TECHNICAL DELIVERABLE REPORT 2

Long Term Operational Monitoring Programme for Algal-Based Tertiary Treatment in Maturation Ponds of the Brandwacht Wastewater Treatment Works

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1 EXECUTIVE SUMMARY

Careful planning and design of a monitoring programme should allow for the generation of information of direct relevance to managers, stakeholders and the regulator. To emphasise the importance of the planning and design phases. A monitoring programme is the process of routinely, systematically, and purposefully gathering information for use in management-decision making. Monitoring should include qualitative data observations, such as recording information about the Brandwacht Waste Water Treatment Works (WWTW). Fundamentally, the underlying goal of information obtained from a monitoring programme is to protect human health and assess environmental risk. The results of a routine monitoring programme will also provide some insight on the effectiveness of the pond systems (Jack et al., 2006). In practice, additional monitoring requirements may be imposed for compliance through regulatory authorities to prevent or minimise environmental impacts or in the chase of algae treatment technology. The very first step in developing a monitoring programme is to define monitoring objectives. These objectives provide the justification for data collection and should allow the effectiveness of the programme to be evaluated. The objectives of the operational monitoring programme for Brandwacht WWTW falls under the legislation and guidance documentation of DWS to ensure that monitoring is being undertaken according to ‘ General and Special Standards: Government Gazette 18 May 1984 No. 9225: Regulation No. 991 18 May 1984: Requirements for the Purification of Wastewater or Effluent’.

2 PURPOSE OF THE MANUAL

Operational monitoring allows the system operator to assess, in a timeous manner, the effectiveness of the performance of algae treatment system and to undertake the necessary remedial action if and when required (Jack et al., 2006). It needs to be noted that the time interval for the various aspects of monitoring may vary, based on the performance of the algae treatment.

3 SELECTING OPERATIONAL MONITORING PARAMETERS

The Department of Water and Sanitation has existing formalised measurement parameters, linked to specific authorisation applicable to each WWTW (General Authorisation: Section 39 of the National Water Act no 36 of 1998). Table 1 provides a summary of the monitoring requirements for waste water treatment works in general. Table 2 provides a list of parameters that requires monitoring when phycoremediation is included. These constituents need to be monitored at the different ponds which have been inoculated with algae.

Table 1. Selecting operational monitoring parameters and different time frames

SUBSTANCE/PARAMETER	GENERAL LIMIT	TIME FRAME	POND ID	BOREHOLES
Faecal Coliforms (cfu/per 100 ml	1000	Monthly	Pond 7 (effluent)	Quarterly
Chemical Oxygen Demand (mg/l)	75 (after removal of algae)	Monthly	Pond 7 (effluent)	
pH	5.5-9.5	Monthly	Pond 7 (effluent)	Quarterly
Ammonia (mg/l)	3	Monthly	Pond 7 (effluent)	Quarterly
Nitrate/Nitrite (mg/l)	15	Monthly	Pond 7 (effluent)	Quarterly
Chlorine (mg/l)	0.25	Monthly	Pond 7 (effluent)	Quarterly
Suspended Solids (mg/l)	25	Monthly	Pond 7 (effluent)	
Electrical Conductivity (mS/m)	70	Monthly	Pond 7 (effluent)	Quarterly
Ortho-Phosphate mg/l	10	Monthly	Pond 7 (effluent)	Quarterly
Fluoride (mg/l)	1	Annually	Pond 7 (effluent)	Annually
Soap, oil or grease (mg/l)	2.5	Annually	Pond 7 (effluent)	Annually
Dissolved Arsenic (mg/l)	0.02	Annually	Pond 7 (effluent)	Annually
Dissolved Cadmium (mg/l)	0.005	Annually	Pond 7 (effluent)	Annually
Dissolved Chromium (mg/l)	0.05	Annually	Pond 7 (effluent)	Annually
Dissolved Copper (mg/l)	0.01	Annually	Pond 7 (effluent)	Annually
Dissolved Cyanide (mg/l)	0.02	Annually	Pond 7 (effluent)	Annually
Dissolved Iron (mg/l)	0.3	Annually	Pond 7 (effluent)	Annually
Dissolved Lead (mg/l)	0.01	Annually	Pond 7 (effluent)	Annually
Dissolved Manganese (mg/l)	0.1	Annually	Pond 7	Annually

SUBSTANCE/PARAMETER	GENERAL LIMIT	TIME FRAME	POND ID	BOREHOLES
			(effluent)	
Dissolved Mercury (mg/l)	0.005	Annually	Pond 7 (effluent)	Annually
Dissolved Selenium (mg/l)	0.02	Annually	Pond 7 (effluent)	Annually
Dissolved Zinc (mg/l)	0.7	Annually	Pond 7 (effluent)	Annually
Boron (mg/l)	1	Annually	Pond 7 (effluent)	Annually
Chl-*a* /effluent (µg/l)		Monthly	Pond 7 (effluent)	

Table 2. Additional operational monitoring parameters for phycoremediation

SUBSTANCE/PARAMETER	GENERAL LIMIT	TIME FRAME	POND ID	BOREHOLES
Chl-*a* /ponds (µg/l)	500	Quarterly	Ponds 3,4,5,6	
Microscopic analyses of algae assemblage		Quarterly	Ponds 3,4,5,6 and algae bioreactors	
E. coli (counts/mL)	1000	Quarterly	Ponds 3,4,5,6	

4 SAMPLING PROCEDURES

All sampling procedures should confirm to Standard Methods (APHA, 2005).

a) Selected monitoring points must stay the same at all times

b) Chlorophyll-a samples must be taken at the same time period of the day

c) All samples (for chemical analysis) must be stored in acid washed polyethylene bottles and kept cool in the dark during transfer from the field to the laboratory. Water samples for microbiological analysis should be taken in sterile polyethylene bottles and transported at 4◦C to the laboratory for analysis, preferably within 6 – 8 hrs.

d) All samples physical, chemical (1 litre), chlorophyll-a (1 litre), algae assemblage (1 litre) and microbiological faecal indicator (500 mL) samples must be taken at the same water column depth (within first 30 cm from surface) of the selected pond.

e) Algae samples for identification must be preserved in the field by addition of acidic Lugol's solution.

f) Algae identification can be done by using Van Vuuren, S., Taylor, J.C., Gerber, A., Van Ginkel, C., 2006. Easy Identification of the Most Common Freshwater Algae. North-West University and Department of Water Affairs and Forestry. Pretoria, South Africa. Pp. 1-200.

5 REFERENCES

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