

ENVIRONMENTAL DYNAMICS

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10 January 2023

TasWater
GPO Box 1393
Hobart, TAS 7001

Attn: Jason Taylor
Acting Dept Manager – Development Services

Dear Jason,

Re: Orford STP odour impact during upset conditions

My thanks to you and your colleagues for meeting with me and Neil Shepard on 20th December 2022 to discuss the odour impact of the Orford sewage treatment plant (STP) on the proposed subdivision at 155 Rheban Road, Orford, and for your subsequent advice regarding odour emission rates during upset conditions. I write to set out what the STP's odour impact on the proposed subdivision will be during such conditions, and for the sake of clarity I also summarise the key aspects of the Orford STP odour impact study that I carried out in mid-2018.

Background

The 2018 Orford STP odour impact study predicted worse case odour ground level concentrations (GLCs) and concluded they were well under the 2 OU (1 hour) design GLC set by the Tasmanian *Environment Protection Policy (Air Quality) 2004* (EPP).

During our meeting on 20th December 2022 I outlined the study methodology and the conservative nature of the odour GLC predictions.

The odour prediction model

- i) The modelling situation is straightforward. The terrain is flat with no buildings that might produce turbulence in the vicinity of the STP, the STP's odour emissions are from ground level area sources, and the proposed subdivision is only about 250m from the closest secondary pond.
- ii) For this modelling situation odour GLC predictions can be made by a hand calculation for a given set of meteorological conditions, which was the approach used before the development of computer dispersion models. The GLC contours will be concentric rings around the STP. Unlike the situation with emissions from a stack, there is no possibility that odour GLCs far from the STP might be higher than the odour GLCs close to the STP.
- iii) CSIRO's model TAPM was used because it allows odour impacts throughout an entire year to be examined, using 3-D winds that change hourly.

Odour emission rates for normal operating conditions

- i) Odour samples were taken from the aeration pond near the inlet works, near the outflow to the three secondary ponds, and at a location roughly halfway between the two, as shown in Figure 1. Conditions were ideal for the sampling work.

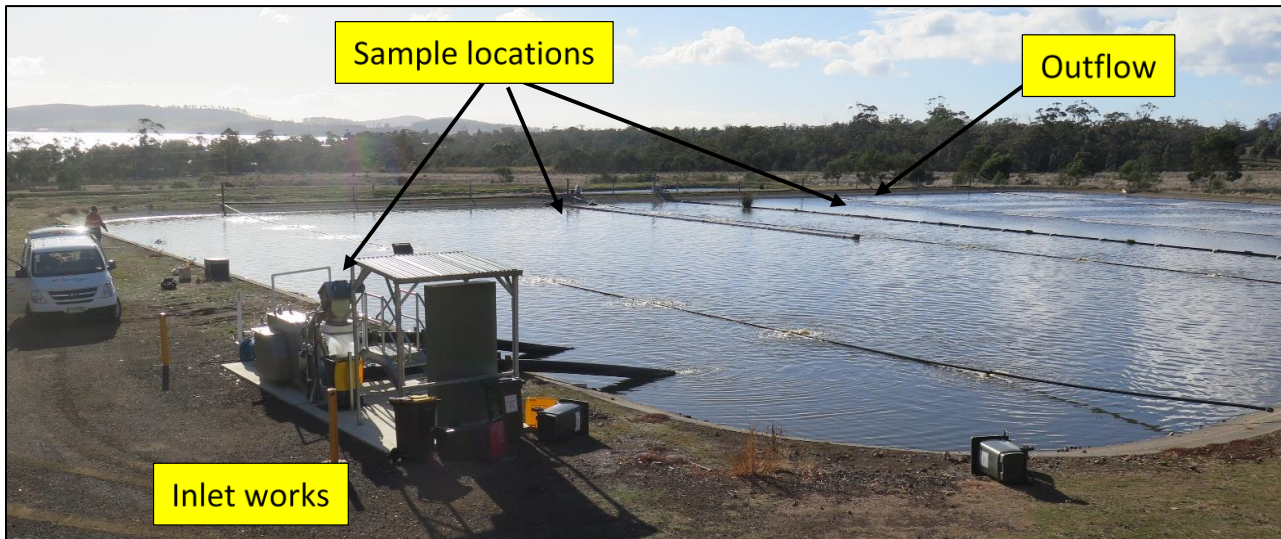


Figure 1. The STP's aeration lagoon, showing odour sampling locations (Figure 5 in the 2018 report).

The measured specific odour emission rates (SOERs) were 0.42 OUV/s per m² near the inlet works, 0.20 OUV/s per m² near the lagoon outflow, and 0.37 OUV/s per m² halfway between these two locations. As explained in the 2018 study report, these measured SOERs accord with expectations based on previous odour assessments of similar STPs, both in Tasmania and interstate.

- ii) An SOER of 0.42 OUV/s per m² was assigned to the aeration pond, and an SOER of 0.20 OUV/s per m² was assigned to each secondary pond. TasWater has advised that these SOERs are acceptable (Jason Taylor, email 23rd December 2022) and the SOERs assigned to the secondary ponds are conservative. The actual SOERs are certainly lower, although they were not measured.
- iii) The inlet works is only a minor source of odour compared to the primary lagoon. The 2018 study conservatively assumed an odour emission rate (OER) of 100 OUV/s.

Odour predictions for normal operating conditions

The *Environment Protection Policy (Air Quality) 2004* specifies that maximum odour GLC predictions should be used to assess compliance with the design GLC of 2 OU (1 hour), unless site-specific meteorology and credible odour emission rates are available, in which case the 99.5 percentile GLC predictions can be used to assess compliance. In the case of the Orford STP operating under normal conditions, the quality of the input meteorological data and odour emission rates allow the 99.5 percentile GLC predictions to be used, but the 2018 study presented both sets of GLC predictions for the sake of completeness.

The 2018 study concluded that the design GLC of 2 OU (1 hour) is met everywhere beyond the boundary of the STP facility. The highest predicted odour GLCs impacting the proposed subdivision are naturally along its Rheban Road boundary, with the highest maximum GLCs predicted to be 0.13 OU (1 hour) and the highest 99.5 percentile GLCs predicted to be just under 0.1 OU (1 hour).

These worst case maximum and 99.5 percentile predictions are 15 and 20 times lower respectively than the odour design GLC, so any seasonal variation in normal operating conditions will not change the conclusion that even the part of the proposed subdivision closest to the STP will not be impacted by its odour emissions. This agrees with the observation that odour from the final (third) secondary pond can barely be detected by someone standing next to it.

Odour predictions for upset conditions

In our meeting on 20th December 2022, TasWater noted that from time to time the Orford STP's primary lagoon may experience upset conditions in which aeration is insufficient to keep up with the oxygen demand of the lower levels of the lagoon.

TasWater subsequently provided the following advice (based on external and internal consultation) about the expected nature of upset conditions for the Orford STP [Jason Taylor, emails 23rd December 2022 and 3rd January 2023].

- Upset conditions may not happen every year and are expected to occur no more than a couple of times a year, typically during the summer at peak tourist times, and on each occasion should last for perhaps a week or so. However, upset conditions will occur more when the STP gets closer to its design flow.
- An upset condition SOER of 4.0 OUV/s per m² should be considered. Under shock loading, where aeration is unable to keep up with oxygen demand, the primary lagoon's odour emissions are expected to become similar to emissions from a primary sedimentation tank (~1.5 OUV/s per m²), but could be as bad as an anaerobic zone (~4.0 OUV/s per m²).

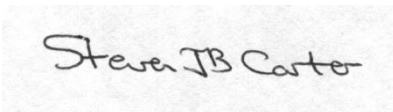
Odour GLC predictions scale according to the SOERs. In the part of the proposed sub-division closest to the Orford STP, an upset condition SOER of 4.0 OUV/s per m² equates to a worst case maximum odour GLC of $(4.0 / 0.42) \times 0.13 \approx \underline{1.2 \text{ OU (1 hour)}}$, where 0.42 OUV/s per m² is the SOER for normal conditions and 0.13 OU (1 hour) is the corresponding worst case maximum odour GLC. Similarly, the worst case 99.5 percentile odour GLC for upset conditions is $(4.0 / 0.42) \times 0.1 \approx \underline{1.0 \text{ OU (1 hour)}}$.

In summary, the worst case odour GLCs impacting the proposed sub-division closest to the STP during upset conditions are expected to be about 1 OU (1 hour), irrespective of whether the maximum or 99.5 percentile GLC predictions are considered. This is about half the design GLC of 2 OU (1 hour) specified by the *Tasmanian Environment Protection Policy (Air Quality) 2004*.

A short discussion is in order since an odour concentration of 1 OU corresponds to the threshold of human odour detection. The model is predicting that residents of the subdivision will never detect odour from the STP during normal operating conditions, but they may occasionally detect slight odour during upset conditions, although this is quite unlikely because of the conservative nature of the modelling exercise.

To explain this, the modelling exercise assumes STP upset conditions are constant throughout the year, which ensures that the worst-case odour GLC predictions correspond to the annual worst-case dispersion conditions. However, as noted above, TasWater has advised that upset condition events will tend to happen in the summer and will not last more than a week or so. This means there is only a low chance of an upset condition event coinciding with annual worst-case dispersion conditions, which tend to happen in the winter, usually at night when the gentle nocturnal cold-air katabatic breeze transports odour without significant vertical mixing. This was a finding of the detailed odour impact study that supported the approval of Tassal's waste fish processing plant 4 km north of Triabunna.

Summer weather usually produces more vertical mixing, which dilutes the odour as it moves downwind, so STP upset conditions do not coincide with annual worst-case dispersion conditions, making the above GLC predictions conservative.

A handwritten signature in black ink that reads "Steve JB Carter". The signature is written in a cursive, slightly slanted style.

Dr Steve Carter
Environmental Engineer