sisulu University	Science, Engineering and Technology			INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Executive Dean Prof Sandile P Songca Secretary Nancy Njoli Tel: 043 709 4008 Fax: 043 726 3050	
Walter Sisulu University	Sciences, Engineering and	School Of Applied And		INFORMATION NOT AVAILABLE AT TIME OF				Professor ND Jumbam	

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Institution	Faculty/College	School	Department/Unit	Course/Programme/Research Topics	Course length	Undergrad	Postgrad	Contact	Description
	Technology	Environmental Sciences		PUBLICATION					
Walter Sisulu University		WSU-Centre for Rural Development and The Council for Scientific and Industrial Research (CSIR)		INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Professor Peggy Nomfundo Luswazi Director: Centre for Rural Development Business: +27 (0) 47 537 0179 / Fax: +27 (0) 47 537 0177 Mobile: +27 (0) 83 446 0077 / +27 (0) 76 404 7156	
University of Zululand			Admin	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Chief Research Admin Officer Ms Daniella Viljoen	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION
University of Zululand	Science and Agriculture		Dept of Chemistry?	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION				Prof J A Kolawole	Biotechnology course – find out more
University of Zululand	Science and Agriculture		Geog and Env Science?	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION					INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION

Universities of Technology

Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
Cape Peninsula University of Technology	Engineering	Engineering: Chemical	Course envisaged			Research	Prof Daniel Ikhu-Omoregbe	Conversion of solid waste and landfill gas to energy
Cape Peninsula University of Technology	Applied Sciences	Environmental Health (old?)	National Diploma: Env Health	Full-Time: Three years	2 nd year Environmental Pollution: Waste & Water 2		Cape Town Contact: Faculty Office Telephone: +27 +21 460 3153 Fax: +27 +21 460 3217 Email: vanwykl@cput.ac.za Cape Town Contact: Ms Vuyokazi Ntapane Telephone: +27 +21 460 9068 Fax: +27 +21 460 3905 Email: ntapanev@cput.ac.za	Environmental Health Practitioners (EHPs) are committed to improving environmental and occupational health. The task of the EHP is determined by legislation and includes the following: Industrial, commercial and housing development; safe water supply; food safety; occupational health and safety; pollution control (air, water, soil, radiation and environmental noise pollution); disease control; health surveillance; research; health promotion and community development; waste management; pest control; transport safety; public relations; as well as accident and disaster control.
Cape Peninsula University of Technology	Applied Sciences	Environmental and Occupational	Courses in Environmental Health and				Vuyokazi Ntapane +27 21 460 9068 Fax: +27 21 460	Waste disposal (by enforcing waste legislation).

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Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
		Studies (new?)	Environmental Management (including National Diploma, BTech, MTech and DTech).				9193 Email: ntapanev@cput.ac.za	
Central University of Technology	Health and Environmental Sciences	School of Agriculture and Env Sciences	N. Dip. / B. Tech.: Environmental Health N. Dip.: three years full-time / B. Tech. once the student completed the National Diploma (one year full-time or two or more years part-time)		2 nd year Environmental Pollution: Waste and Water II 4 th year Waste Management IV		Dr Hester Roberts	Upon successful completion of the first three years of study students are awarded the National Diploma. After successful completion of the National Diploma the student must undergo a year compulsory community service. They can then qualify to enrol for a fourth year of study to obtain the B. Tech. degree followed by the M. Tech. and D. Tech. degrees.
Central University of Technology	Engineering and Information Technology	School of Civil Engineering and Built Environment						
Central University of Technology		Sustainable Development Project	Sustainable Development Project				Prof G Jordaan	INFORMATION NOT AVAILABLE AT TIME OF PUBLICATION yet

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Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
Durban University of Technology	Engineering and the Built Environment (FEBE)	Civil Engineering and Surveying	B Tech Eng Civil:	1 year but must have completed the requirements for the National Diploma: Engineering: Civil or the National Higher Diploma: Civil Engineering or equivalent	Compulsory modules: SWMT411 **Solid Waste Management IV (Module 1 Theory) L7 SWMT421 Solid Waste Management IV (Module 2 Project) L7		Head of Dept: Mr Y M Vawda Secretary: Ms Pauline Steel Telephone No: 031 373 2224 Fax No: 031 373 2816 Executive Dean Prof Theo Andrew Telephone No : 031 373 2762 Fax No : 031 373 2668	This instructional programme has a minimum duration of two (2) semesters if undertaken on a full-time basis or four (4) semesters if undertaken on a part-time or block basis and may be offered in six specialist options I
Durban University of Technology	Applied Health Sciences	Community Health Studies: Environmental Health	National Diploma: Environmental Health B Tech: Environmental Health	3 or extended option of 4 years Additional 1 year	In 2 nd or 3 rd year: Environmental Pollution & Waste II, Level 6 In 4 th year: Optional module:	M Tech: Environmental Health Research dissertation	All departmental queries to: Dr Poovie Reddy Secretary: Mrs Anusha Karamchand Tel No: 031-373-2696 Fax No: 031-373-2038 Location of	Environmental Health (EH) comprises those aspects of human health, (including the quality of life), that are determined by physical, chemical, biological, social and psycho-social factors in the environment. It also refers to the theory and practice of ascertaining, correcting, controlling, minimising and preventing those factors in the environment that can potentially adversely affect the health of present and future generations.

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Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
					Waste Managem ent 4, Level 7		Department: Room 220 Mansfield Building, Ritson Campus All Faculty queries to: Mr. Vikesh Singh Faculty officer: Tel No: 031-373-2701 Fax No: 031-373-2407 Executive Dean: Prof T Puckree Tel No: 031-373-2704 Fax No: 031-373-2407	The EH scope of practice includes: <ul style="list-style-type: none"> • Water pollution control • Waste management • Health surveillance of premises • Surveillance and prevention of communicable diseases • Vector control • Environmental pollution control • Occupational health and safety • Port health
Durban University of Technology		Institute for Water and Wastewater Technology				Research-waste water; Industrial wastes	Director: Prof Faizal Bux	Research projects are selected and designed in close consultation with industrial partners. Projects are mainly aimed at helping industries maintain acceptable levels of effluent discharges, thus reducing negative environmental impact and commercialisation of products generated from waste streams. The focus of research at IWWT is within the broad areas of water treatment,

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								wastewater treatment and beneficiation and algal biotechnology. Emphasis is targeted towards developing and adapting technology for local application with the target recipients being Industry, water utilities, local government and the community.
Mangosuthu University of Technology	Natural Sciences	Environmental Health	National Diploma: Environmental Health	3 to 5 years	2 nd yr Waste and Water II		Dean : Faculty of Natural Sciences Prof. NJ Ndlazi Tel: +27 (31) 907 7601 TT Poswa	
Tshwane University of Technology	Science	Department of Environmental, Water and Earth Sciences	Rand Water Chair in Water Utilisation				Prof Jannie Maree	
Tshwane University of Technology	Science	Environmental Health	National Diploma: Environmental Health B Tech: Env Health	Diploma (3 years full time study) Additional two years, block basis One year full time	4 th year: Waste Management IV	Specialised programs on doctorate level. M Tech: Env Health D Tech: Env Health		Students become competent in Environmental Management: Water-, air-, and waste pollution Also short learning programmes are also very popular that equip students from industry with specialised skills in various areas in the field of environmental health.

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Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
Tshwane University of Technology	Science	Department of Environmental, Water and Earth Sciences	Nat Diploma: Env Management B Tech: Env Management M Tech D Tech Research	3years full-time: five semesters formal University training and one semester of experiential learning. A minimum of one year and a maximum of three years A minimum of two years and a maximum of five years.			Senior Secretary: Ms Retha Gerber Tel (012) 382-6232 / 6379 E-mail: GerberME@tut.ac.za	Research Programmes in the Department : Current research programmes funded by NRF, Laser Centre, government, and industry include: Waste and Wastewater Management: Removal of heavy metals from aqueous solution using maize tassels and aminopolycarboxylic acid-type cellulose interaction of heavy metals with dead cells of fungi. Pollution Measurement: Speciation of Manganese in street dust in Pretoria area, South Africa Determination of endocrine disrupting compounds in the Jukskei River Quantification of brominated flame retardants in landfill leachates Air dispersion modeling and monitoring of chlorine emissions http://www.tut.ac.za/Students/facultiesdepartments/science/departments/enviro nsience/Documents/2010%20Env,Water%20and%20Earth%20Science.pdf
Vaal University of Technology	Faculty of Applied and Computer	Department of Biosciences	Biotechnology	?			Head: Vaal University of Technology	Website inaccessible

Institution	Faculty	Department /Unit	Course/ Programme /Research	Course length	Under-grad	Postgrad	Contact	Description
	Sciences						Private Bag X021 VANDERBIJLPARK 1900 Tel: (016) 950 9248; Fax: (016) 950 9794 E-mail: madeleine@vut.ac. za	

Examples of SWM modules at Universities of Technology

**DUT Faculty of Engineering and Built Environment: B Tech (others Univ's of Tech similar)

SOLID WASTE MANAGEMENT IV MODULE 1 THEORY (SWMT411) (0806120060)

Theory: 4 periods per week

Semester Mark: Two tests - 20% each

Examination: One three-hour paper - 60%

SYLLABUS

1. Characteristics of waste
2. Solid waste disposal methods
3. Design, operation & management of landfill sites
4. Operation & management of solid waste removal systems
5. Third World applications
6. Waste recycling
7. Emergency waste management
8. Legal aspects

SOLID WASTE MANAGEMENT IV MODULE 2 PROJECT (SWMT421) (0806120060)

Project: 1 period per week

Semester Mark: One industry based project - 100%

SYLLABUS

Students will be required to investigate and produce an appropriate industry related design project.