Mount Alexander Waste to Energy

Wastewater Effluent Treatment for Trade Waste Disposal

22nd November 2021

Situation

- MAWtE project will treat Dons, wastes and a much larger amount of other organic wastes using anaerobic digestion which converts carbon based pollutants in the water to biogas, a renewable fuel.
- The AD process does not remove nutrients from wastewater, particularly Nitrogen and Phosphorous or salts.
- Dons do not want the treated AD effluent to pass through their responsibly to Coliban Water.
- MAWtE project will need to send the treated AD effluent to Coliban Water, via a trade waste agreement.

Problem

- Anaerobic Digester effluent wastewater is too concentrated to simply send to trade waste.
- Coliban Water commissioned GHD to study the impact of the WtE effluent upon the Castlemaine WWTP and concluded that the existing plant cannot cope with the effluent. The plant will either fail to meet its N discharge levels or fail to provide sufficient air for the process.
- The WtE project will therefore install its own effluent treatment system to reduce the levels of N in the effluent to a point that Coliban Water will accept the wastewater.
- A high level design of the wastewater treatment plant is required to size the required treatment tanks and estimate the power consumption of the proposed plant.
- Rainwater collected in the tank farm and hard surfaces that are potentially contaminated with wastes are also being collected and need to be treated.
- Wastewater from the de-contaminating truck wash will also be collected and treated.

Investigation

1. A biological nutrient reduction process can be deployed in a sequencing batch reactor to clean up the wastewaters. The SBR tank is sized as follows:
   - The incoming wastes that the MAWtE plant will treat anaerobically are understood to be:
     - Dons Meat Waste at 2622 tonnes per annum at 66% moisture
     - Dons DAF Sludge at 1,495 tonnes per annum at 90% moisture
     - Community wastes 89 tonnes per day
     - Total Average 105 tonnes per day.
   - Feeds 70% moisture, so water load 73 tonnes per day
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2. SBR Tank.
    - BNR plant will require 5 days to treat the water, and this equate to a volume of 369 m3.
    - At a water depth 3.5 m, tank depth 4.0m the tank diameter will be 12m.
3. Decanter Tank
    - The decanter will draw treated effluent from the top of the SBR in a batch process and deliver this water to a tank, referred to as the decanter tank.
    - The decanter tank will be 3.5 m in height, with 3.0m water height (0.5m lower than the SBR water level) and 5.6m in diameter, sufficient to hold one day's wastewater.
    - Water will be pumped from the decanter tank to the stabilization lagoon.

4. Aeration Blower Capacity
    - The quality of the anaerobic digester effluent is not known to a high degree of certainty.
    - To develop a sizing for this BNR plant, data from Biogass Renewables and GHD has been used.
    - It is assumed for this design that the effluent will have
        - COD 3,200 mg/L
        - BOD_5 2,100 mg/L (assumed at 1.5 times less than COD)
        - Total Nitrogen 1,690 mg/L
    - Typical sewer as 300 mg/L BOD and 50 mg/L, so the wastewater has 7 times more BOD than sewer but 33 times more Nitrogen. Some additional BOD is expected be required to treat the Nitrogen, and this is available from the raw wastes being treated.
    - The air required to provide the oxygen for the treatment of this wastewater is calculated below.
    - An air blower to provide this airflow at 3.3m diffuser depth is a summarized in the table below.
    - We have assumed the full required air flow at temperatures up to 35 C
    - Blower Make Model and power consumption
        - Aerzen Positive Displacement, three lobe blowers, in Duty-Duty
        - Model GM30L G5 Delta
        - 30 KW each, 60 KW total.

4. Stabilization lagoon
    a. The wastewater from the decanter tank will be pumped into a stabilization lagoon where it will be naturally polished an average of 12 months.
    b. Solar powered surface aerators will be used to provide mixing aeration.
    c. The stabilization lagoon will be 60m by 60 m by 4m
    d. After this treatment, the wastewater is expected to have:
        i. Suspended Solids of less than 30 mg/L
        ii. BOD of less than 50 mg/L
        iii. TKN of less than 20 mg/L
        iv. pH of 6 - 8
        v. Temperature of 15 to 18 C

5. Discharge to Trade Waste
    a. Stabilized wastewater will be discharged to trade waste at a constant flow rate via a pumping system.
    b. The 73m3 per day will be pumped at an average flow 0.85 L per second, and peak flow of 1.6/second

BOD5 to be reduced	4000	mg/L
Daily peak Flow	73,000.00	L
KG BOD per day	321.20	kg per day
Transfer Efficency fine bubble diffusers	20%	
Oxygen Required	1,606.00	KG per day
Alpha Factor	0.8	
Fouling Factor	0.8	
Oxygen Required	2,509.38	KG per day
Oxygen Content of air	23%	
Air Required	10,910.33	KG per day
SG of air at 50 C	0.8	kg/m3
Volume air required	13,637.91	m3 per day
Safety Margin	10%	
	1,363.79	
Design Air Flow	15,001.70	m3 per day
Aeration Running Hours	18.00	
	833.43	m3 per hour

Total Nitrogen to be reduced	1690	mg/L
Daily peak Flow	73,000.00	L
KG TKN per day	123.37	kg per day
Ratio Oxygen to TKN	4.70	
KG Oxygen Required	579.84	KG per day
Transfer Efficency fine bubble diffusers	20%	
Oxygen Required	2,899.20	KG per day
Alpha Factor	0.8	
Fouling Factor	0.8	
Oxygen Required	4,529.99	KG per day
Oxygen Content of air	23%	
Air Required	19,695.62	KG per day
SG of air at 50 C	0.8	kg/m3
Volume air required	24,619.52	m3 per day
Safety Margin	10%	
	2,461.95	
Design Air Flow	27,081.48	m3 per day
Aeration Running Hours	18.00	
	1,504.53	m3 per hour

Total	42,083.17	m3 per day
Aeration Hours	18.00	
	2,337.95	m3 per hour

Resolution

- Wastewater from the Anaerobic Digestion of wastes will be treated to a standard that Coliban Water will accept as trade waste.