



On-site Effluent Treatment National Testing Programme (OSET NTP)

PERFORMANCE CERTIFICATE Worm Smart Plus OSET NTP Trial 13, 2017/2018

System Tested

The Worm Smart Plus plant, comprising a vermicompost system followed by single pass foam-filled trickling filter, participated in Trial 13 of the On-site Effluent Treatment National Testing Programme (OSET NTP). This commenced on 23 October 2017 and ran over ten months (44 weeks) during which the treated effluent discharge was monitored generally every six days. The Worm Smart Plus plant tested had a normal operational capacity of 1,800L/day and maximum capacity of 1,800L/day. The plant comprised two 3,000L polypropylene tanks and a 400L elevated plastic tank with primary filter and sludge storage. Tank 1 is a primary tank which comprises the vermicompost unit (300mm diameter x 3m long coconut fibre log laid in snake fashion over a 0.5mm screen mesh on 450mm high plastic support media which provides storage for the primary lift pump), the primary lift pump is a Davey D15VA float controlled vortex pump, 240Lpm which lifts vermicompost effluent to the elevated primary filter located between Tanks 1 & 2. Tank 2 comprises a trickling filter containing 2,700L of Polyethylene Open Cell foam filter media, chopped up into blocks and stored in onion bags and a final effluent pump station with a Davey 23A/B 0.2kW float controlled sump pump.

The emergency storage which includes the effluent pump station and media submergence is 2,540L.

The service requirement is annual

Test Flow Rate

The Worm Smart Plus plant was tested at 1,000L/day (equivalent to servicing a 3-bedroom 5 to 6 person household) over an 10 month (40 week) period November 2017 to August 2018 including a 1 month (4 week) high load effects test involving 5 days at 2,000L/day then 1,000L/day over the following 3 weeks. Note that the manufacturer's advised design capacity for this plant is 1,800L/day.

Testing and Evaluation Procedures

A two-month (8 week) media development and settling-in period was initially proposed, but this was extended to 12 weeks due to an unscheduled geothermal waste influent flow on 23 November, followed by extreme weather events in Rotorua, resulting in widespread flooding and high infiltration into the sewerage system, along with an electrical storm impacting on the testing facility control system in early December. Ten samples were taken during this period (Weeks 4 to 12). Neither the geothermal influent nor the weather events had any apparent impact upon the Worm Smart Plus plant performance.

The performance evaluation testing programme followed involving a three-month pre-benchmarking period (20 samples over Weeks 13 to 28), and a three-month benchmarking period (19 samples over Weeks 29 to 40). Within each block, a five-day consecutive sample period occurred (Weeks 25 and 34). A one-month high load assessment period followed in Weeks 42 to 44 (three samples).

The 39 samples taken through the pre-benchmarking and benchmarking periods were used to assess treatment performance against the **Secondary Effluent Quality** requirements for biochemical oxygen demand (BOD₅) and total suspended solids (TSS) defined by AS/NZS 1547:2012 as set out in AS/NZS 1546.3:2008

A total of 19 treated effluent samples of organic matter (BOD₅), total suspended solids (TSS), total nitrogen (TN), ammonia nitrogen (NH₄-N), total phosphorus (TP) and faecal coliforms (FC) at generally six day intervals during weeks 28 through 40 were tested and the results benchmarked and rated on their median values.

General Performance

The Worm Smart Plus plant performed well throughout the study, with no equipment failures or attendance required. In terms of effluent quality, the plant performed well, with low energy usage, low and stable BOD₅



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and TSS results. However, the plant achieved little nitrification with moderately high $\text{NH}_4\text{-N}$, and high TN in the treated effluent. Bacteria reduction was poor.

The plant's median power usage was only 0.3kWh/day, as the only power usage was for the primary lift pump and the final effluent discharge pump.

AS/NZS 1547:2012 Secondary Effluent Quality Requirements

These requirements are that 90% of all test samples must achieve a BOD_5 of $\leq 20 \text{ g/m}^3$ and TSS of $\leq 30 \text{ g/m}^3$ with no one result for BOD_5 being $>30 \text{ g/m}^3$ and no one result for TSS being $>45 \text{ g/m}^3$.

The Worm Smart Plus plant had **100% of BOD_5** and **TSS** results within the requirements for the maximum limits above, and **97% of BOD_5** results and **100% of TSS** results within the requirements for the 90 percentile limits above. The Worm Smart Plus plant therefore **achieved AS/NZS 1547 secondary effluent quality performance requirements** when tested at 1,000L/day, which is 56% of the manufacturer's advised normal flow design capacity.

Benchmark Ratings

The Worm Smart Plus system achieved the following effluent quality ratings (when operated at 1,000L/day, 56% of manufacturer's advised normal flow design capacity):

Indicator Parameters	Median	Std Dev	Rating	Rating System				
				A+	A	B	C	D
BOD (mg/L)	8.4	4.5	A	<5	<10	<20	<30	≥ 30
TSS (mg/L)	7.2	3.6	A	<5	<10	<20	<30	≥ 30
Total Nitrogen (mg/L)	34	5.6	D	<5	<15	<25	<30	≥ 30
$\text{NH}_4\text{-Nitrogen}$ (mg/L)	14	2.5	C	<1	<5	<10	<20	≥ 20
Total phosphorus (mg/L)	4.1	0.5	B	<1	<2	<5	<7	≥ 7
Faecal Coliforms (cfu/100mL)	550,000	284,600	D	<10	<200	<10,000	<100,000	$\geq 100,000$
Energy (kWh/d) (mean)	0.3	0.09	A	0	<1	<2	<5	≥ 5

This Certificate of Performance only applies to the Worm Smart Plus plant as described in the 'System Tested' above when operated at 1,000 L/day, which is 56% of manufacturer's advised normal flow design capacity.

The certificate is valid for 5 years from the date below. For the full OSET NTP report on the performance of the Worm Smart Plus treatment plant contact Wayne Gilinsky, Mobile: 0274 372 089 or Email: wayne@natural-flow.co.nz

Authorised By:

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