BiOWiSH® TECHNOLOGIES

Case Study

BiOWiSH® Aqua

BiOWiSH® Aqua Improves Nutrient Removal in a Wastewater Treatment Plant - Oberon, Australia

Executive Summary

A bioaugmentation program using BiOWiSH® Aqua was implemented at a wastewater treatment (WWTP) plant in Oberon, Australia starting August 2016. The objective of the three-month study was to quantify reductions in the ammonia, total nitrogen, and phosphorus concentrations across the process. The average concentration of ammonia in the effluent was reduced 83.42%, total nitrogen by 54.77%, and total phosphorus by 49.40%. The results show that the consortium of microorganisms in BiOWiSH® Aqua is effectively working with the existing microbiota and enhancing nutrient removal at the Oberon WWTP.

Background

The wastewater treatment plant in Oberon, NSW – Australia services a population of 2600 people in addition to an industrial customer that processes wood pulp to produce medium density fiber (MDF) board building products. MDF board manufacturing plants frequently use Urea-Formaldehyde as a binding agent, which can cause elevated nitrogen in the treatment plants' effluent. Local agriculture and timber industries, supported by the Oberon Facility, are another possible source of the nutrients in the effluent.

Looking to enhance nutrient removal, the Oberon Facility installed two trickling filters in its treatment process in addition to the existing sedimentation tanks, activated sludge tank, and the four effluent ponds in series.

Objectives

The objective of this implementation was to evaluate the effectiveness of BiOWiSH® Aqua in removing ammonia, total nitrogen, and phosphorus from the wastewater effluent, over a three-month period, in the Oberon WWTP. An additional goal of the trial was to enhance plant stability and eliminate excess nutrients that cause seasonal upsets

Implementation Program

In an effort to improve nitrogen and phosphorus removal, BiOWiSH® Aqua was dosed upstream of the treatment plants' inlet. This allowed BiOWiSH® the maximum hydraulic retention time through all of the process' unit operations. Solutions of BiOWiSH® Aqua were easily prepared in batches every Tuesday and Friday, by dissolving BiOWiSH®'s highly soluble formula into a 1000L tote with tap water. The tank was equipped with a dosing pump which continually dosed BiOWiSH® Aqua into the treatment stream. A set flow was established to achieve an overall target concentration. The continuous dosing system does not require intensive maintenance or manual labor.

The dosing schedule used in this study (shown in Table 1) was calculated under the assumption of a 1 MLD average flow. Water quality at the trickling filter, clarifier, and ponds were monitored throughout the study, following existing operational guidelines.

BiOWiSH® Aqua

- Rapid nitrification and denitrification in aerobic and anaerobic conditions
- Reduces sludge production
- Increases plant treatment capacity
- Reduces odors
- Reduces aeration requirements
- Reduces need for chemical additives
- Improves plant stability
- Pre-treats influent in collection systems
- Natural and non-toxic

Available Sizes

- 100g/3.5oz
- 1kg/2.2lbs
- 5kg/11lbs
- 10kg/22lbs

Dosing (days)	BiOWiSH® Aqua/Batch (kg)	Target Concentration (ppm)
1 - 4	0.25	0.25
5 - 6	0.5	0.5
7 - 9	1.0	1.0
10 - Onwards	0.5	0.5

Table 1: Dosing schedule of BiOWiSH® Aqua during the 3-month trial period

Results

The results obtained during August through November 2016 were compared to data collected the previous year for the same months. BiOWiSH® dosing began on August 5th, 2016.

Trickling Filter Improvement

Figure 1 shows that ammonia levels were maintained at or below levels from 2015, after BiOWiSH® Aqua was introduced. This is true even when the flow rate into the plant was 104% greater than 2015 levels. Figure 1 also demonstrates that after peaks in ammonia concentration BiOWiSH® Aqua helped to quickly restore pre-existing levels. This validates that bioaugmentation with BiOWiSH® technology contributes to overall process stability.

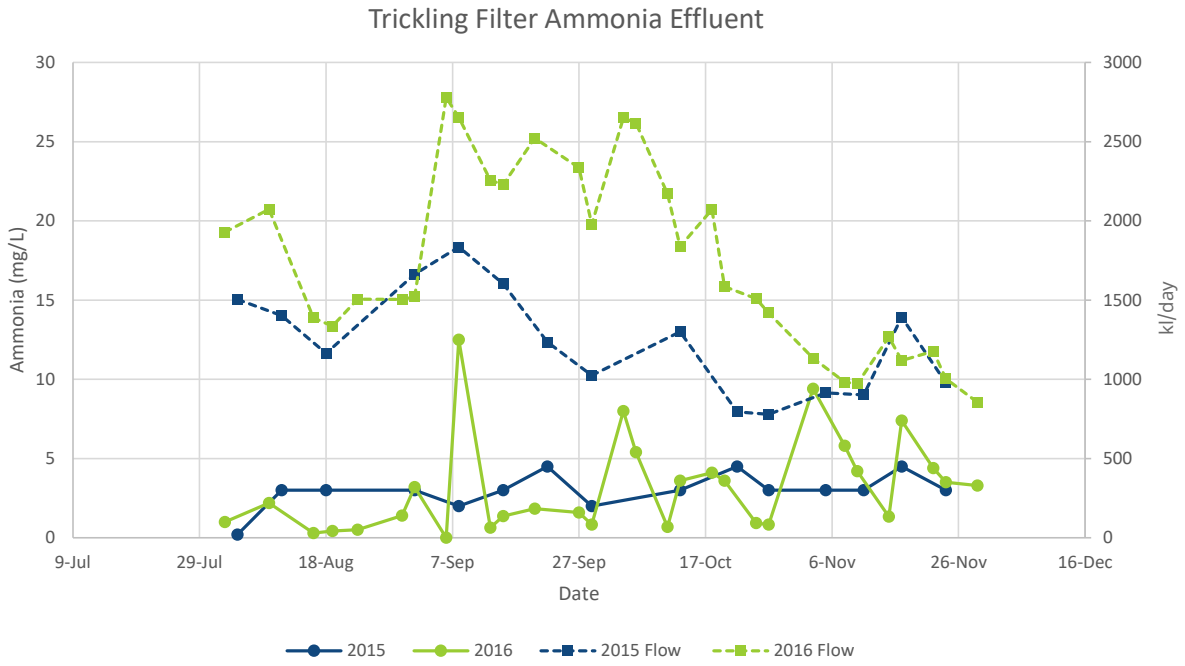

Figure 1: Trickling filter ammonia effluent concentration and flow rate data before BiOWiSH® is introduced (2015) and after BiOWiSH® is introduced (Aug 2016)

Another notable result was that despite differing flows, the ratio of the nitrate concentration to the ammonia concentration was consistent, which is illustrated in *Figure 2*. This occurrence shows that despite higher total nitrogen loading, there is a consistently lower total nitrogen concentration leaving the filter, which could indicate enhanced nitrogen removal.

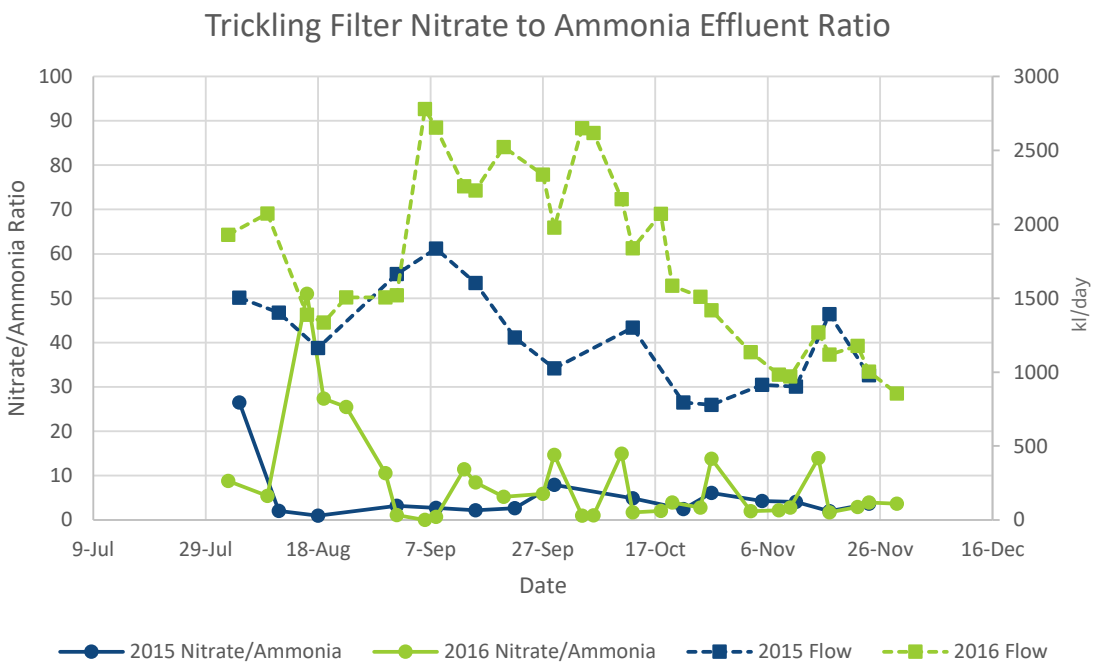

Figure 2: Ratio of nitrate to ammonia leaving the trickling filter and flow rate data before BiOWiSH® is introduced (2015) and after BiOWiSH® is introduced (Aug 2016).

Clarifier Effluent

On average the total phosphorus (TP) out of the clarifier was reduced by 78%. There was a spike in the phosphorus concentration leaving the clarifier, but only when the daily flow increased greatly. *Figure 3* shows the phosphorus concentration of the effluent leaving the clarifier in 2015 and 2016. The enhanced phosphorus removal indicates that BiOWiSH® microorganisms are enhancing biological phosphorus removal and increasing sludge settle-ability.

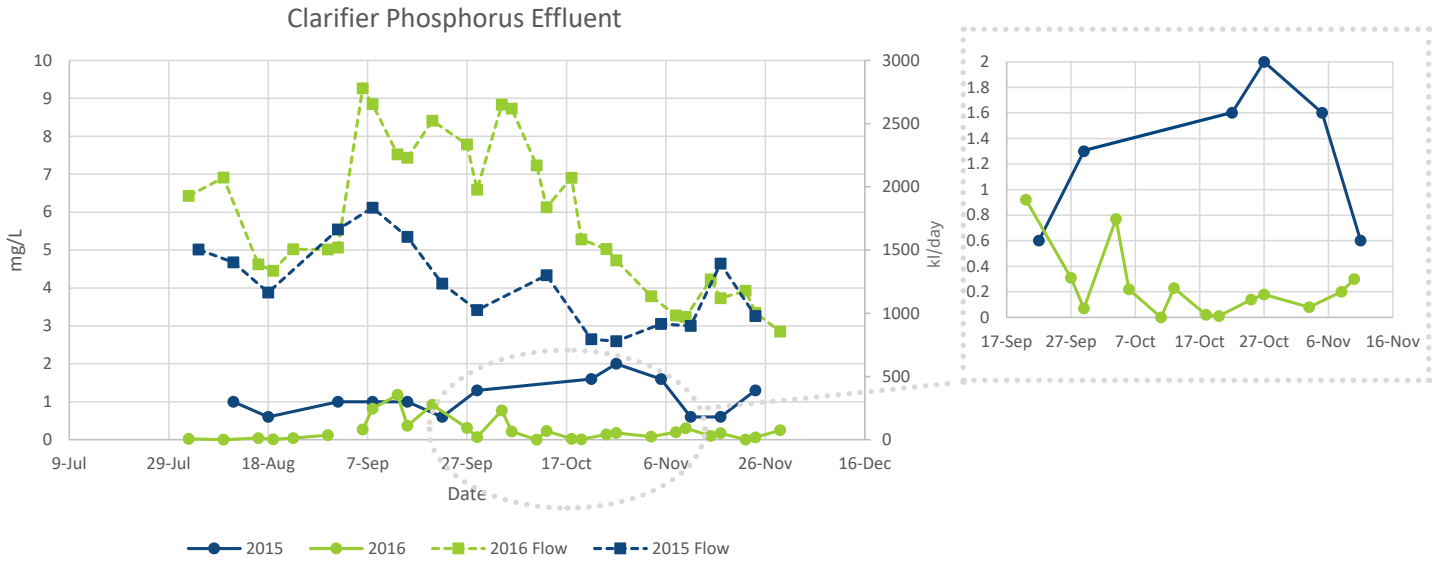

Figure 3: Clarifier Phosphorus effluent concentration and flow rate data before BiOWiSH® is introduced (2015) and after BiOWiSH® is introduced (Aug 2016).

Settling Pond Effluent

After the introduction of BiOWiSH® Aqua, ammonia and TP concentration in the settling pond effluent improved. On average, ammonia and phosphorus from the effluent pond were reduced by 82% and 63%, respectively.

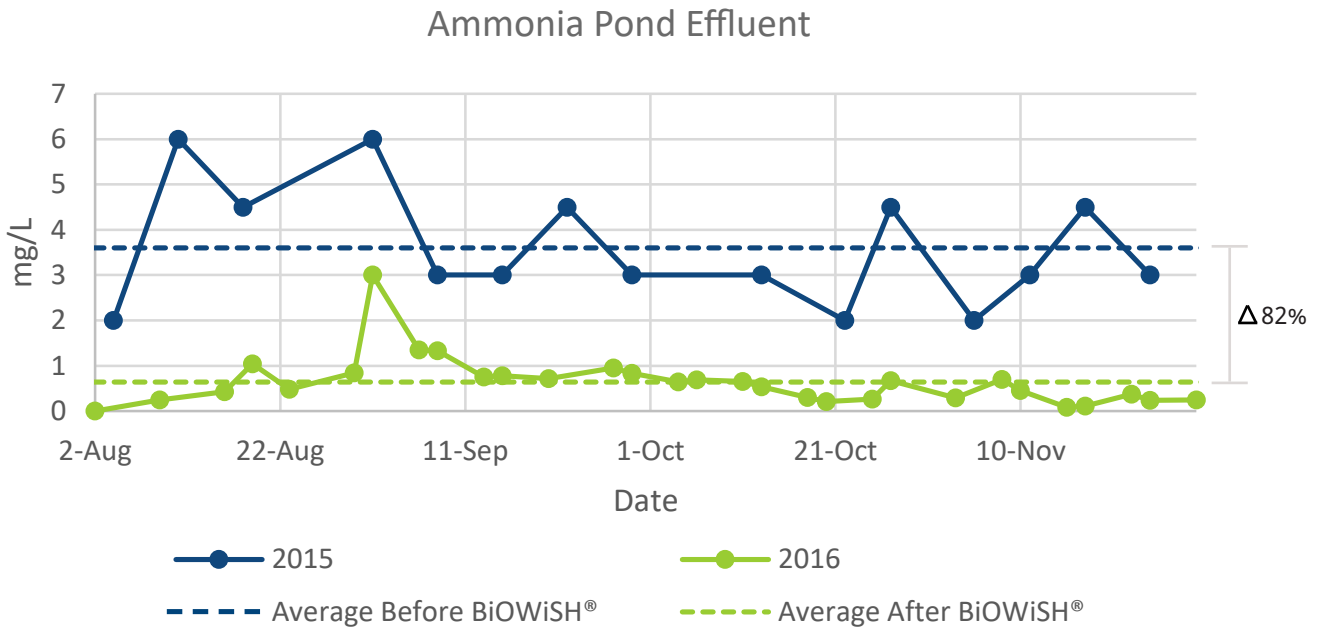

Figure 4: Pond Ammonia effluent concentration before BiOWiSH® is introduced (2015) and after BiOWiSH® is introduced (Aug 2016).

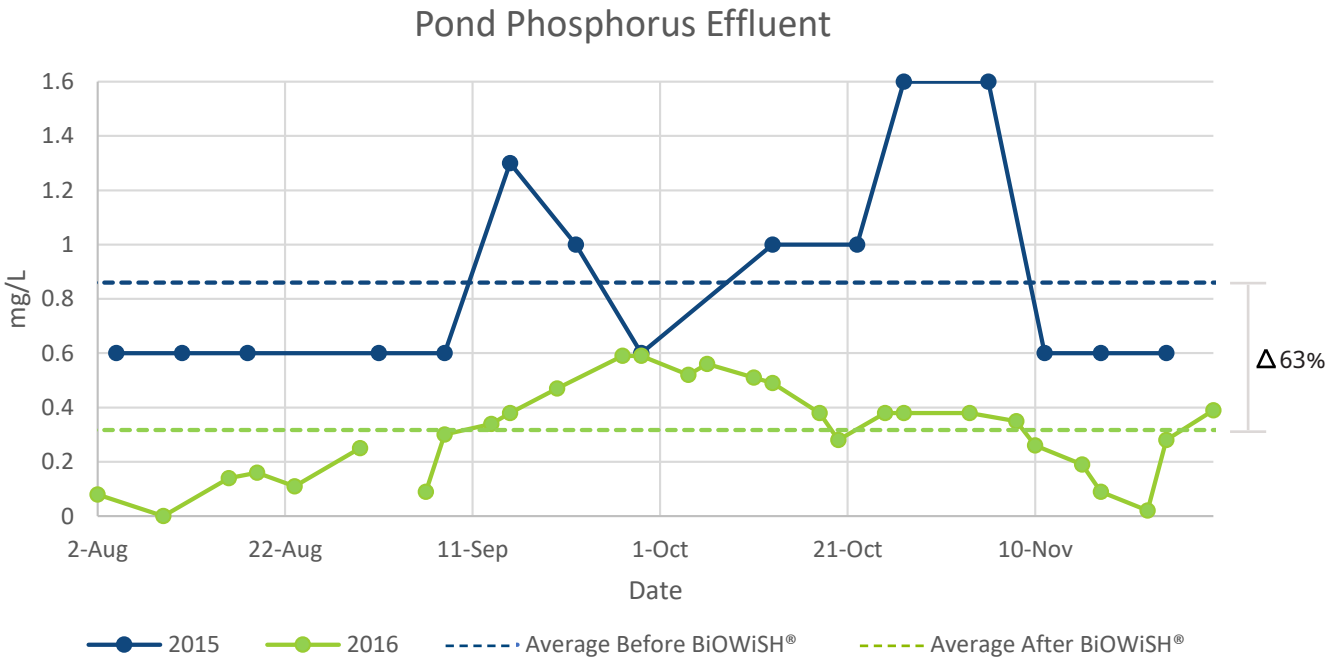

Figure 5: Pond Phosphorus effluent concentration before BiOWiSH® is introduced (2015) and after BiOWiSH® is introduced (2016).

A summary of the improvement in water quality after BiOWiSH® Aqua was introduced is given in *Table 2*.

Date	Ammonia (mg/l)	BOD (mg/l)	Total N (mg/l)	Total P (mg/l)
August - 2015	12.3	14	20	0.9
September - 2015	5.8	20	18.4	0.82
October - 2015	9.7	15	15	1.1
November - 2015	8.9	12	13.2	1.6
December - 2015	2.7	10	8.4	1.2
August - 2016	0.28	16	10	0.38
September - 2016	2.1	2	7.7	0.31
October - 2016	1.2	2	8.7	0.94
November - 2016	0.83	3	4.9	0.49
December - 2016	8.1	3	21.5	0.54
Mean Before BiOWiSH®	7.88	14.20	15.00	1.12
Mean After BiOWiSH®	1.10	5.75	7.83	0.53
Reduction	**83.42%**	**35.63%**	**54.77%**	**49.40%**

Table 2: EPA monitoring data showing water quality improvement after introduction of BiOWiSH® Aqua

Conclusion

Introduction of BiOWiSH® Aqua into the Oberon WWTP plant showed definite improvement in effluent ammonia, total nitrogen, and phosphorus concentrations. BiOWiSH® Aqua also added process stability to all stages of treatment. Average ammonia effluent was reduced by 83.42%, average nitrogen effluent was reduced by 54.77%, and average phosphorus effluent was reduced by 49.40% over the three-month trial period.

Plant operators were extremely satisfied by the benefits demonstrated by BiOWiSH® Aqua during the three-month period and decided to extend the bioaugmentation program for an additional year to further quantify process wide benefits.

Contact us:
wastewater@biowishtech.com
+1 312 572 6700
biowishtech.com