CUSTOMER CASE STUDY

SUMMIT LAKE

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EXECUTIVE SUMMARY

Summit Lake, Indiana, was a perfect example of the challenges faced by remote communities with highly variable flow, significant distance from established infrastructure and difficulties in getting qualified staff to operate and manage a traditional wastewater facility.

The existing wastewater treatment facility was failing to meet the discharge limits set by the EPA and the National Park Authority needed to find a solution that could operate with limited power, be maintained easily by the staff on hand and meet and exceed discharge limits during its operational lifetime.

The Algaesys solution met all of these requirements and more.

If you are looking for a carbon-negative, sustainable, off-grid wastewater treatment solution, then look no further.

INTRODUCTION

ENVIRONMENTAL FACTORS

With temperatures ranging from -10°C to +30°C throughout the year and 92 days of rainfall Summit Lake State Park, Indiana the environment in which the plant needed to operate may not have been considered to be the most ideal for a plant whos' principal form of energy is solar (photosynthesis). That said, the plant design, in its own dedicated greenhouse with polycarbonate frontage to allow sufficient light to reach the bioreactors, meant that the environment in which the bioreactors operated was controlled with elevated temperatures and lack of exposure to rain, dust, snow and wind. As an existing plant was already in place, we made use of the existing pumping infrastructure and built the plant in close proximity to the old facility at the end of the 8km of sewers on site.

INFLUENT CHARACTERISTICS

What made Summit Lake such an interesting challenge was the combination of the variability and composition of the influent flow. Throughout the year, during the week the average load for the treatment plant was the effluent produced by eight resident park rangers. During the weekend and holiday seasons, the parks' population grew to encompass approximately 350 recreational vehicles. The recreational vehicles emptied their chemical toilets into the intakes for the plant along with their grey-water tanks and any other liquid or semi-liquid food-stuffs. This variation in flow and toxicity would typically cause significant problems for a traditional WWTP, as evidenced by the inability of the existing plant to meet discharge limits, however our treatment solutions deal with flow variation much better than typical treatment processes due to its self-balancing nature.

Figure 1 Algaesys Plant by the side of previous wastewater treatment facility

RESULTS

PLANT OVERVIEW

- CAPEX – USD $400k
- Labor – USD $158k
- Plant size – 275 m3/day

PERFORMANCE

- BOD5 – 6mg/l
- NH4-N – 0.4mg/l
- SS – 7mg/l
- CFU/100ml - 940

POTENTIAL USES

- Caravan/camping grounds
- Residential Developments
- Municipal WWTPs
- Mine Sites
- Eco Tourism Resorts
- Hotels/Shopping Centers
- Large Sporting Facilities
- Airports

CONSTRUCTION & RELIABILITY

Construction and commissioning of the plant took 12 weeks. Speed of the build is facilitated by having minimal loading and small (by WWTP standards) tanks. With the building acting as a bund to control any accidental spillages and the typical n+1 design to avoid any individual component causing a failure after coming into operation in June 2014, the plant has only experienced a single failure in treatment operations, caused by a direct lightning strike. Being self-contained in a dedicated building, the plant is both quiet and odorless, although in Summit Lake this wasn't a key consideration.

PERFORMANCE

As the technology was considered to be "novel" by IDEM (Indiana Department of Environmental Management) the requirement initially was to run the effluent from the plant through the old WWTP in order to minimize risk. Additionally IDEM imposed the following discharge limits. BOD5 of 20mg/l, NH4-N of 1mg/l, SS of 20mg/l and CFU of 1000 per 100ml. Once the plant went into operation and consistently outperformed the discharge requirements, IDEM halved all limits except the CFU count. In all of the years of operation the plant has never failed to meet the permitted discharge limits while remaining below the designed flow-rate.

MANAGEABILITY

Since implementation the plant has been managed by the Park Rangers following a short induction by Algaesys. Activities relating to the management of the plant require approximately 3 hours per week. The 3 hours are dictated by the need to carry out effluent testing using the mobile testing kit and the duration of one of the tests is three hours. Activities outside of the water quality testing are limited to checking the levels on the solids tank, cleaning weirs, checking the rotation of the logs (sometimes get stuck by a build-up of water snails), general cleaning and the need to put excess biomass outside on a drying table.

Due to the simplicity of the plant design and the flexibility of the bio-remediation system, it is almost entirely autonomous and does not require continuous monitoring or adjustment in order to maintain treatment efficacy.

Combined with the minimalistic power use due to the non-mechanical nature of the method used for log rotation and water flow and you have an incredibly safe, robust and simple plant to operate.

DEVELOPMENTS

Sustainable wastewater treatment will be significant in achieving net zero targets.

Since the implementation of the Summit Lake facility, Algaesys has made significant progress in developing the plant design, improving efficacy and reducing the carbon footprint of our plant operations.

We now construct the bioreactor tanks out of 345 Stainless Steel (smaller carbon footprint to produce than the pre-cast concrete tanks), longer operational lifetime and the ability to re-use/move plants in the event they are no longer needed in the original commissioning location.

We now make the logs out of gas entrained polypropylene, which results in 15% lighter logs, less energy and material required to produce them, less cost and weight for shipping, less energy required to rotate them (in operations) and it also delivers a "pitted" surface which allows the organisms in our bio-reactors to attach better and reduces our commissioning times.

The results of these developments combined with the perfection of our process means that we now routinely produce the following results (with no Chlorine dosing or UV Filtration).

Parameter	**Final configuration**	
	Average result (effluent)	**% removal**
Bio-chemical oxygen demand **BOD5** mg/l	4	98.70%
Chemical Oxygen Demand **COD** mg/l	6	99.20%
Suspended Solids **TSS** mg/l	0.7	99.80%
Ammonia Nitrogen **NH_4-N** mg/l	0.1	99.90%
Total Nitrogen **T-N** mg/l [With ASDN]	0.1	99.90%
Total Phosphorus, **T-P** mg/l	0.4	96.70%
Pathogens – E-Coli count (CFU/100 ml)	800	

Providing quality water for re-use with a carbon-negative process is what we do.

GLOSSARY

BOD – Biological Oxygen Demand

BOD5 – Test used to quantify how much Dissolved Oxygen is needed within a given time to biologically degrade the organic wastewater content.

CFU – Colony Forming Units always measured per 100ml (sometimes also referred to as MPN (most probable number).

COD – Chemical Oxygen Demand. The amount of Dissolved Oxygen needed to oxidize chemical organic materials (e.g. petroleum).

SS – Suspended Solids

TSS – Total Suspended Solids (number of waterborne particles > 2 microns)

TDS – Total Dissolved Solids (particles < 2 microns)

UV - UltraViolet

WWTP – Waste Water Treatment Plant (also WWTF Facility replacing Plant)

CO2 – Carbon Dioxide

CO2e – Carbon Dioxide Equivalent

NH4 – Ammonia

CH4 – Methane

H2O2 – Hydrogen Peroxide