To fix our rivers we must fix our municipalities

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The authors argue that there are two imperatives for improving the wastewater situation – building the capacity of municipalities so that they can employ more engineering professionals, and increasing partnerships with private service providers. Only a small part of the substantial national expenditure earmarked for improving capacity in municipalities has a direct impact on building critical technical capacity.

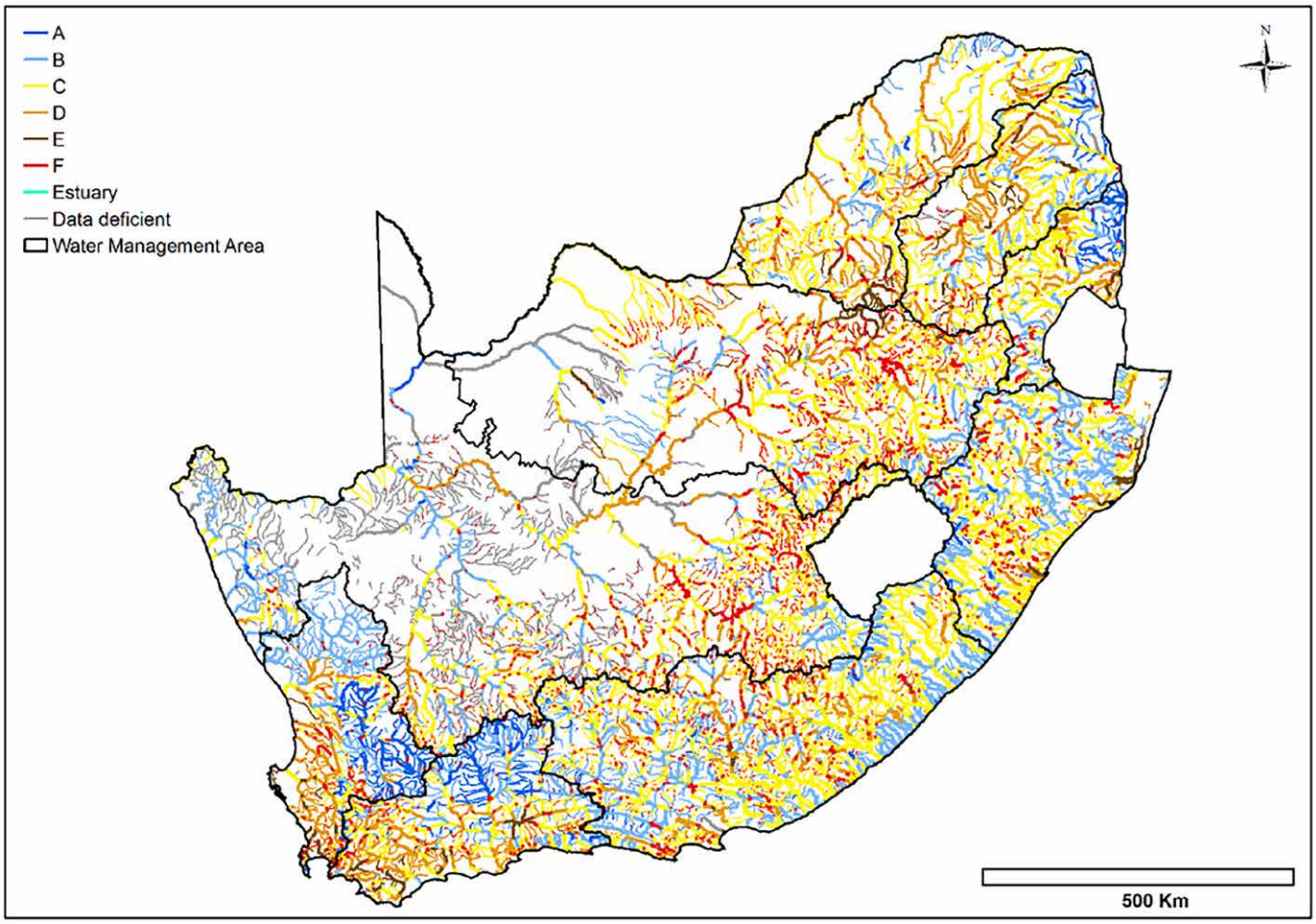
Municipalities are on the front line in protecting our rivers. They are responsible for managing the wastewater produced in their areas from sewerage systems, agriculture, mines and factories. Two-thirds of municipalities in South Africa do a poor job on this count. And this is causing a serious decline in water quality in rivers and dams.

The wastewater flowing into South Africa's rivers is a major cause of the decline in the water quality of our rivers, threatening the sustainability of our water resources and hence our livelihoods. It is not surprising that this is associated with a decline in the performance of municipalities over the past decade, with municipalities unable to recruit and retain sufficient capable engineering professionals to manage wastewater infrastructure. This article provides an overview of the state of our rivers and municipalities, leading to recommendations on what can be done.

STATE OF SOUTH AFRICA'S RIVERS

The *State of Rivers Report 2017-2018* by the Department of Water and Sanitation (DWS, 2019) found that, when assessed by the prevalence and variety of macroinvertebrates in the water, only 16% of the sites samples from the country's rivers fall into the 'healthy' category. Another 50% of the rivers are 'modified', which means the river is in an average condition but cannot return to a pristine state without human intervention and assistance. The rivers that were in the 'unsustainable' category were largely found in urban areas, and this was as a result of pollution that typically arose from a 'lack of proper management and maintenance of wastewater treatment works and insufficient capacities of these works for the population served' (DWS, 2019: 3). The data on the state of South African rivers is also a concern, with the DWS stating that recent cost-cutting measures implemented in the department necessitate[s] the reduction in the number of sites monitored' and that the data on inland rivers and inland wetland systems is incomplete and insufficient.

The South African National Biodiversity Institute's (SANBI's) 2018 assessment of South Africa's inland aquatic realm found that 67% of rivers are degraded, with tributaries in a generally better condition than main rivers (see Figure 1).



Note: classification of rivers based on ecological quality: A=Natural, B=Near natural, C= Moderately modified, D= Severely modified, E&F=Critically modified.
Figure 1. State of South Africa's Rivers (Source: SANBI, 2018)

WASTEWATER SYSTEMS

Pollutants in water bodies are varied and come from a range of sources associated with human activity. In simple terms they can be divided as follows:

- Suspended solids, which may be small particles but also includes gross solids of larger size such as bottles, nappies, plastic bags and other packaging. Aside from the aesthetic impact of these solids, they include organics which serve as an energy source for bacteria growing in rivers and dams which reduce oxygen in the water which affects aquatic life.
- Dissolved solids, which include a wide range of inorganics which contribute to increased salinity in water bodies. Included here are nutrients, specifically nitrates and phosphates which are associated with eutrophication (primarily algal growth in dams). Nitrates and phosphates are a specific concern as they are not removed through standard biological treatment processes. Heavy metals such as lead, cadmium, nickel, mercury, chromium, cobalt and zinc are also a concern as they are toxic to humans.
- Pathogenic bacteria, which are harmful to humans. Typically, the concentration of Escherichia coli (E. coli) is used as a measure of bacterial pollution although, in general, E.coli are themselves not harmful to humans. There are other measures which specifically pick up pathogenic bacterial pollution but require more complex testing.

While this article focuses on pollution from human settlements, it ➤➤

Failure typically occurs due to the breakdown of mechanical or electrical equipment which is associated with poor maintenance or the inability to replace equipment ...

is notable that pollution is caused by other human activity, with agriculture and mining being most significant, particularly with regard to salinity and nutrients. The relative impact from other sources depends on the extent of human activity in these catchments, with pollution from human settlements obviously being the biggest concern in those that are highly urbanised. For example, Gauteng is on the continental watershed and has a severe impact on multiple rivers which flow through the province and then into long watercourses, which include dams supplying downstream users.

There are three primary sources of pollutants from human settlements: failed sewerage systems, wastewater treatment works effluent, and stormwater runoff. Only the first two will be considered in this article.

Failed sewerage systems

Wastewater (or sewage) flows from dwellings, institutions, commercial properties and industries into the sewerage system which comprises pipes and, sometimes, wastewater pumping stations. If this system is fully functional the wastewater is transported to wastewater treatment works where it is treated using biological processes to remove the majority of pollutants, with the flow leaving the works referred to as 'effluent' (more on this below).

The failures in the sewerage system are, firstly, linked to blockages in the sewers which are typically associated with gross solids: large items put into the sewers illegally. Wastewater (sewage) then backs up in the sewers and flows out of the manholes into streets or walkways, both in formal and informal settlements, and then into ponds, streams or rivers. Secondly, the failure of wastewater pumping stations, leading to wastewater flowing into streets and pathways, is also a big concern, both to communities who are directly exposed to the odour or possibly direct contact with the flow, and to the environment when these flows reach a water body.

While the sumps at these pump stations can store wastewater for a short period they are at high risk if there are power supply failures lasting more than a few hours. Further, the mechanical and electrical equipment in these pump stations require a high level of maintenance and hence are a vulnerable spot in the sewerage system.

Wastewater treatment works effluent

The performance of wastewater treatment works is obviously a key factor as it is here that the majority of pollutants are removed from the wastewater flow to produce an effluent which should be of good enough quality not to unduly harm the water bodies below the discharge point. There are a range of wastewater treatment technologies, from simple pond systems which have no mechanical equipment to complex plants designed to remove nutrients. Treatment is primarily based on a biological process with most of the wastewater in South Africa treated using 'activated sludge' technology which incorporates reaction tanks that require mechanical equipment to provide aeration to allow the bacteria in the tank to react with the organics in the wastewater.[1] All wastewater treatment plants produce sludge which needs to be disposed of safely. While this is a potential pollutant, it is not addressed further in this article.

The effluent for a treatment plant, where it flows into a water body, is a key point for monitoring the impact of human activity on the environment. There are basically two standards applied to these effluents: the 'general standard' limit which is something achievable by most modern activated sludge treatments works and the 'special standard' limit, which is aimed, inter alia, at reduced concentration of nutrients. The special standard is applied to works which discharge into vulnerable watercourses. This includes most works in Gauteng as effluents pass into sensitive river systems, as noted above.

Failure of a treatment works, whether this be total breakdown or reduced performance resulting on below-standard effluent, obviously leads to excess pollution in the river, whether this be through organics, inorganics (nutrients most importantly) or microbial pollutants. Failure typically occurs due to the breakdown of mechanical or electrical equipment which is associated with poor maintenance or the inability to replace equipment which has reached the end of its useful life. Poor performance of treatment works is widespread in South Africa as shown by data reported later in this article.

MUNICIPALITIES ON THE FRONT LINE, BUT LOSING THE BATTLE

Emfuleni Municipality and the Vaal River

The most widely known example of municipal mismanagement that has led to the pollution of a waterway is that of Emfuleni Local Municipality, in Gauteng, located on the Vaal River.

The Vaal River provides drinking water for approximately 19 million people and supplies numerous commercial enterprises. The South African Human Rights Commission (SAHRC), after finding *prima facie* evidence of a human rights violation, conducted a comprehensive investigation in early 2021 and found that the main cause of the degradation of the Vaal was due to 'inoperative and dilapidated wastewater treatment plants which have been unable to properly process … sewage" (SAHRC, 2011: 2) that originates in a municipality or flows into its wastewater systems for treatment from a neighbouring municipality. Reports of this damage to the environment and human health have been circulating for well over a decade.

The SAHRC concluded that the municipality is at fault for not fulfilling its mandate to provide water and sanitation services. The report also found that the entity responsible for overseeing that these services take place, the national Department of Water and Sanitation, and the entity responsible for ensuring that the environment is not significantly harmed or polluted, the Department of Environment, Forestry and Fisheries, have failed to hold the municipality to account for their actions.

The responsibility for the treatment of this sewage is that of the municipality. The Emfuleni Municipality was placed under administration[2] in November 2018 due to economic, financial, governance, institutional and service delivery failures (Parliamentary Monitoring Group, 2018), after Section 154 support, implemented in 2015, failed to make sufficient impact. The S139 intervention was extended in 2020 due to a lack of sufficient progress.

The SAHRC received submissions that the reasons for the poor state of the wastewater system in Emfuleni included a lack of technical ability in the municipality, theft and vandalism, and a lack of governance controls and accountability measures. As of 2020, the municipal water entity owned by the Ekurhuleni Metropolitan Municipality, the East Rand Water Care Company, has been appointed as an implementing agent to make sure that the wastewater infrastructure is operational and stops the pollution of the Vaal River from poor quality effluent from wastewater treatment works in Emfuleni. However, there is still much to be done; 60% of water samples collected in the week of 7 July 2021 indicate that there is still a 'significant risk' of gastrointestinal disorders due to E.coli levels found in the water (Rand Water, 2021).

Makana, Eastern Cape

Makana Municipality in the Eastern Cape, centred on the university and arts town of Grahamstown/Makhanda, is facing a water challenge on many fronts; a four-year drought, neglect of water and sanitation infrastructure, corruption (Adam, 2021) and maladministration. The municipality has undergone two Section 139 interventions (in 2014 and 2016) where the provincial government took over the administration of the municipality. A ruling by the High Court in 2020 found that the municipality was in breach of Section 152(1) of the Constitution in that it was failing to provide services in a sustainable manner and was not promoting a safe and healthy environment, along with a breach of Section 153, that the municipality was not meeting the basic needs of the community. The court also ordered that the Provincial Executive Council dissolve the council of the municipality due to the failure of the municipality to meet its constitutional obligations (Parliamentary Monitoring Group, 2020b). This ruling has been appealed.

Infrastructure renewal, maintenance and upgrade has been neglected for many years, which has resulted in some wastewater treatments works, such as the Belmont Valley Works, operating at almost 150% design capacity, which results in poor quality effluent discharged into the Bloukrans River (Grocott's Mail, 2016). The municipality also states that the raw water that is received is of poor quality due to upstream wastewater treatment works that discharge poor-quality effluent into the waterway from which the raw water supply is drawn, which further compounds the water quality issues, particularly in times of drought (Maclennan, 2019).

According to the municipality, interventions coordinated by the Municipal Infrastructure Support Agent (MISA) and Department of Cooperative Governance and Traditional Affairs have yielded some positive results (Makana Local Municipality, 2020). However, the municipality no longer reports into the national database, with the most recent results for effluent water quality available in 2017.

Butterworth, Eastern Cape

Failures of wastewater treatment works can lead to large-scale environmental damage or negative impact on human health, but it is not only limited to large-scale events. The town of Butterworth in the Eastern Cape has a population of 46,000 people and is reliant on the Amathole District Municipality to supply water and treat the wastewater that is generated. Evidently, the Amathole District Municipality is failing in this regard, as there are reports of E.coli concentrations of 540 times the maximum allowable limit (Kretzmann et al., 2021a).

All Water Service Authorities (who have the legislated mandate to implement water and sanitation services in their jurisdiction) are required to report into the Integrated Regulatory Information System (IRIS). The Amathole District Municipality reports effluent quality data on its Butterworth wastewater treatment works into IRIS, however, over the period 2016-2020 only 59% of the required data points have been entered, and this proportion has ››

declined from 65% in 2016 to 53% in 2020. The compliance scores for this period are an average of 70%. However, given the lack of compliance with the frequency of measurement the accuracy of this data is uncertain. Water services authorities who do not report into IRIS are in breach of the regulations which govern their actions, but there is little evidence that this is being actively monitored or enforced. The data that is entered into the system itself is also questionable, as there is evidence that this data is inaccurate (ibid).

Table 1: Results of 'distressed'[1] municipality assessment by NT and DCoG, 2018

Category	Total number	% distressed	Total population (million)[2]	Population in distressed municipalities (million)	% people in distressed municipalities
B1 – Secondary cities	19	37%	8.3	3.5	43%
B2 – Large towns	27	33%	4.9	2.4	49%
B3 – Small towns	99	41%	7.8	3.6	47%
B4 – Rural[3]	60	28%	12.5	4.0	32%
C1 – Districts not WSAs[4]	23	9%	15.3	0.9	6%
C2 – Districts – WSAs	21	52%	18.2	9.4	52%

Note:

1. *The extent of 'distress' is assessed through multiple criteria with a municipality that is ranked as 'distressed' being unable to provide effective services to citizens and businesses.*
2. *Population covers only non-metros with total of 33.5 million in 2018. Total population in districts equals total population in local municipalities.*
3. *B4 local municipalities are shown to have a low level of distress but most of them are not responsible for water, sanitation and electricity.*
4. *WSA stands for Water Service Authority – where district municipalities have the responsibility for water and sanitation, the local (B) municipalities are not responsible for these services.*

PERFORMANCE OF MUNICIPALITIES

With municipalities on the front line protecting our rivers, it is important to understand why their performance has been in decline over the past decade.[3] While there are regular articles in the news about failing municipalities, there is, unfortunately, far too little data to track performance of municipalities as a whole, although there are monitoring arrangements for water and sanitation which are covered below.

That said, the overall performance monitoring is improving in metros through a new national reporting system being implemented by National Treasury under the Municipal Finance Management Act, with 'Circular 88' reporting requirements, but currently this does not cover non-metro municipalities. In the case of metros there is only a year of data, so no trend can be tracked. However, the declining performance of metros – with the possible exception of Cape Town – has been well reported in the media.

Without being able to track performance of non-metro municipalities over time, we need to rely on 'snap-shots', with the 2018 'distressed' municipality study by the Department of Cooperative Governance and National Treasury being most useful, showing the following results:

The situation with C2 district municipalities which are responsible for water supply and sanitation is the biggest concern. However, as they serve mostly rural areas, they are responsible for relatively few waterborne sanitation systems, although the example of Butterworth quoted above shows how poor performance of a district leads to decline in river water quality.

Access to sanitation infrastructure

For the purposes of this article, sanitation infrastructure can be broadly separated into that required for sewered systems in urban areas and that required for 'on-site' systems (that are not connected to a wastewater system), mostly in rural areas. In considering the performance of municipalities it is necessary to separate performance regarding the provision of this infrastructure from that related to the management of the infrastructure.

The trends regarding the provision of sanitation infrastructure are remarkably positive, using the StatsSA annual household survey results as a measure (StatSA, 2020). The survey includes a question related to the type of sanitation facility to which the household has access. 'Improved sanitation' includes flush toilets connected to a public sewerage system, or a septic tank, or a pit toilet with a ventilation pipe. Access to improved sanitation increased from 61.7% in 2006 to 82.1% in 2019.

While these findings are positive, they only refer to the extent to which infrastructure exists (a pipe to the house or ventilated pit, for example) and not to the functionality of the service, which is addressed below.

Functionality of sanitation services

The functionality of wastewater treatment works is the main concern of this article, rather than functionality of 'on-site' sanitation systems. These may be problematic from the point of view of users of the facility, but they are less of an issue for water quality in rivers. It has been noted above that the key indicator of performance of treatment works is the quality of the effluent in relation to standards set by DWS. Municipalities are required to report to DWS on effluent water quality, with results entered into the IRIS database. The decline in reporting (number of treatment works for which reports are submitted) and the extent to which the effluent quality complies with standards is shown in Figure 2.

Looking more broadly at the performance of the whole wastewater system, historically DWS has implemented a successful system for monitoring the overall performance of wastewater systems through their 'Green Drop' reports. But their publication was discontinued in 2014, with no reasons provided. The 2014 Green Drop progress report for the period 2008 to 2014 showed an increase in the number of plants at high risk. Of the 850-odd plants assessed, the number which were considered to be at the highest risk increased from 129 to 212 over this period.

There is a new commitment by the government to re-instate this reporting system. In the interim, we have to rely on individual indicators, using the DWS IRIS reporting dashboard. This is the source of information used by Kretzmann et al. (2021b), who state that 56% of the country's 1,150 wastewater treatment plants are 'in poor or in critical condition'. Of these, 265 are 'in a state of decay', says department spokesperson Sputnik Ratau, as reported by Kretzmann et al. 'Getting them back to full operation is challenging, both because of the scale of equipment which needs to be replaced and the extent to which management of the works needs to be improved.'

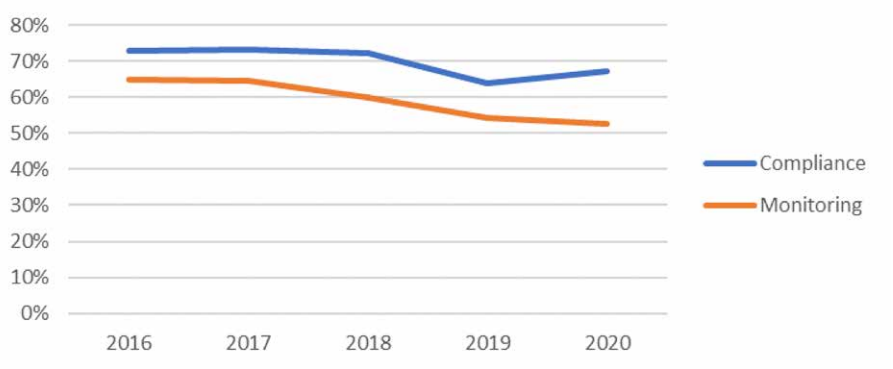


Figure 2: Trends with wastewater treatment works effluent quality

TECHNICAL CAPACITY

The performance of the departments within municipalities responsible for providing sanitation (including wastewater) services cannot be separated from the overall performance of the municipalities. It is well recognised that dysfunction often originates from poor governance. Incapable (or corrupt) councils can easily lead to weak leadership by municipal managers and reduce the ability to appoint properly qualified people into senior positions in departments responsible for large-scale infrastructure and associated services.[4]

Water and sanitation infrastructure is the realm of civil engineering. Yet municipalities employ far too few engineering professionals. Palmer et al. (2017) report on the survey carried out by Allyson Lawless for the South African Institute of Civil Engineers (SAICE): 'In 2005 there were 1,875 civil engineering staff[5] in local government of which 27% were engineers. This represents 0.33 engineering staff per 10,000 people in the country; 0.12 engineers per 10,000 people. These figures are extraordinarily low by international developed country standards where figures of two to four engineering professionals per 10,000 people are typical.'

Not only are the numbers low, but there is insufficient recognition of the key role engineers play in providing these services and, particularly, of the importance of having engineers in leadership positions where they have sufficient autonomy to manage these services without undue political and administrative interference. This decline in the professionalism of municipal engineering departments has been highlighted by Neil Macleod in a 2021 *Business Day* article where he notes that the municipalities themselves recognise that they are not equipped to deliver on their water supply and sanitation responsibilities, as demonstrated by the Municipal Services Strategic Assessment (MuSSA) carried out in 2018. About 78% of respondents stated that they were in an extremely vulnerable or highly vulnerable state. Macleod argues that this will only change when certified engineering professionals are placed at the head of technical services departments, with this position backed by the Water Institute of Southern Africa (Macleod, 2021).

A survey carried out by the SAICE (2019) also illustrates the extent to which engineers feel marginalised within municipalities: '.... amongst 1,367 of its members, 932 (68%) of the surveyed engineering professionals indicated willingness to work in the public sector. There are specific issues however, that prevent engineering professionals from ››

joining the public sector. These include an over-politicisation of infrastructure departments, the diminished decision-making roles of technocrats, the lack of systems, processes and structures for efficient administration, lack of training, development and career paths, and unwarranted interference of HR and finance divisions in the work of infrastructure engineering professionals.'

Trends with engineers in local government: are we improving?

The most recent and comprehensive data on engineering professionals in local government is provided through reporting by municipalities to National Treasury in terms of the Municipal Budget and Reporting Reform (MBRR) standard budget tables. Report SA24 includes data on all professionals and water and sanitation professionals,[6] with data for the latter shown as Figure 3.

The indication from this data is that the number of engineering professionals is in decline in metros, with small gains in local municipalities and districts. This finding conforms with earlier surveys carried out by the SAICE and the Municipal Demarcation Board (MDB), although the MDB does not have valid data for metros. All surveys show alarmingly low numbers in district municipalities which are responsible for water supply and sanitation (C2 districts). According to MDB 2018 data there are five C2 districts with no registered professional engineers and four with only one. Yet each C2 district is, on average, responsible for providing water and sanitation services to 850,000 people.

WHAT CAN BE DONE TO IMPROVE THE TECHNICAL CAPACITY OF MUNICIPALITIES?

Capacity building has been high on the government agenda over the past decade. Yet the evidence on this presented here leads to the conclusion that the overall performance of municipalities in managing water and sanitation services is poor and is not getting better – although there will be successes in some individual municipalities or groups of municipalities. Overall, the indication has been that current capacity-building initiatives have been ineffective, whether these be internal to municipalities or instituted provincially or nationally.

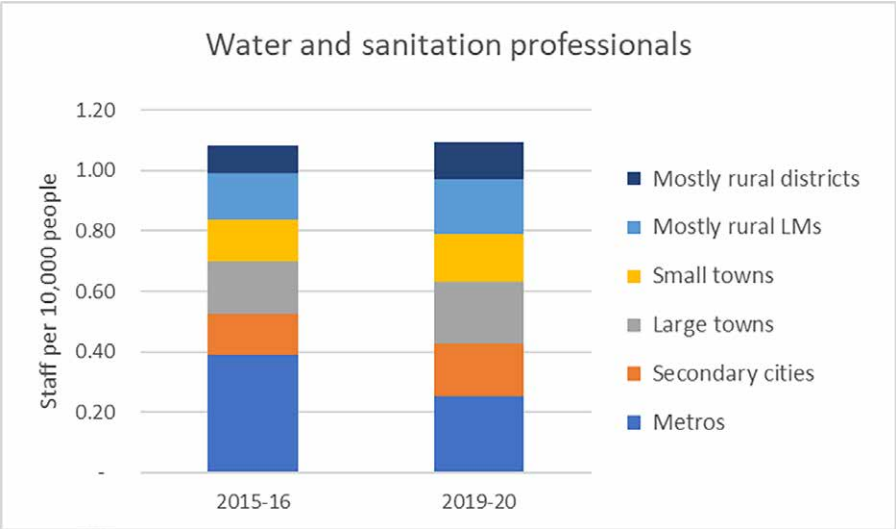


Figure 3: Trends for water services professionals per 10,000 people, by category

There is as yet no nationally developed strategy to improve the technical capability of municipalities across all categories of municipalities with regard to goals, organisational responsibilities and financing proposals. Reliance has been placed on national departments and agencies to 'build capacity', specifically the DWS, MISA and the Government Technical Advisory Centre (GTAC) within National Treasury. But these organisations lack sufficient infrastructure management capacity themselves, whether this be to set up programmes, provide direct advice or set up partnerships with private sector providers.

Without a technical capacity-building strategy accepted by the government, reference is made to proposals put forward at a technical capacity-building workshop held in February 2020 at the DBSA Vulindlela Academy. These proposals, which build on programmes already in place, or at least conceptualised, and focus on a blend of public and private sector activity, are used as the basis for recommendations made here.

Support the supporters

DWS, MISA, GTAC and the provinces all lack technical capacity, professional engineers most importantly, and they require technical assistance. This is best provided as a combined effort between national government and international development agencies. In the case of MISA, this assistance should be focused on measures to increase the ratio of graduate engineers to engineering technologists and improve their ability to assist municipalities to set up a range of partnerships with private service providers. In the case of GTAC, their public-private partnerships (PPPs) unit needs to be given much greater responsibility to support municipalities with PPPs and they need to expand the type of partnerships they support to include management contracts and operating contracts.

Failures of wastewater treatment works can lead to large-scale environmental damage or negative impact on human health.

Focus on programmes

The proposed capacity-building intervention is focused on four programmes which either exist or need to be established.

1. **City Support Programme (CSP),** targeted at the eight metros, started its second five-year phase in 2019. It is hosted by National Treasury and staffed by specialists on five-year contracts. Support is provided across a range of activities with moderate support for infrastructure provision. It is funded by National Treasury and supported by the World Bank. The CSP needs greater emphasis on infrastructure-intensive services and support to metros to set up partnerships.
2. **The Intermediate City Municipality Support Programme** is targeted at 39 intermediate cities[7] which include the 19 secondary cities. It is at an early stage of implementation with a design completed, some city diagnostics and two cities supported at pilot phase. The design provides for a project management unit (PMU) to be located within the Department of Cooperative Governance with a staffing structure including an infrastructure manager. But the means for bringing in high-level engineering expertise is uncertain. The programme requires funding of about one billion rand over five years but remains largely unfunded. It is assumed that some of this can be considered as technical capacity building, but supplementary funding will be necessary to deal with the large shortage of technical expertise.
3. **Towns and Rural Local Municipalities Support Programme:** This programme does not exist, although the South African Local Government Association (SALGA) has hosted a small-scale small towns regeneration programme over recent years. There are 157 local municipalities in this group, some 100 of these potentially categorised as 'small towns', with the remainder being larger towns and rural municipalities. Supporting these municipalities is a great challenge best met by provinces and MISA. MISA is best suited to run this programme nationally but will require funding and technical assistance to implement it.
4. **Rural Districts Support Programme:** There are 21 districts, referred to as C2s, which are responsible for water and sanitation and have a low level of technical capability. A business plan for **Regional Management Support Contracts (RMSC)** for these districts was set up by MISA in 2015 and supported conceptually by the Department of Cooperative Governance, with funding from National Treasury. At the time, the World Bank's PPP unit was also engaged. The programme was not implemented in accordance with its business plan and has made limited progress since then in three districts, far short of the 21-district implementation envisaged for the five years commencing in 2016. Nevertheless, based on the business plan, it remains the primary option for substantially improving water and sanitation services in these districts. But a new programme management structure is required. ››

Public-private partnerships

PPPs can be narrowly defined to include relatively well-known concession, build-operate-transfer (BOT) and lease contracts which require investment by the private partner in the case of the first two, and ongoing management of the infrastructure. But management contracts – where the private partner works together with management in the municipality to manage the service – and operating contracts – where the private partner operates the infrastructure for a fee – are the most important partnership options. In a situation with inadequate capacity in the public sector these partnerships will be important in the future, with the role of GTAC in supporting their implementation mentioned above.

Financing technical capacity-building interventions

National Treasury has suggested that R3 billion is already being spent on capacity building for municipalities. However, only a small part of this has a direct impact on building technical capacity. There are questions over the effectiveness with which this funding is spent to improve technical capacity, with two primary concerns: there is too little emphasis on operations and maintenance; and funding is not sufficiently aligned with a properly designed support programme. It is proposed here that funding needs to be realigned and targeted at the four programmes mentioned above, and international development partners need to play a more substantial role.

TO CONCLUDE

The sanitation (wastewater) service in South Africa is poorly managed by two-thirds of municipalities and this is causing a serious decline in water quality in rivers and dams. But there are ways of improving this through building the capacity of municipalities so that they can employ more engineering professionals and increase partnerships with private service providers. The highest priority should be given to funding properly structured infrastructure provision support programmes and to setting requirements for professional engineers to head technical departments in larger municipalities.

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ENDNOTES

1. For more on wastewater treatment see Hansen, 2015.
2. An intervention in line with S139(1b) of the Constitution whereby an Administrator is appointed to oversee the operation of the municipality.
3. See Palmer, et al., 2017, for an overview of the capability of municipalities.
4. See SALGA, 2009, for more detail on governance of municipalities.
5. The term 'engineering staff' incorporates graduate engineers, technologists and technicians. 'Engineering professionals' include graduate engineers and technologists.
6. The term 'professionals' is not defined but is assumed to include graduate engineers and technologists.
7. The inclusion of all these municipalities as 'cities' is questionable. NA