# Appendix H

# Odour Assessment

GOLDER

16 February 2020

Project No. 20438027-004-L-Rev0

**Jocelyn Lewes**
Selwyn District Council
2 Norman Kirk Drive,
Rolleston 7614,
Selwyn

**REVIEW OF ODOUR EFFECTS RELATING TO LINCOLN SEWAGE TREATMENT PLANT SETBACK - LINCOLN SOUTH PLAN CHANGE**

Dear Jocelyn,

Rolleston Industrial Developments Ltd (RIDL) have lodged a private plan change request with Selwyn District Council (SDC) (Plan change request 69). This plan change is to change the Selwyn District Plan (Plan) by rezoning approximately 186 hectares of Rural Outer Plains Zone to Living X, Living Z and Business 1 Zones, in Lincoln. Following the application, SDC have issued a request for further information (RFI). Item 40 of the RFI identifies the current restriction on housing when within 150 m of the boundary of the area designated for the Lincoln Sewage Treatment Plant (rule C4.9.32 of the Plan). The request is as follows:

> *40. The Lincoln Sewage Treatment Plan, referred to in the request* [plan change request] *as the Allendale Pump Station, is located on the north-eastern boundary of the plan change area. This area is designated (SDC-153) and Rule C4.9.32 requires that any dwelling shall be setback not less than 150 m from the boundary of the designed area. The plan change request has not sought to vary this rule, therefore please demonstrate how this will be achieved and address any other reserve sensitivity effects that may arise from the location of residential activity in close proximity to the designated area. This is particularly relevant as the request proposes that the ponds will be required to buffer wastewater flows from the plan change area during periods of wet weather.*

This letter[1] provides a review on the potential odour effects of the Lincoln Sewage treatment plant operations on the proposed Lincoln South Plan Change area and whether the existing 150 m setback is still required to prevent reverse sensitivity odour effects.

## Background

The Lincoln Sewage Treatment Plant included sequential batch reactor (SBR) tanks and oxidation pond treatment system prior to discharge into the L II River. The discharge of treated wastewater was only permitted under CRC210644 until 31 March 2013. There is no longer discharge of wastewater, or treatment

[1] This letter is subject to the limitations provided in Attachment 1.

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of wastewater at this site and since 2013 all wastewater is pumped to the Pines WWTP in Rolleston for treatment. Currently the tanks and pond are available for emergency wastewater storage events.

It is noted that the 150 m setback rule for housing (referred to in the RFI) was set when there was sewage treatment undertaken at the site.

## Wastewater Storage at Allendale Pump Station

Using conservative assumptions, WSP (2020)[2] estimated that with the addition of the Lincoln South Plan Change area (2,000 households), that a 1 in 5-year annual reoccurrence interval (ARI) 12-hour storm event, would result in 700m$^3$ of wastewater overflow from the Eastern Selwyn Sewerage Scheme. This volume of wastewater would need to be stored near to the Allendale pump station. It is understood that this would be stored firstly in the three former SBR tanks (up to 600 m$^3$) and then any additional (up to 100 m$^3$) within the adjacent pond.

As the storage would be required following high rainfall events (due to water infiltration into the wastewater system), WSP[3] have estimated that the 700 m$^3$ of excess wastewater would be approximately 2 to 3.5 times more dilute than the normal municipal wastewater, and wastewater entering the pond being at the upper end of this level of dilution.

Once normal system flows have resumed, WSP[3] have also estimated that it would take 1 hour to empty the three former SBR storage tanks and they consider it is unlikely that the pond would be emptied.

## Odour Potential

A key driver of odour is the maintenance of the wastewater in a non-septic state – that is avoiding anaerobic conditions. For the tanks, the duration that wastewater is to be stored in them is expected to be relatively low, i.e., it is expected to be a number of hours[3]. Therefore, the wastewater in the tanks is unlikely to become septic prior to being pumped to the Pines WWTP.

For the pond storage, we have undertaken a desktop review of the oxygen demand of the inflow wastewater compared to the ability of the pond to provide this demand with its existing residual dissolved oxygen inventory.

New Zealand municipal wastewater typically has a biochemical oxygen demand ($BOD_5$) of approximately 200 to 300 g/m$^3$ (MfE 2003[4]). Therefore, the dilute wastewater that could be discharged into the pond in a wet weather event is estimated to have a biological oxygen demand in the order of 8.5 kg[5].

The pond has an area of 3.32 ha (WSP[3]) and is understood to currently have a water level of around 1.2 m deep. Based on a review of historical aerial photographs available through Google Earth, we can see no strong evidence that the pond suffers from seasonal algal blooms, i.e., there is no obvious sign of such events, or other pond discolouration. Some aerial photographs indicate significant surface aerations (white caps) during wind events. Therefore, it is likely that at least the top 0.5 m of the pond, would be close to being fully saturated (or close to it) with oxygen. At sea level and a temperature of 25 °C, the saturated dissolved

[2] Memorandum WSP Charlotte Mills to Bruce Van Duyn 31 October 2020.

[3] Pers Comms Charlotte Mills (WSP), Bruce van Duyn Carter Group).

[4] Section 2.3 of Sustainable wastewater management: A handbook for smaller communities MfE (2003). Accessed at https://www.mfe.govt.nz/publications/waste/sustainable-wastewater-management-handbook-smaller-communities-part-1-0 last accessed 9/2/2020.

[5] 8.5 kg = ((300 g/m$^3$ * 100 m$^3$) / (1000 g/kg)) / 3.5 (assumed dilution factor).

oxygen content is 8 g/m$^3$ (footnote[6]). This means there is approximately 130 kg[7] of available dissolved oxygen inventory within the pond when dilute sewage enters. At lower temperatures, the percentage dissolved oxygen in saturated conditions will be higher, therefore, this is considered to be a conservative assumption.

Using the above assumptions, if the $BOD_5$ demand of the inflow was met within the top 0.5 m of the pond, this would result in an approximate reduction in the dissolved oxygen content of 6.3 % (i.e., 8.5 kg / 133 kg). This would reduce the dissolved oxygen to 7.5 g/m$^3$ (footnote [8]). It is noted that the pond may not be fully mixed, and a small area of lower dissolved oxygen may occur in the pond, however, it is expected that pond mixing, and natural aeration is expected to readily restore the dissolved oxygen to typical levels within hours. Therefore, the dissolved oxygen content is unlikely to reduce as much as indicated by the above simplistic calculation.

## Odour Effects

Regarding odour effects on the proposed Lincoln South subdivision, given the distance between the tanks and the boundary with the subdivision (approximately 190 m), the low frequency which the tanks will be used and the expected short duration of storages, there are expected to be less than minor odour effects from the use of the tanks as short-term wastewater storage in high rainfall events.

Regarding the use of the pond, the natural capacity of the pond to provide the oxygen required by the dilute wastewater is expected to result in a less than minor potential for offsite odour effects. The use of the pond for receiving excess wastewater flows would be infrequent (one event in five years), and these events have a very low potential to cause odour that could be recognised at the proposed sub-division.

It is also noted that it is unclear if using the pond for buffering excessive wastewater flow during 1 in 5 year ARI storm event would be adopted by SDC or whether additional tank storage would be installed. While the option of additional tank storage has not been fully evaluated, due to the distance to the plan change area, and relatively short-term storage of wastewater (as is the case for the current tanks), it is expected that several additional tanks located close to the current tanks, would be unlikely to result in offsite odour effects at the Lincoln South Plan change area.

Therefore, when considering odour effects, it is considered that a 150 m buffer, as current Rule C4.9.32 suggests is not required. While this was appropriate for the previous use of the Lincoln WWTP system, given the current consented use of the Lincoln WWTP, based on the tanks/pond being used only for storage during peak rainfall events, there is expected to be less than minor odour effects beyond the boundary and no restrictions on land use in the Lincoln South subdivision is considered necessary to mitigate against reverse sensitivity odour.

## Closing

We trust the above information will assist RIDL in understanding the odour impacts on the proposed Lincoln South Plan Change area due to the Lincoln WWTP operation in a wet weather scenario. If you have any queries regarding this letter, please contact the undersigned by email at cnieuwenhuijsen@golder.co.nz or by phone at (021) 782 440.

[6] https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/. Last Accessed 15/2/2021.

[7] 133 kg = (((3.32 ha x 10,000 m$^2$/ha) * 0.5m) * 8 g/m3) / 1000 g/kg.

[8] 7.5g/m$^3$ = (133 kg - 8.5 kg) / (3.32 * 10,000 * 0.5).

Yours sincerely,

**Golder Associates (NZ) Limited**

Cathy Nieuwenhuijsen
*Senior Air Quality Consultant*

CN/RC/mt

Attachment: Report Limitations.

https://golderassociates-my.sharepoint.com/personal/mtsoy_golder_com/documents/documents/2021/cathy/20438027-004-l-rev0-review of odour effects lincoln wwtp.docx

**ATTACHMENT 1**

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