

# **SELF-REGULATION OF THE PACKAGE PLANTS/SWWTW INDUSTRY:**

## **VOLUME 2**

**Development of a “Green Droplet” Accreditation System**

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**Water Research Commission**

by

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This report forms part of a series of two reports. The other report is *Self Regulation of the Package Plants/SWWTW Industry. Development of Proposed Framework of Standards, a Conceptual Model for a Test Facility and an Accreditation System for each "New" Technology Provided by Suppliers* (WRC Report No. TT 620/14)

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## EXECUTIVE SUMMARY

The Green Drop regulation programme was established by the Department of Water Affairs in 2008 and culminates in the prestigious Green Drop awards. This is to certify the wastewater systems of all municipalities and water service providers in South Africa. It rewards excellence in the management of wastewater from source, in sewer networks, its treatment at wastewater works and its final discharge to the receiving environment. Treatment works and associated wastewater networks are assessed by auditors to strict Green Drop criteria. These criteria ensure a high standard is maintained thus minimising risk to public health and the environment. The elusive Green Drop award is held in very high esteem.

Small wastewater treatment (inclusive of package plants) are a common form of service utility in sewage treatment for smaller communities and are needed where sewerage reticulation is absent due to inadequate space, difficult terrain, remoteness of areas in need and where standards set are higher than the effluent quality obtained from simple septic tank systems. The SWWTW industry in South Africa has grown rapidly from a small base and is currently unregulated in terms of process design, construction materials, etc. Most of the suppliers are not process experts but rather entrepreneurs who have funded the development of their product using limited resources. In this industry, traditional maintenance contracts were not required by purchasers. Furthermore, some property developers provided the SWWTW suppliers with incorrect flow and strength data on which to base the design, or added extra housing units onto an existing plant without expanding it and Body Corporates also tended to neglect the operation and maintenance of the plants.

The aims of this project were as follows:

- Develop a framework of standards for small wastewater treatment technologies, which is practical for South Africa.
- Assess and recommend how the framework of standards will work within the sector ensuring that duplication is eliminated in the process.
- Develop a conceptual model with key criteria for an independent testing facility of the different technologies, including the evaluation of the feasibility of using existing in South Africa.
- Develop an accreditation system for technologies by the various suppliers which will encompass technical and managerial aspects, including a modification of the Green Droplet System that is currently used by the Department of Water and Sanitation. This should also include the institutional and cost issues pertaining to implementation.

This study resulted in the compilation of 2 reports: SELF-REGULATION OF THE PACKAGE PLANTS/SWWTW INDUSTRY:

- √ VOLUME 1 – Development of Proposed Framework of Standards, a Conceptual Model for a Test Facility and an Accreditation System For Each “New” Technology Provided by Suppliers
- √ VOLUME 2 – Development of a “Green Droplet” Accreditation System

Volume 1 provides an introduction to the framework of standards which could be adapted for use in South Africa, and discusses their strengths and weaknesses, together with the feasibility of scaling them up for use on larger works. It draws from current industry know-how as well as Australian, European and the United States NSF standards used internationally.

It examines the current South African legislative standards for discharge of treated effluent to the environment, together with the corresponding monitoring requirements. It continues to further examine the current General Authorisation Discharge Requirements, and makes strong recommendations with respect to:

- The quality of water to be used for lawn irrigation
- The issue of satisfactory compliance which needs to be properly defined, including the method of calculation and the percentage compliance.

A categorization framework for SWWTW sizes was discussed and a three-tier system recommended after consultation with the industry body SEWPACKSA and the WISA SWWTW Division. Furthermore, a proposed SWWTW Treatment Efficiency Testing Standard was formulated inclusive of proposed process design standards. The intention behind this proposed SWWTW Treatment Efficiency Testing Standard is that it would serve as a national standard and would obviate the need for various municipalities to publish their own individual standards or by-laws. The study did a brief evaluation of the concept of a SWWTW evaluation facility making recommendations with respect to the requirements, funding of the facility and its operation.

**Volume 2 (this report)** examines the development of the Green Droplet System for Small Wastewater Treatment Works (SWWTW). The Green Droplet System for SWWTW was mooted by eThekweni Water and Sanitation (EWS) with a view to self-regulation of the Small Wastewater Treatment Plants under their jurisdiction. The Green Droplet System for SWWTW was born out of a number of stakeholders needs as can be seen below:

Stakeholder	Needs
General Public	Desire for clean, unpolluted, aquatic environment
Regulators	Desire for a self-regulated system in place of a command and control system
SWWTW Owners	Desire for compliance with legislative requirements
SWWTW Suppliers	Desire for compliance with legislative requirements for SWWTW supplied

The behavioural change espoused in this concept of self-regulation is that the various stakeholders (owner, designer, supplier, operator, regulator) would see fit to take the right actions proactively while understanding their role in the chain of accountability to minimize risk to environment, health and reputation.

Thus, the system proposed is a simplified and graded system applicable to different Categories of SWWTW. In order for the implementation of the Green Droplet System to be successful, the drivers that need to be institutionalised are:

- √ The aim of the Green Droplet System is to protect the environment and should be seen in a positive light.
- √ The entire implementation of the System needs to be conducted with enthusiasm and the process seen as a positive one, rather than a bureaucratic requirement.

- √ The System should lead to positive recognition, incentives and rewards.
- √ The system should be carefully set out in the supporting paperwork to ensure that it is simple and easily understood to prevent confusion and frustration during implementation.

## **ACKNOWLEDGEMENTS**

The Steering Committee responsible for this project consisted of the following persons:

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## VOLUME 2: GREEN DROPLET ACCREDITATION SYSTEM

### 1 INTRODUCTION: GREEN DROP SYSTEM

The Green Drop regulation programme was established by the Department of Water Affairs in 2008 and culminates in the prestigious Green Drop awards. This is to certify the wastewater systems of all municipalities and water service providers in South Africa. It rewards excellence in the management of wastewater from source, in sewer networks, its treatment at wastewater works and its final discharge to the receiving environment.

Treatment works and associated wastewater networks are assessed by auditors to strict Green Drop criteria. These criteria ensure a high standard is maintained thus minimising risk to public health and the environment. The elusive Green Drop award is held in very high esteem.

### 2 INTRODUCTION: “GREEN DROPLET” SYSTEM

The Green Droplet System for SWWTW was mooted by eThekweni Water and Sanitation (EWS) with a view to self regulation of the Small Wastewater Treatment Plants under their jurisdiction. The Green Droplet System for SWWTW was born out of a number of stakeholders needs as can be seen in the table below.

**Table 1: Stakeholder Needs**

Stakeholder	Needs
General Public	Desire for clean, unpolluted, aquatic environment
Regulators	Desire for a self-regulated system in place of a command and control system
SWWTW Owners	Desire for compliance with legislative requirements
SWWTW Suppliers	Desire for compliance with legislative requirements for SWWTW supplied

The philosophical approach is that through self-regulation owners will take responsibility and become proactive in the management of their works as opposed to the current scenario where the regulator, in this case EWS, advises them of non-compliance after the fact, which then results in some action being taken in a reactive manner with the associated delays.



**Figure 1: Command and Control System versus Self-Regulated System**

### **3 IMPLEMENTATION**

In implementing the Green Droplet System every effort must be made to ensure that it is “Right First Time” to prevent wastage of money and time. As such discussions have shown that it would be preferable to conduct a Pilot Study to iron out any problems which may come to the fore, rather than rolling the System out countrywide initially. eThekweni Water and Sanitation, who originally mooted the introduction of such a system would appear to be the ideal agents to implement the Green Droplet System in a Pilot form as they have the existing infrastructure and resources.

Some of the questions which need to be resolved are as follows:

- Who should make up the audit team? Should it be large to incorporate the implementing agent, municipality, DWS and provincial DEA? Will this be practical in terms of the amount of time spent in coordinating such teams and will it be “user friendly” to the entity being audited?
- Should a leaner approach be to simply use a representative of the implementing agent, with other bodies copied with information so as to create maximum efficiency and save on time and money?
- Who will provide what information for the audit, i.e. owners, suppliers and authorities?

### **4 RISK/IMPACT/BUY-IN**

In order for the implementation of the Green Droplet System to be successful what are the drivers that need to be instituted? Drivers which are considered to be important are as follows:

- The aim of the Green Droplet System is to protect the environment and should be seen in a positive light.
- The entire implementation of the System needs to be conducted with enthusiasm and the process seen as a positive one, rather than a bureaucratic requirement.
- The System should lead to positive recognition, incentives and rewards.
- The system should be carefully set out in the supporting paperwork to ensure that it is simple and easily understood to prevent confusion and frustrating in implementation

**Example 1:**

A simple, user-friendly, website will need to be established with step-by-step guides to the System, pro-forma documents for completion, spreadsheets for compliance calculation after inputting of results, amongst other things.

**Example 2:**

The PowerPoint slides used to illustrate the detail of the focus areas should be very closely aligned to the support document and the support documentation should be set up in such a way that there are separate pages for each of the focus areas which can then be cut out and pasted onto file dividers giving full detail of what information is required under each focus area and where it can be found.

**5 FOCUS AREAS**

The focus areas to be found in the Green Droplet System are similar to those the Green Drop System currently promoted by the Department of Water and Sanitation (formerly DWA) for municipal WWTW. They are as follows:

- Operations
- Plant monitoring
- Sample analysis
- Submission of results
- Effluent compliance
- Effluent failure and management
- Stormwater management
- Design capacity
- Performance management
- Asset Management

This in turn led to the development of the Green Droplet Matrix of Requirements which can be seen below. The requirements are very similar to those of the Green Drop System applied to Municipal WWTWs.

**Table 2: EWS Green Droplet System**

No.	Criteria	Requirements	Target Indicator or Source
1. (15%)	Operations	Operator Training	Training documentation for operators. Indication of years of experience. DWA operator classification if available. Filed and kept on site. Information plate with contact details to be displayed on site.
		Engineer Appointment	5 year operations and maintenance contract with engineer/consultant. Appointment letter for Engineer/Consultant. Filed with eThekwini and also kept on site. Information plate with contact details to be displayed on site
		Training for owners and managers	Certificates of training/induction from consultant/Engineer
		Proof of maintenance	Maintenance process in place. Service level agreement. Maintenance plan and procedure. List of possible service providers. Filed and kept on site
		Operations and Maintenance manual	O&M manual to contain structural, mechanical, electrical detail of plant, design specifications of plant, reference to drawings, operational schedules, maintenance schedules, process details and control, instrumentation specification/type, fault finding, monitoring, pump curves ,Plant and septic tank capacity and schematic
		Bonus	N3 Waste water certificate for Operator
2. (15%)	Plant Monitoring	Unit Processes	Monitoring of the sludge levels in the septic tank. Unit process monitoring which includes checks of the amounts of the solids pre and post clarifier using an Imhoff cone or rain gauge. Labelled dip point and log sheet daily recordings
		Sample Analysis	Details of in-house sample analysis, determinands and frequency of operational monitoring including flowlogs and registers of the records. Evidence of equipment used. Service agreement between plant owner and professional engineer for the control and monitoring of the plant for compliance with the GLV's.
		Sludge Monitoring	Monitoring of levels in sludge in sumps labelled dip point & log sheet

			daily recordings
	Environmental impact of discharge		Upstream and downstream monitoring
3. (5%)	Wastewater Sample Analysis	Name of the laboratory	Minister/DWA approved laboratory conducting periodic analysis as per guideline 12 Section 3.13. Analysis results must be sent to the EWS. SLA between laboratory and package plant owner must be filed and submitted to the EWS. Sampling chain of custody procedure must be submitted to EWS as well as evidence documents.
		Certificate of Accreditation	Check if laboratory methods are accredited to perform specific tests on par with EWS, to ensure correct range and resolution. Certificate of Accreditation for applicable methods
		Process Correction	Explain how monitoring results are used to amend/improve process control. Show records
		Bonus	Monitoring a required determinand at a higher frequency. e.g. phosphorus
4. (5%)	Submission of Wastewater Quality Results & flow estimation	Quality Results	Monthly submissions to EWS except where higher frequencies are required. Submissions must be made by the 16th working day of each month. Filed and kept on site e.g. Received by whom and when and method of submission
5. (30%)	Effluent Quality Compliance	Compliance	Copy of applicable Authorisation, containing the specified effluent quality limits or standards for discharge to a water body compared with actual results e.g. Graphs. Calculated compliance
		Categories	Effluent Quality Compliance per Category Physical (solids, turbidity, colour, etc.), chemical (pH, ammonia, chlorine, etc.) and bacteriological ( <i>E. coli</i> , etc.)
6. (10%)	Wastewater Quality Failure Response Management	Warning systems Emergency response Provide evidence of implementation of protocol	A practical and acceptable Wastewater Management Rectification or Risk Abatement Plan is in place to address inefficiencies/inadequacies that result in non-compliance. Standby generator or backup power supply. Alarm. List of after-hours emergency contacts. Waste water quality and equipment failure incident and sewer spillage incident register

7. (5%)	Storm water management	Storm water management plan detailing how storm water will be prevented from entering the treatment plant	Storm water balancing tank and identification of cross connections. Kept on file
		Bonus	Rain water harvesting
8. (10%)	Adherence to guidelines 8 and 12. Evidence of GLV and authorization by local authority	Copies and response to written notices	Copy of guideline document to be present on site
9. (5%)	Wastewater treatment facility capacity	Documented design capacity for organic and hydraulic loads and receiving flows. Daily records of inflow and outflow. Sludge handling and disposal	Design capacity as average dry weather flow. COD and settleable solids load to the plant. Calculations and measurement method to be explained. Records of desludging frequency and safe disposal certificates. Engineer's approval of design capacity
10. (5%)	Communication of wastewater management performance	Plant performance needs to be communicated to the interested and affected parties (e.g. Body corporate, shareholders, stakeholders, etc.)	Minutes of all meetings. Annual performance report to EWS
11. (5%)	Wastewater asset management	Wastewater infrastructure asset register. Operation and maintenance budget. Maintenance records. Asset replacement plan.	Proof of asset register. Proof of budget. Proof of all maintenance work done on mechanical, electrical, pumps, timers, tanks, valves and piping

## 6 CATEGORIES OF SWWTW

Categorisation of items provides for:

- Simplification of management
- Determination of processes
- Evaluation of impact and risk
- Designation of staffing levels
- Determination of Monitoring frequency and detail

In terms of the legislation there are numerous different classifications, but two important examples which include classification are:

- Regulation R2834 of the Water Act (Act 54 of 1956) – categorisation and staffing levels/qualifications
- Regulation R17/813/826 of Water Services Act, 1997

In terms of the Guideline Document: Package Plants for the Treatment of Domestic Wastewater (K5/1869) there are also classifications with respect to capacity, and type of facility where the Works is situated.

In terms of the General Authorisation (Section 39 of the National Water Act, 1998) Works are once again categorised according to their volumetric treatment capacity as per Table 3.

**Table 3: General Authorisation Categorisation of Works**

Daily Discharge Volume	Monitoring Requirements
< 10 cubic metres	None
10 to 100 cubic metres	pH Electrical Conductivity (mS/m) Faecal Coliforms (per 100 ml)
100 to 1000 cubic metres	pH Electrical Conductivity (mS/m) Faecal Coliforms (per 100 ml) Chemical Oxygen Demand (mg/l) Ammonia as Nitrogen (mg/l) Suspended Solids (mg/l)
1 000 to 2 000 cubic metres	pH Electrical Conductivity (mS/m) Faecal Coliforms (per 100 ml) Chemical Oxygen Demand (mg/l) Ammonia as Nitrogen (mg/l) Nitrate/Nitrite as Nitrogen (mg/l) Free Chlorine (mg/l) Suspended Solids (mg/l) Ortho-Phosphate as Phosphorous (mg/l)

After discussions between members of the Reference Committee for this project, members of the WISA SWWTW Division and SEWPACKSA it was agreed that WWTW could be classified in terms of their capacities according to the system derived by SEWPACKSA which is indicated in Table 4 below as SEWPACKSA may be the primary driver of such a system for their Association.

**Table 4: Plant categories versus Capacity**

<b>Category</b>	<b>Capacity (m<sup>3</sup>/d)</b>
A	<5
B	<50
C	<500
D	<2000

## **7 SUGGESTED GREEN DROPLET SYSTEM FOR NATIONWIDE APPLICATION**

In order for the Green Droplet System to be introduced nationwide it needs to be simplified to be in line with the General Authorisation (GN 1191 of 1999), with specific municipalities being able to modify it to more stringent levels where these are in place in the bylaws.

The System has to be simple in order that property owners and Body Corporates adopt it. The system must also be pragmatic and affordable in order that it is adopted. If it is complex and unaffordable the public will simply reject it out of hand, and nothing will be achieved. Requirements such as SETA approved training for operators are simply not affordable as the training is onerous both in terms of cost and time.

The suggested Green Droplet System for nationwide application is given below in Table 5. It can be observed that a number of requirements which exceed those of the General Authorisation have been removed. The order of some of the items under the "Target Indicator or Source" column has also been changed for the sake of clarity and logic.

Certain of the items can be omitted, or reduced in terms of requirements according to the Works classification.



**Table 5: Suggested Green Droplet System for Nationwide Application**

No	Criteria	Parameter	Target Indicator or Source
1. (30%)	Operations and Maintenance	Operator Training	<ul style="list-style-type: none"> <li>• Training documentation for operators</li> <li>• Indication of years of experience</li> <li>• DWA operator classification if available.</li> </ul>
		Engineer Appointment	<ul style="list-style-type: none"> <li>• 5 year operations and maintenance contract with supplier.</li> <li>• Appointment letter for Engineer/Consultant.</li> </ul>
		Training for Owners And Managers	<ul style="list-style-type: none"> <li>• Certificates of training/induction from supplier</li> </ul>
		Proof of Maintenance	<ul style="list-style-type: none"> <li>• Maintenance contract in place</li> <li>• Maintenance schedule available</li> <li>• Proof of budget</li> <li>• Proof of all maintenance work done on mechanical, electrical, pumps, timers, tanks, valves and piping</li> </ul>
		Operations and Maintenance Manual	<ul style="list-style-type: none"> <li>• Process,, mechanical, electrical detail of plant,</li> <li>• Design specifications of plant in terms of organic and volumetric capacity,</li> <li>• Reference to location of drawings,</li> <li>• O&amp;M schedules</li> <li>• Process details and optimisation</li> <li>• Troubleshooting matrix</li> </ul>
	Bonus		N3 Waste water certificate for Operator

No	Criteria	Parameter	Target Indicator or Source
2. (10%)	Plant Monitoring (In-House)	Unit Processes	<ul style="list-style-type: none"> <li>Unit process monitoring, e.g. mixed liquor SVI<sub>30</sub></li> <li>Labelled sampling points</li> <li>Completion of daily log sheets</li> </ul>
		Sample Analysis	<ul style="list-style-type: none"> <li>Details of in-house sample analysis, determinands and frequency of operational monitoring</li> <li>Including records of analysis, flows, and evidence of equipment.</li> </ul>
		Environmental Impact of Discharge	<ul style="list-style-type: none"> <li>Upstream and downstream monitoring</li> </ul>
3. (10%)	Wastewater Sample Analysis (External for Regulator)	Contract for Monitoring by Accredited/Approved Laboratory	<ul style="list-style-type: none"> <li>SANAS Accredited or PTS approved laboratory conducting monitoring as per GA.</li> <li>Contract for Monitoring and Analysis</li> </ul>
		Process Correction	<ul style="list-style-type: none"> <li>Explain how monitoring results are used to amend/improve process control. Show records</li> </ul>
		Bonus	<ul style="list-style-type: none"> <li>Monitoring a required determinand at a higher frequency, e.g. phosphorus</li> </ul>
4. (30%)	Submission of Wastewater Quality Results & flow estimation / Effluent Quality Compliance	Quality Results	<ul style="list-style-type: none"> <li>Monthly submissions to regulator except where higher frequencies are required.</li> <li>Filed and kept on site</li> <li>Record of dispatch of results</li> </ul>

No	Criteria	Parameter	Target Indicator or Source
		Compliance	<ul style="list-style-type: none"> <li>• Copy of applicable Authorisation and specified effluent quality limits or standards for discharge to a water body</li> <li>• Monthly or periodically calculated compliance</li> </ul>
5. (10%)	Wastewater Quality Failure Response Management	Warning systems Emergency response Provide evidence of implementation of protocol	<ul style="list-style-type: none"> <li>• A practical and acceptable Wastewater Risk Abatement Plan to minimise non-compliances</li> <li>• Standby generator or backup power supply</li> <li>• Alarm</li> <li>• List of after-hours emergency contacts</li> <li>• Register of equipment failure and sewage spills</li> </ul>
6. (5%)	Storm water management	Storm water management plan	<ul style="list-style-type: none"> <li>• Detailing how storm water will be prevented from entering the treatment plant</li> <li>• Identification and elimination of cross connections- details to be kept on file</li> </ul>
7. (5%)	Communication of wastewater management performance	Plant performance needs to be communicated	<p>Records of all communications to:</p> <ul style="list-style-type: none"> <li>• Body corporate</li> <li>• Shareholders</li> <li>• Stakeholders</li> </ul>

## 8 PHASED APPROACH AND IMPLEMENTATION PLAN

During the Workshop held with SEWPACKSA and the WISA Small Wastewater Treatment Works Division, it was agreed that a phased approach should be implemented, together with an approach which takes cognisance of the Category or capacity of the plant. This approach is discussed below. The purpose of the “Phased Approach” is twofold:

- To get a “foot in the door” with plant owners as far as implementing the system.
- To prevent anxiety from having too much of a demand for information in one instalment.
- To allow a reasonably quick audit of the plant by the appointed auditor.

Feedback from the DWA Green Drop System has shown that municipal staff became frustrated and confused as the Green Drop System had more and more requirements for documentation under a number of different criteria, as the system was phased in over the years.

The staff, which is often not technically qualified, battled to establish for themselves what was new and what was pre-existing, resulting in confusion and ultimately lack of motivation. Coupled with this was that they also had to continue with their normal duties which were of a demanding nature.

To prevent this occurring in the phasing in of this system, it is recommended that half the criteria be implemented one year, and half the next. Cognisance is also given to the sequence of the phased criteria to ensure that the correct sequence is followed so as to prevent confusion.

It is suggested that the phasing in take place as indicated in Table 75 below.

**Table 6: Details of Phasing-In Approach**

Criteria	Year 1	Year 2	Explanation
1. Operations	X		
2. Plant monitoring	X		
3. Sample analysis	X		
4. Submission of results	X		
5. Wastewater Quality Failure Response		X	Follows on Criteria 3 and 4
6. Stormwater management		X	Follows on Criteria 3 and 4
7. Communication of Performance		X	Follows on Criteria 3 and 4

Discussions between the Reference Committee, WISA SWWTW Division and SEWPACKSA have shown that the WISA SWWTW Division is probably the most competent, suitable and impartial implementing Agent for the Green Droplet System.

It is suggested that the implementation take place as follows:

- WISA SWWTW appoint an Administrator to execute the project

- The Administrator draws up the necessary final documentation with detailed explanatory notes and compiles an Implementation Pack which would include the matrix, explanatory notes and 11 file dividers printed with the various Criteria headings and contents requirements (two different colours can be used to signify Year 1 and Year 2 for the phasing in).
- It is recommended that the system be piloted in the eThekweni municipal area in order to assess any problems with the system rollout, and to allow for improvements prior to the countrywide rollout.

## **9 CODE OF CONDUCT AND CONFIDENTIALITY**

It will be necessary to draw up a Code of Conduct for the Implementation Phase, which should include confidentiality clauses to protect the SWWTW suppliers Intellectual Property. The latter will however need to be drafted in such a way that while Intellectual Property is protected, there is as much transparency as possible.

## **10 CONCLUSIONS**

Volume 2 of this project report examines the various factors affecting the introduction of a Green Droplet System for SWWTW, and seeks to provide a route map for the rollout, including practical ideas to obtain buy-in from the owners themselves, and make the process enjoyable.

The suggested Green Droplet system has been modified and simplified to a 7 category system which should be simpler to manage than other longer systems, with no duplication and a minimum of complexity.

It is recommended that the system be piloted in the eThekweni municipal area in order to assess any problems with the system rollout, and to allow for improvements prior to the countrywide rollout.