MASKAM® WATER

FUSION®
Wastewater Treatment Plant

Is your development being affected by the lack of treatment capacity in the Zandvliet, Macassar and Potsdam Wastewater Treatment Works and the subsequent

SOP for Package Plants

issued by City of Cape Town?

info@maskam.co.za
maskamwater.com

DID YOU KNOW?

If you install and on-site wastewater treatment plant (Package Plant) in the affected areas, not only can your development continue, but the City of Cape Town will:

- Discount the DC for sewage.
- Not levy a sewage charge on the utilities bill for as long as the plant is in operation.

Treating wastewater on-site for re-use purposes, will:

- ✔ Increase your development's green rating.
- ✔ Reduce the potable water demand, which is a nett saving for the home owners.

The water saving and not paying for sewage can be very good sales points for your development...

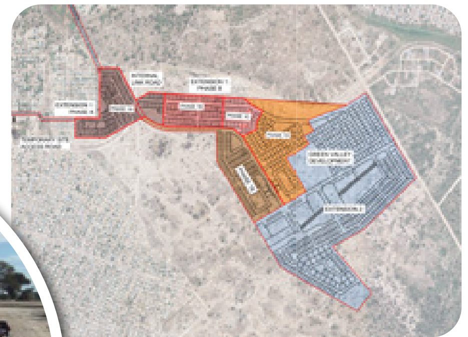
Fusion Wastewater Treatment Plant is the best option for your urban development.

- No space is lost to accommodate the Wastewater Treatment Plant. Fusion installations are sub-surface and can thus be installed in POS. Installing in parking areas is possible provided a weight-bearing slab is cast over the plant.
- Stretching your cash flow...
  - Fusion allows for modular installation and can grow with your development. i.e. you only need one ZF4000 Fusion to occupy the first 20 houses, and additional units can be installed as more houses are built.
  - For larger developments it is possible to decentralize within the development, i.e. the entire plant installation need not be in one spot. This can bring significant savings in terms of internal infrastructure.
- Aesthetically pleasing. Being underground, the Fusions are hardly visible.
- Treated effluent can be used for garden irrigation, cleaning of hard landscapes and toilet flushing.

Katima Mulilo - Namibia

Each phase will get it's own set of treatment plants, thus omitting long pipe runs even within the development

New developments
(decentralised)



Equal flow splitter
(can accomodate 6 plants)

DID YOU KNOW?

- Fusion has the longest service intervals of any small plant on the market.
- Servicing is limited to one hour per Fusion every six months only. No regular check-ups or visits to the plant.
- Fusion is factory-built and drop-in on site, therefore it is very easy to install, retrofit or expand as needed.
- The energy consumption of Fusion is the lowest in it's class, with the ZF4000 using only 0,55kW per kl of wastewater treated.
- It is easy to run Fusion off alternative power, i.e. solar.
- Fusion is specifically designed for urban use and can be installed in close proximity to buildings. There is no foul odour during normal operation.

When installing a Fusion Wastewater Treatment Plant, and re-using the treated effluent for non-drinking purposes on-site, you automatically comply with CoCT Water Amendment By-law, 2018:

(c) by the substitution for subsection (5) of the following subsection:
"(5) Where renovations to an existing building triggers a building plan approval process, full details of any [proposed] water conservation and demand management system or alterative water systems [such as a grey water system, air conditioner or bleed-off] for flushing toilets, irrigation, swimming pool filling or top-up or other non-domestic purposes must accompany the building plans."; and
(d) by addition after subsection (5) of the following subsections:
"(6) All new developments must provide for the installation of water conservation and demand management systems or alternative water solutions for non-domestic purposes and full details thereof must accompany the building plans.

Fusion needs minimal maintenance...

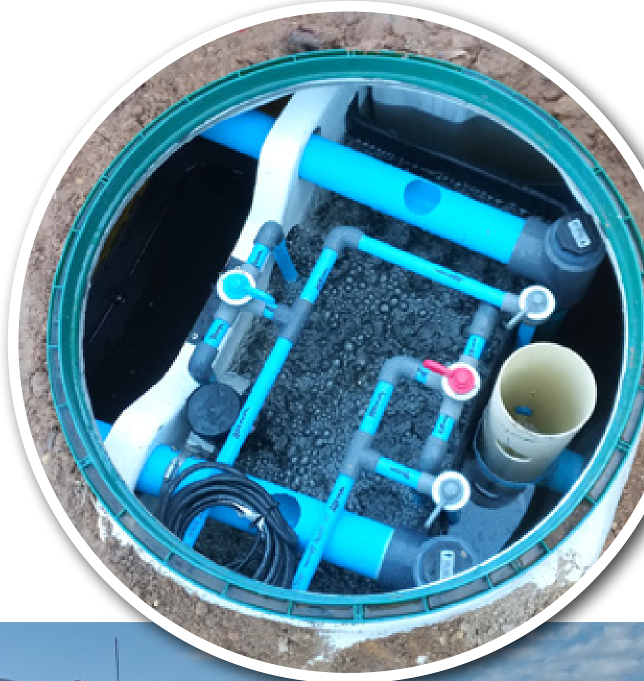
- Only the pre-screen needs periodic cleaning.
- No daily, weekly or monthly check-ups!
- The Early Warning System will notify the user if there is any mechanical failure or high water level conditions within the unit.
- Service interval: Once every six months only!
- SLA available from a number of installers and service agents.
- Average period of desludging is every 4 years only!

Fusion has the lowest running cost...

The total running cost for the ZF4000 is less than R4 per kl**.

This includes:

- Power consumption
- Services
- Service parts
- UV lamp replacement
- Desludging



** Cost of power: R3/kWh
Irrigating with treated effluent from the Fusion is much cheaper than municipal water.

Easy to install:

- Factory-built, drop-in on site
- No concrete structures required
- All materials used are non-corrosive in the septic environment.
- No metal in the bioreactor

Smallholding, 2014 - **Upington**

Benefits of modular design

Modular design reduces environmental risk

The modular design for larger applications significantly reduces environmental risk.

This modular system significantly reduces the environmental risk. **If, e.g. 10 x Fusions are installed in one area and there is mechanical failure on one, only 10% of the total volume may be compromised.** The other plants will operate as usual and still deliver good quality effluent. Given that the only moving part on a Fusion is the air pump, downtime in the event of mechanical failure should never be more than a few hours at most, since it only takes half an hour to exchange the air pump. That in itself significantly reduces environmental risk.

Easy expansion

The modular design allows for expansions at any stage. Given that each module is a fully functional wastewater treatment plant in its own right, adding or removing modules to add or reduce daily treatment volume is easy.

If future growth is anticipated, it is recommended that a splitter box be installed to accommodate the total number of plants needed. Unused outlets will simply be blocked off until such time that they are needed. The same applies to the outfall, where it is better to design for the total volume and Fusions can be added at any given point.

Curro School Group, Curro School - Bloemfontein

Saving 15kl per day. Treated effluent used for irrigating the sports fields.

Original Curro 2018 installation for 600 learners.

2023 - 50% capacity added without changing the infrastructure.

Identifiable and relocatable:

- Each Fusion is serial-numbered and materials used during manufacturing can be traced back if needed.
- Being a single tank construction, it is easy to relocate, should the need arise.

Certifications and accreditations:


WASTEWATER TECHNOLOGY

NSF

CERTIFICATION

NSF International has determined by performance evaluation under the provisions of NSF/ANSI Standard 40 (revised August 2005) that the Zoeller ZF450 manufactured by Zoeller, Inc. has fulfilled the requirements of NSF/ANSI Standard 40. The ZF450 has therefore been authorized to bear the NSF Mark so long as Zoeller continues to meet the requirements of Standard 40 and the NSF General and Program Specific Policies.

General performance evaluation and stress tests were performed at the NSF Wastewater Technology Test Facility located in Waco, Texas. The raw wastewater used in the test was municipal wastewater. The characteristics of the wastewater during the test are included in the tabulated data of this report.

The observations and analyses included in this report are certified to be correct and true copies of the data secured during the performance tests conducted by NSF on the wastewater treatment system described herein. The manufacturer has agreed to present the data in this certification in its entirety whenever it is used in advertising, prospectuses, bids or similar uses.

Thomas J. Bruursema
General Manager
Wastewater Treatment Unit Program

Thomas Stevens
Technical Manager
Federal Programs

COP27 Solutions Call Winner

DID YOU KNOW?

Fusion has been in use in rural and urban areas since 2010.

340 Plants installed in 8 African countries, Mauritius, and the UAE.

Manufactured in the Western Cape.

Installed and maintained by local contractors.

CASE STUDIES

Western Cape Goverment

The Department of Environmental Affairs and Development Planning - Cape Town

Saves 1 million litres of water a year.
Treated effluent used for flushing toilets.

Oudtshoorn Munisipality

Cango Caves, Heritage Site

Cango Caves saves 3.5 Megalitres of water per year.

City of Ekhuruleni

Rhynfield Bunny Park - Benoni

The low power consumption makes the Fusion ideal to be powered by solar energy.

American School - Maputo

Treated effluent used for irrigating the sports fields.

Cape Nature

De Hoop Nature Reserve - 2019

Fusions installed on the Whale Trail.

Wind farms

- Loeriesfontein
- Springbok
- Sutherland

Department of Public Works/ Education

Oyster Bay - Eastern Cape

Treated effluent used for irrigating vegetable garden.

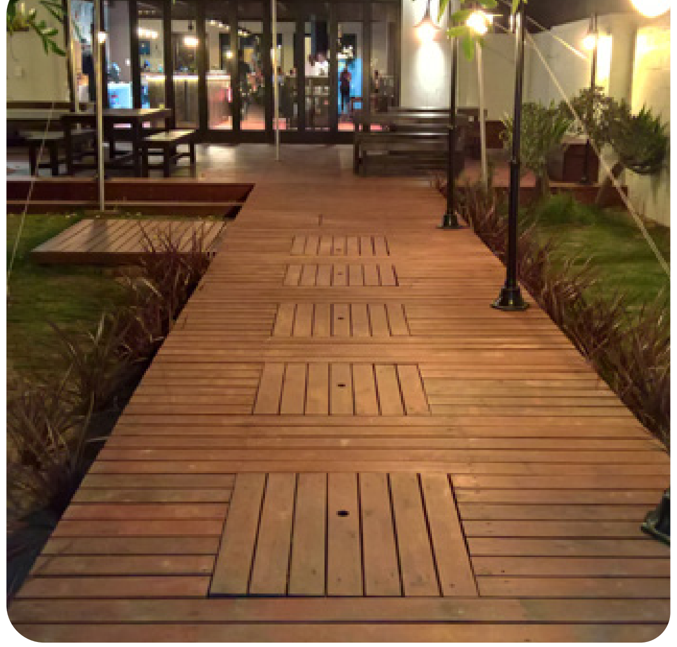
Barloworld

Barlow World Caterpillar, Maputo

Installed under walkway. Treated effluent used for garden irrigation.

Synergy Groove Bar & Grill - McGregor

Fusion installed under walkway from the restaurant to the toilets. Treated effluent used for garden irrigation.



Acacia Cottages - Franschhoek

First Fusion installed in South Africa in 2010. Eco-friendly, development.

Taleni Africa

Sossusvlei Lodge (2 Fusions)

Treated effluent used for vegetable garden irrigation.

A FEW OTHER CASE STUDIES

Customer	Site
City of Cape Town	Helderberg Nature Reserve
South African National Botanical Institue	Harold Porter Botanical Garden
Cape Nature	Vrolijkheid Nature Reserve
Shell	Shell Ultra City, Lobatse Border Post
Caltex	Sonop Motors, Citrusdal
Copper Mine Botswana	Mining village, Copper min e, Maun
Botswana Government	Maun International Airport
Taleni Africa	Etosha Trading Post
	Desert Camp
	Desert Quiver Camp

City of Cape Town's Standard Operating Procedure for Package Plants:

The procedure from the City states the following:

- City of Cape Town has made provision for package plants to be installed in Potsdam, Zandvliet and Macassar areas where the sewage works have reached capacity.
- Once applicants contact the district planning office, it will trigger a pre-application consultation with the City.
- City officials will guide the applicant on the process within the City.
- Thereafter the application is evaluated including public participation.
- Where a package plant is recommended, the City issues an endorsement letter supporting the temporary package plant.
- The developer should apply to external authorities (DWS and DEA &DP) for Water use and environmental approvals separately (with respect to the package plant).
- The applicant enters into a Water Services Intermediary (WSI) agreement with the City to establish and ensure compliance monitoring.
- The Water Use and Environmental approvals will be part of the requirements to obtain the City's clearance for property transfer.
- The package plant can then be utilised.

The Fusion Wastewater Treatment system ticks all the sustainable, alternative water boxes!

info@maskam.co.za • maskamwater.com

Wastewater treatment and reuse/reclamation

CASE STUDY


Photo © Maskam Water

Wastewater treatment and reuse/reclamation refers to the process of contaminant removal from captured discharged water and chemically, biologically or physically treating it to a desired standard as reclaimed water for restored use.

SA CHALLENGES ADDRESSED BY WASTEWATER TREATMENT AND REUSE/ RECLAMATION

Comparative costs of centralised wastewater treatment systems

Connection to centralised wastewater treatment systems and managing wastewater sludge are costly (~40 - 60% of total WWTW plant costs), and usually requires significantly longer development timeframes.

Disposal and landfilling costs

Residual sludge (digestate) disposal is becoming less viable due to transportation costs and landfilling fees.

Producer-beneficiater misalignment

Lack of bespoke infrastructure and technology requirements that adequately meet the wastewater sludge composition/quality for beneficiation.

Property developments are constrained due to lack of wastewater infrastructure and capacity at WWTWs.

ASSOCIATED CLEAN TECHNOLOGIES
examples and service providers

- **SAFWATER**
  Mobile sewage treatment plant - Mobile package solutions of various volume and effluent capacities for waste water treatment. The 17m3/h WWTW runs on as little as 340Watt and can easily be powered through a solar PV installation.
- **MASKAM WATER**
  Clarus Fusion - A sustainable on-site wastewater recycling solution.
- **OTHER EXAMPLES OF WASTEWATER TREATMENT AND REUSE/RECLAMATION SERVICE PROVIDERS**
  KaacKai

KEY DRIVERS FOR THE UPTAKE OF WASTEWATER TREATMENT AND REUSE/RECLAMATION

Sludge diversion opportunities

Municipalities can save ~R330 million per annum through technology service providers by diverting sludge from disposal and saving on transportation costs.

Regulatory landscape changes

- Imminent organic waste to landfill reduction plan and existing liquid waste to landfill ban in 2027.
- National target for **75% organic waste diversion from landfills** by 2030.
- Imminent organic waste to landfill ban by 2027 in the WC.

Project preparation support for wastewater infrastructure projects

Increased interventions by **Government to support technical feasibility studies** and pipeline of potential projects in water reuse, non-revenue water, and off-grid sanitation (eg. DBSA's Project Preparation Facility)

KEY BENEFITS OF WASTEWATER TREATMENT AND REUSE/RECLAMATION

Decentralized and effective

On-site wastewater treatment is more cost effective, and implementation can occur over a short time frame without having to connect to central wastewater treatment plants.

Multitude of uses possible with treated grey, blackwater and industrial effluent

Non-potable water can be used at household levels (reuse of grey and/or black water), commercial and industrial levels (onsite treatment and reuse of organic and inorganic wastewater), and municipal levels (municipal-scale reuse of treated effluent).

Business case of wastewater reuse and sludge beneficiation

Potable water savings, water and sanitation tariff savings. Beneficiating wastewater sludge and faecal matter to produce fertiliser, compost, bio-char, and fuels for energy recovery and power generation.

UNDP'S SUSTAINABLE DEVELOPMENT GOALS (SDGS)

- **6** Clean water and sanitation
- **7** Affordable and clean energy
- **11** Sustainable cities and communities
- **12** Responsible consumption and production

What will it take to shift the dial on Wastewater treatment and reuse/reclamation

INCREASED INVESTMENT IN WATER AND SANITATION SECTOR

The Department of Water and Sanitation (DWS) estimates a **R90bn per annum capital requirement** for the water and sanitation sector, of which R70bn is required to supply and maintain water supply infrastructure, and R20bn is for sanitation and wastewater collection and treatment.

THIS REPRESENTS A SHORTFALL IN FUNDING OF **R33BN** PER ANNUM.

ALTERNATIVE, SUSTAINABLE AND INNOVATIVE SOLUTIONS to decentralized wastewater treatment due to deterioration and inadequate refurbishment of WWTW and infrastructure.

OUT OF **824 ASSESSED WWTWS** IN SA:

212 ARE CRITICAL RISKS

259 ARE HIGH RISK

218 ARE MEDIUM RISK

135 ARE LOW RISK

SAFWATER MASKAM WATER GreenCape

This content is produced in collaboration with the Friedrich Naumann Foundation for Freedom in partnership with GreenCape. Thank you to NFT Hydro for providing information.

FRIEDRICH NAUMANN FOUNDATION For Freedom. South Africa

GreenCape

CaseStudy

2021

Off grid sanitation

Cango Caves, Oudtshoorn

By installing off grid sanitation, the Cango Caves reduced water use by 60%, saving R163 200 in the first year of operation.

Challenge

The Cango Caves, a national heritage site near Oudtshoorn, attracts ~250 000 tourists a year. The site is widely acknowledged as a key contributor to the economies of Oudtshoorn, the Klein Karoo, and the Garden Route. However, with an increasing number of tourists every year, and a seven-year drought in the region, the water supply and sanitation infrastructure has come under extreme pressure.

The Cango Caves has been supplied with municipal water through a small diameter pipeline at relatively high pumping costs. It is serviced by an inefficient old reed bed sewage treatment facility. During peak times, the treatment facility can't handle the sewage volumes and has had to contract a company to remove the excess sewage via honey suckers.

Business benefits

Cango Caves has reduced potable water demand by more than 3.6 million litres per annum (~60%) and saved ~R163 200[2] in the first year (September 2019 – September 2020). The installation of the non-sewered sanitation system has reduced the pumping energy demand, and mitigated potential environmental pollution. The installation would have also saved Cango Caves ~R54 459[3] in the first year if the toilet facilities were connected to a municipal sewer.

Annual business water savings	3 600 kl
% annual water savings	60%
First year municipal water savings	R163 200
Potential first year sanitation savings	R54 459
Total capital investment	R2 500 000

Solution

In 2017, the Oudtshoorn Municipality put out a tender for an alternative (decentralised) wastewater treatment system to replace the old reed bed. The main aims of the alternative system were to reduce municipal water demand and upgrade the wastewater treatment system. A low energy and maintenance sanitation system that can treat and reuse about 70% of the treated effluent to flush the upgraded toilets and for irrigation purposes was procured for R2 500 000[1]. The upgraded toilet facility was fitted with a dual reticulation system to allow for 24 low flush toilets and 6 urinals to be flushed with treated effluent, whilst the wash basins are connected to the potable water system.

Lessons learned and plans for the future

Cango Caves will continue to implement water saving initiatives. They are also looking into augmenting their water supply through the use of rainwater harvesting and groundwater.

CANGO CAVES

Western Cape Government Economic Development and Tourism

BETTER TOGETHER.

[1] Total capital investment includes the cost of the plant (~R1 500 000), installation, piping, instrumentation, electrical, utilities, storage and contractor's fee.
[2] Cost savings (excluding sanitation, reduced energy demand and sewage disposal via honey suckers) calculated based on the Oudsthoorn Level 4 water tariffs at R38.78 and R42.66 for 2019/20 and 2020/21 per kilolitre (excl VAT) for state properties, respectively.
[3] Sanitation savings were calculated based on the 2019/2020 and 2020/21 annual sewerage tariffs of R1788.48 and 1949.44, respectively for government, schools, hospitals or training centres per toilet/pan/urinal.

Authored by Ashton Mpofu, GreenCape: water@greencape.co.za / 021 811 0250
Chris Koch, former Cango Caves Director Technical Services: kochc@bergmun.org.za / 022 913 6085

GreenCape

Industry brief
2020

Reusing wastewater
Promoting on-site treatment and reuse

Main insights

1) The treatment & reuse of wastewater is a key intervention to mitigate the risk of water supply shortages.

2) Grey- and blackwater can be treated to non-potable standards through on-site wastewater treatment processes.

3) Non-potable water can be used in a wide range of applications

4) A strong business case, compliance with regulations and reputable technology providers are important considerations when investing in this solution.

Context

- South Africa is a water scarce country and is projected to have a 30% water supply deficit by 2030.
- The reuse of wastewater, in conjunction with increasing water-use efficiency and developing alternative sources of water (Figure 1), is seen as a key intervention to mitigate this supply deficit.
- Non-potable water has a multitude of uses ranging from simple household reuse of greywater, to on-site treatment and reuse of grey, black, organic and inorganic wastewater in commercial and industrial settings, to municipal-scale reuse of effluent.

This brief focusses on the on-site treatment of grey- and blackwater to non-potable standards for on-site reuse. It highlights applicable regulations and standards, available technology types and drawbacks or barriers to these technologies.

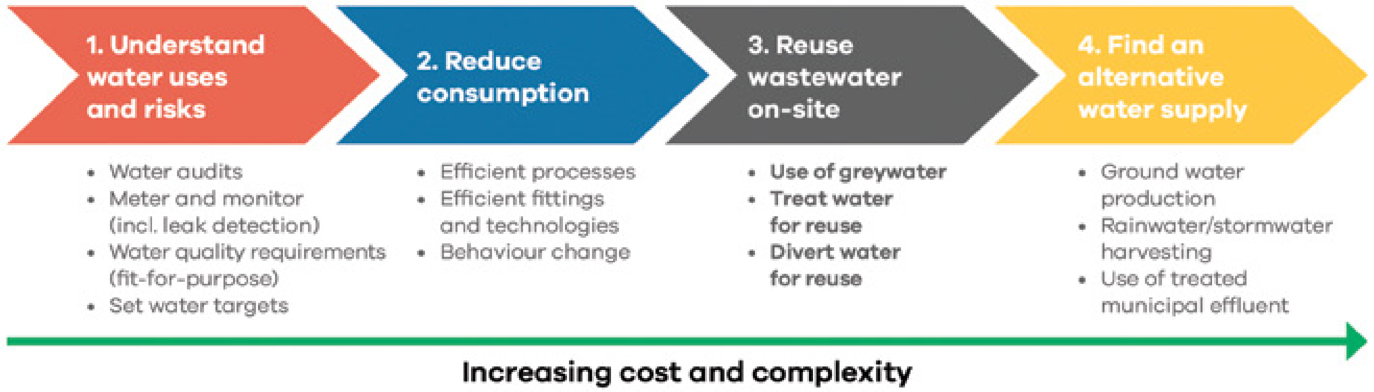


Figure 1: Key interventions that build water resilience.

The Opportunity

1. Wastewater in residential and commercial buildings can be reused for a number of different purposes.
2. While wastewater can be treated to potable standards, this is rarely cost-effective and can be overly complex.
3. Certain industries also produce organic wastewater, while others produce inorganic wastewater, both of which can be treated and reused on-site in many instances.
4. Residential and commercial buildings (offices, retailers, hotels, schools and guesthouses) will have a smaller demand for potable water than non-potable water (Figure 2a), and will produce organic wastewater (grey and blackwater). Therefore, these applications are most likely to be suitable for on-site wastewater treatment and non-potable reuse (Figure 2b).

Key:

- Potable uses
  - drinking
  - food / body washing
- Non-potable uses
  - toilet flushing
  - irrigation
  - outside surfaces
  - vehicle washing
- Losses
  - evaporation
  - drinking
  - irrigation
- Grey water
  - from showers,
  - basins,
  - surface washing
- Blackwater
  - from toilets / kitchen sinks

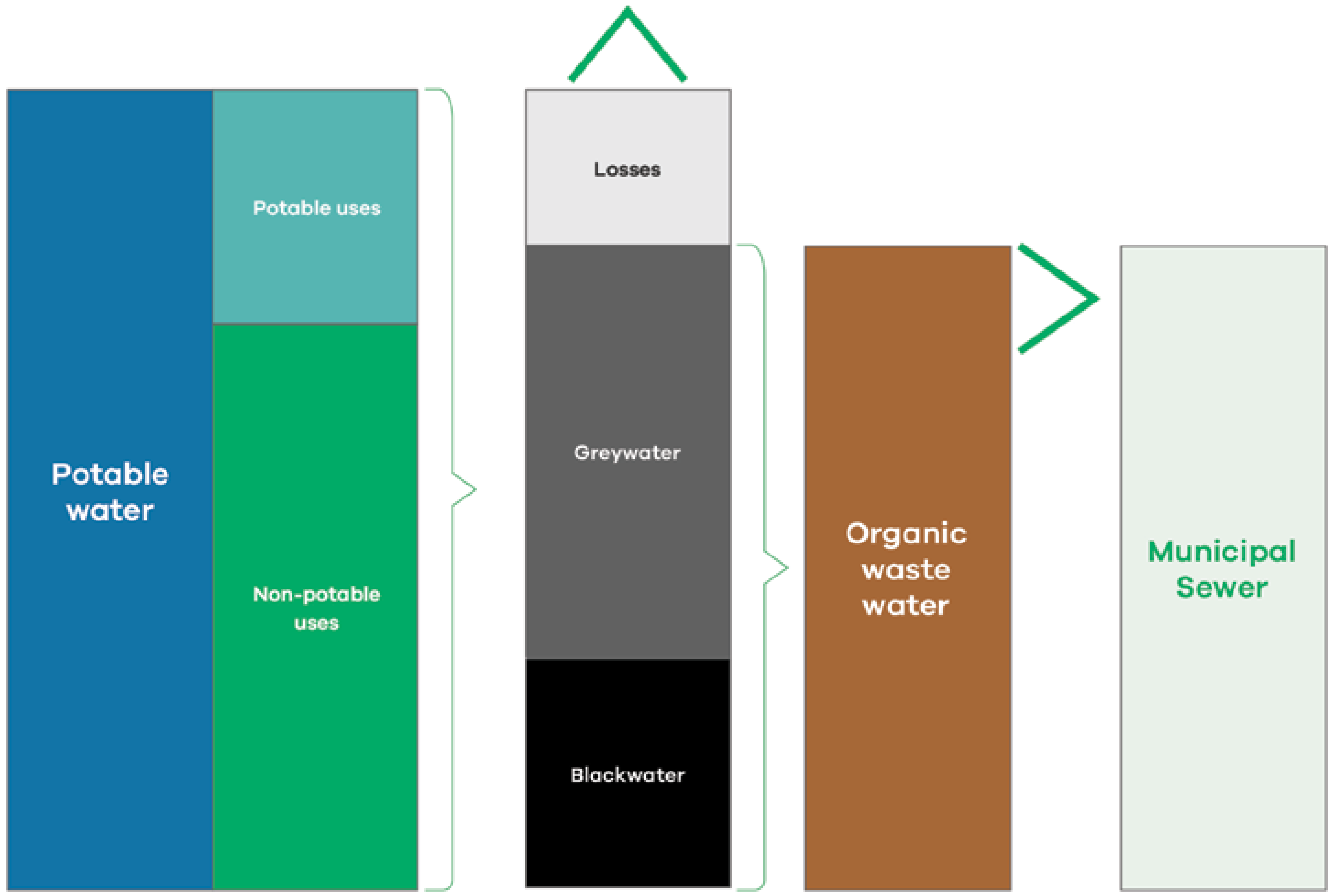


Figure 2a: Water use and wastewater generation flows within a typical residential or commercial property, without on-site wastewater treatment (indicative relative volumes represented by size of blocks).

Glossary:

Organic wastewater:	wastewater that is contaminated with carbon-based contaminants, for example human waste, plant or animal matter.
Greywater:	lightly contaminated wastewater typically from bathroom basins, showers, baths, laundries and light cleaning; classed as organic wastewater.
Blackwater:	contaminated with human excrement (urine and faeces), classed as organic wastewater.
Organic industrial wastewater:	typically wastewater from food and beverage industries with contaminants from food and beverage production
Inorganic industrial wastewater:	contaminated wastewater from industrial processes other than food and beverage production, e.g. mining, petrochemical production
Potable water:	water that is safe to drink, used to wash food or used in production of food and beverage products. Typically supplied by municipality, with quality parameters prescribed by SANS 241.
Non-potable water:	water that does not meet potable standards and, depending on quality, can be used for irrigation, cleaning of vehicles, toilet flushing, industrial processes that do not require high hygiene standards (subject to appropriate guidelines for use). E.g. raw water from a river or dam, or wastewater that has been treated adequately (treated effluent).

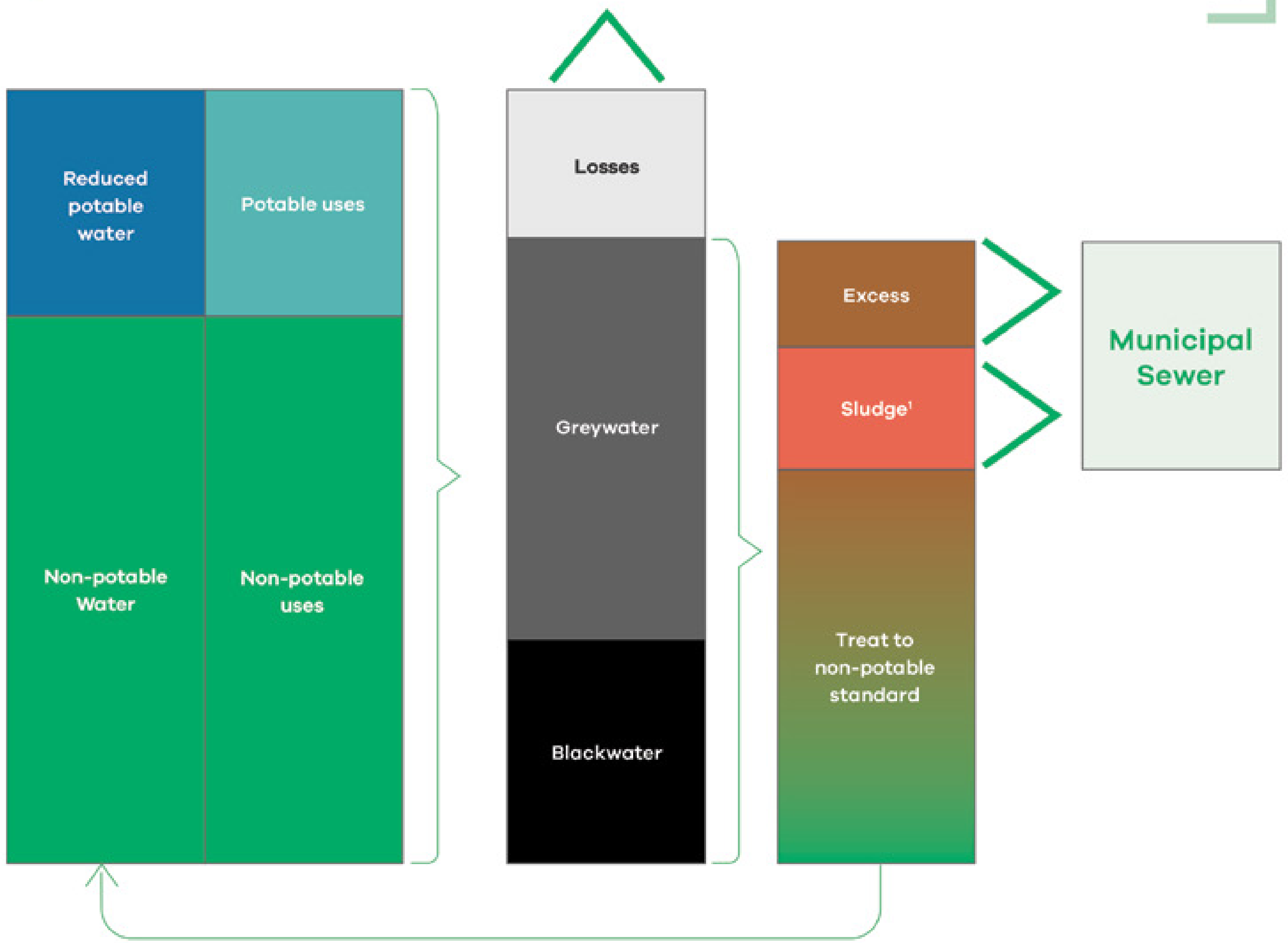


Figure 2b: Water use and wastewater generation flows within a typical residential or commercial property with on-site wastewater treatment and reuse[1] (indicative relative volumes represented by size of blocks).

[1] Sludge can also be removed periodically if it exceeds municipal effluent discharge parameters, or if municipal sewer connection is not available.

The Options

In *urban* settings, a significant proportion of the water demand is for non-potable uses, which is historically met with potable water. Potable water is costlier in most municipalities, and costs are projected to rise at above inflationary rates. In addition, where water restrictions are in place, the cost of water is generally higher, and in many cases, there are restrictions on using potable water for irrigation. Furthermore, in cases where existing wastewater infrastructure doesn't exist (many informal settlements, or in some cases new developments), it may be more cost effective to install on-site wastewater treatment than expanding infrastructure networks to connect to the central wastewater treatment plants.

In *rural* settings, the main driver for on-site wastewater treatment would be the high costs or unfeasibility of connecting to the municipal sewer system, and compliance with the future ban on septic tanks. This would typically apply to:

- Remote / off-grid (farms, schools, guesthouses, hotels; historically serviced by septic tanks, which are unreliable and don't always meet the regulatory standards for treated effluent discharge).
- Mining staff (in addition to being off-grid, staff numbers may fluctuate and can be serviced through temporary on-site wastewater treatment solutions that can be moved to other operations when needed).

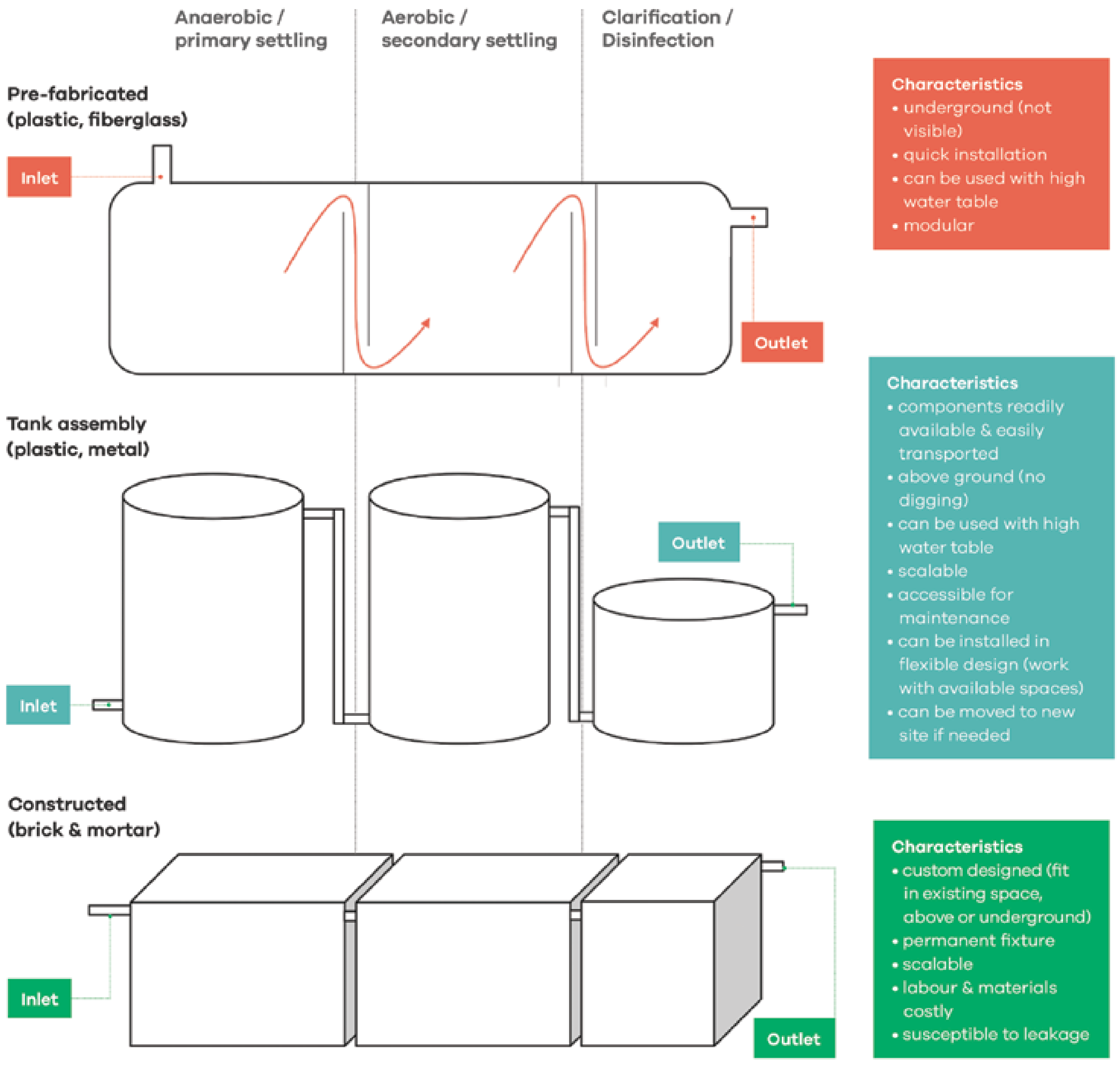


Figure 3: Variants of on-site wastewater treatment technologies, and characteristics specific to each of these.

Technology variants

Organic wastewater is generally treated using biological processes (such as micro-organisms that consume and digest the organic contaminants). In most cases, the following steps are included:

1. Screening to remove large solids;
2. Primary settling where solids settle down, and fats and oils rise to the surface, and initial treatment with anaerobic bacteria occurs (Anaerobic Digestion, AD);
3. Secondary settling where the water from the first treatment step is treated with aerobic bacteria, which requires the addition of oxygen through a variety of mechanisms. Variants here are known as Activated Sludge (AS), or Sequential Batch Reactor (SBR), Trickle Filter, or Rotating Biological Contactor;
4. The final step is clarification and disinfection, typically through chlorination, UV or ozone treatment.

During these treatment steps, sludge is produced, which in some cases has to be extracted and disposed of periodically (every 6 or 12 months depending on the design). While these generalised treatment steps are most common, **technology providers do vary in how they implement these and may exclude one of the steps to reduce costs, or include additional steps to improve performance, depending on the application, the quality of wastewater and desired final water quality.** These variants influence the production and operational costs of a system.

Additionally, materials used to produce or construct on-site wastewater treatment plants vary. These can come in the form of pre-manufactured products, with internal divisions and components, or built using plastic or metal tanks using components commonly available in hardware stores, or constructed with bricks and mortar (see Figure 3 for characteristics of each). The best solution will be determined by site-specific constraints and client needs.

Drawbacks and barriers

On-site wastewater treatment can be effective, but there are some drawbacks even when a system is correctly designed, installed and operated.

- If the design parameters of the system are not adhered to, e.g. with the introduction of **inorganic contaminants, the plant can be rendered ineffective** as the bacteria that treat the organic load are killed. These bacteria can be re-established, but this can take several weeks (during which time the plant will not operate correctly). In some cases, this limitation requires using alternative chemicals or cleaning agents, in conjunction with user education.
- **Variable wastewater volumes or organic loading** (for example seasonal changes in the amount of wastewater that gets discharged into the system) can be problematic as the bacterial populations that digest the organics die off when there is low loading, and cannot multiply quickly enough with sudden increases in loading. Technology suppliers can usually advise on how to address this problem.
- Possible consequences are that effluent that has not been treated to the required quality is discharged / reused (either human or environmental risk). Systems with quality control and ability to over-ride the system until the effluent quality is suitably treated are preferable, and required by the SABS standards.
- Increased operational complexity, as some technologies require periodic de-sludging or frequent dosing with bacteria and / or chlorine. These activities are not overly difficult, but do require additional attention, and some technology suppliers offer this as a service contract.
- **Upfront costs** can be prohibitive, although some technology providers do offer internal financing arrangements, or financing via commercial banks.

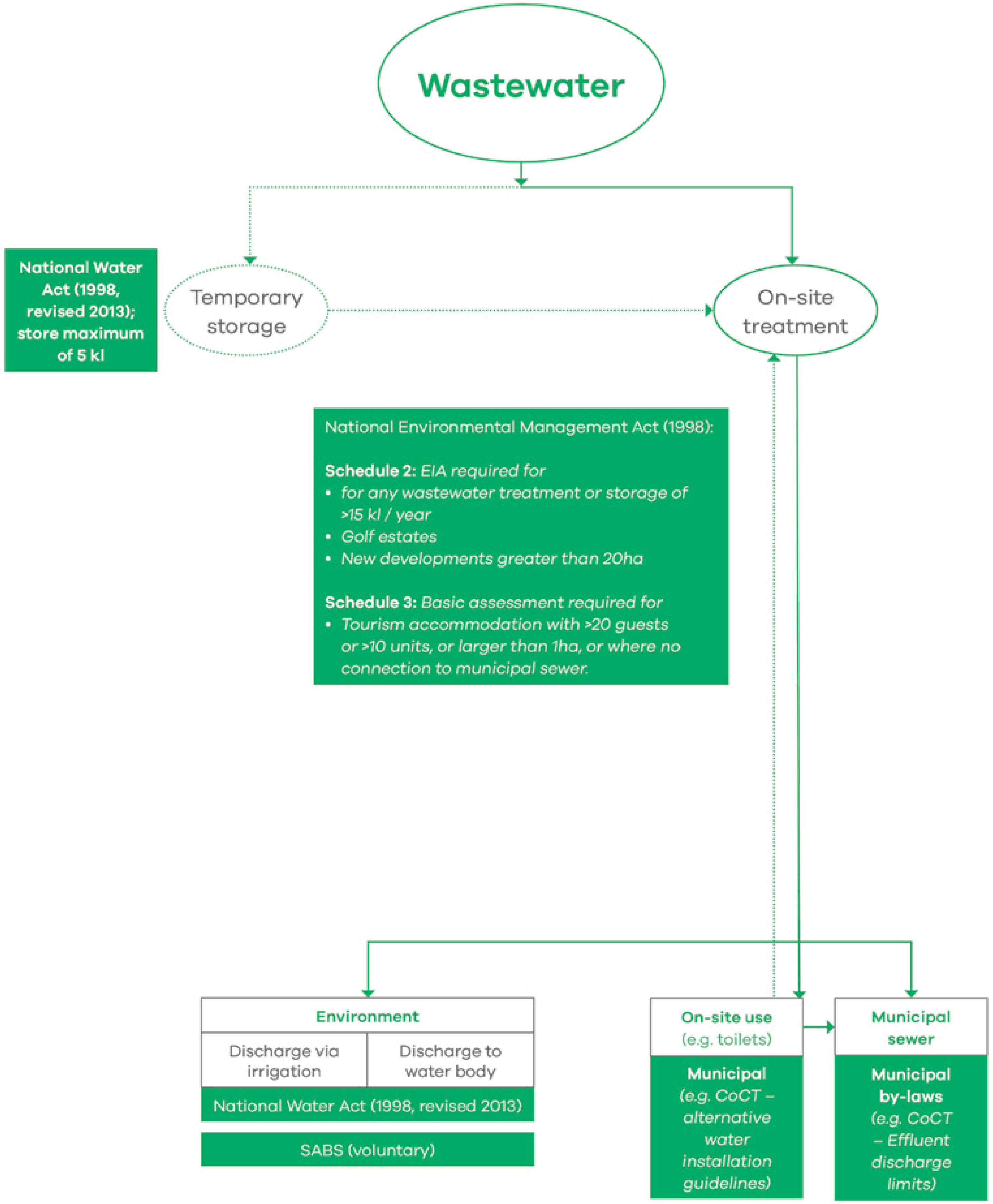


Figure 4: Relevant regulations and standards applicable to on-site wastewater treatment and reuse.

Regulations & standards[2]	
National Water Act (1998) with Revision (2013)	The NWA regulates all wastewater discharged into the environment, and these regulations on General Authorisations for wastewater were revised in 2013. Discharge of wastewater (e.g. for irrigation or into a water body; see Figure 4) should be registered with the national Department of Human Settlements, Water and Sanitation (DHSWS). If the water quality parameters fall within the general limits (see Figure 3) a general authorisation for discharging of wastewater applies. If the conditions of the general authorisation are not met, a Water Use Licence should be applied for. The general authorisation has different maximum limits for the water quality parameters, depending on the total daily discharge volume. Special limits are to be adhered to if treated wastewater is discharged within certain sensitive catchments that are listed in the NWA (revision 2013).
National Environmental Management Act (1998)	The NEMA outlines the conditions that require an environmental impact assessment (EIA) or a basic assessment (see Figure 4).
Municipal	By-laws related to the discharge of effluent or treated effluent into the municipal sewer system (sewer discharge limits, specific to each municipality) Guidelines for the installation of alternative water systems (any alternative water source, such as rainwater harvesting or on-site reuse of wastewater for non-potable uses).

Standards
The SABS has recently produced standards for non-sewered sanitation systems or NSSS (SANS 30500:2019) which include back-end products like on-site wastewater treatment systems. These standards were adopted from the International Organisation for Standardization (ISO), specifically ISO 30500:2018. Importantly, this standard is voluntary and can only be applied to pre-fabricated on-site wastewater treatment products (as tank assemblies and constructed systems cannot be tested for quality assurance according to these standards). The categories of wastewater reuse differ between the SABS and NWA, and it's important to note that the NWA should always be complied with.

	Irrigation[4] (unrestricted access[5])	Irrigation (restricted access[5])	Discharge to water body	Discharge to evaporation pond
National Water Act (1998, and revised 2013)	**General limit: Irrigation <500m3/day** • TSS < 25 mg/l, • COD < 400 mg/l • Faecal coliforms < 100 000 / 100ml		**General limit: 2000m3/day** • TSS < 25 mg/l, • COD < 75 mg/l • Faecal coliforms < 1000 / 100ml	
	General limit: Irrigation <50m3/day • TSS < 25 mg/l, • COD < 5000 mg/l • Faecal coliforms < 100 000 /100ml		**Special limit (discharge within Listed Water Sources)** • TSS < 10 mg/l, • COD < 30 mg/l • Faecal coliforms = 0 /100ml	
SABS	**Category A (unrestricted urban)** • TSS ≤ 10 mg/l, • COD ≤ 50 mg/l • *E.coli* < 100 /l	**Category B (restricted urban; surface water discharge, no indication of discharge to underground)** • TSS < 45 mg/l, • COD < 120 mg/l • *E.coli* < 100 /l		

Figure 5: Maximum discharge limits of key parameters provided by relevant regulations and standards[3] (TSS: total suspended solids, COD: chemical oxygen demand).

[2] This is a brief overview of regulations and standards, and does not constitute regulatory or legal advice. Responsibility of full regulatory compliance lies with each landowner / installer of wastewater treatment technology.

[3] Note that the key parameters are a subset of all the water quality parameters provided. Check the relevant regulations for the limits for all water quality parameters.

[4] In terms of the NWA, irrigation with wastewater is not allowed within 100m of the edge of a water resource (stream, river, dam, borehole) that is used for human consumption or animal watering, or within the 100-year flood-line, or on land that overlies a majour aquifer.

[5] Unrestricted access refers to irrigated urban areas where access by the general public is not restricted (e.g. schools, parks, golf course), while restricted access refers to irrigated urban areas that are not accessible to the general public (e.g. private or municipal land with perimeter fencing).

Case Studies

Western Cape Provincial Government

Department of Environmental Affairs & Development Planning; Dorp Street, Cape Town

Key points:

- Large commercial building (office space)
- 50% of wastewater (grey- and blackwater) is treated on-site.
- The treated non-potable water is used for toilet flushing (100% of the demand)
- Excess treated water is directed to the municipal sewer (the property has no irrigation needs).

Benefits:

- Potable water savings of ~1 million litres per year
- Water and sanitation tariff savings of ~R50 000 / year (at 2019/20 tariffs, excluding VAT)

Primary motivation:

- Water savings, cost savings and technology demonstration

Iona Wine Farm

Western Cape

Key points:

- Grey and blackwater from 24 homes on the farm and wastewater from the cellar (industrial organic wastewater) was previously discharged, with no treatment, into a small holding dam which then overflowed into a nearby river.
- In response, the owners installed an on-site wastewater treatment facility (MBR) to treat 100% of the household and cellar effluent.
- The MBR treats 10 million litres per year to comply with the General Limits.

Benefits:

- Total cost (capital costs and operating expenditure) over 20 years is ~R25/kl. In comparison, the combined rates for water and sanitation is R51.86/kl in the CoCT.
- Treated water used on-site for irrigation and excess is discharged to dam.

Primary motivation:

- Compliance with wastewater discharge regulations

Informal Settlements

Western Cape

A study conducted by the Western Cape Department of Environmental Affairs and Development Planning, compared the total cost of various sanitation technologies over a 10-year period (which includes capital and operating expenditure).

Primary motivations:

- Least-cost solution
- Improved service delivery

Key points:

- On-site (or decentralised) wastewater treatment is the lowest cost technology option, and can be implemented in a short time-frame.
- Connection to centralised wastewater treatment is marginally costlier, but often not feasible and usually requires much longer development timeframes.
- The highest cost option is chemical toilets (currently a widely prevalent solution used in informal settlements)

Next steps

For further information and support on any of the content provided here, please contact GreenCape's water sector desk: **water@greencape.co.za**.

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Additional resources on improving water resilience are available from:
https://www.greencape.co.za/content/focusarea/drought-business-support

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