Memorandum

To	Commissioners E. Burge, P. Callander and B. Cowie
Copy	Fiona Morton and Tabitha Manderson
From	Timothy Baker and Eloise Boam
Date	18 May 2021
Subject	Woodville Wastewater Treatment Plant APP-2010014267.02 Groundwater Contaminant Load

1 Introduction

As part of the hearing of APP-2010014267.02 for resource consents associated with the Woodville Wastewater Treatment Plant (WWTP), Commissioner P. Callander requested that the contaminant load within the groundwater be calculated, relative to the total discharge of effluent from the WWTP.

Mr. Baker performed the required calculations as part of the resource consent hearing on 12-May 2021, which are detailed in the following sections.

2 Groundwater Load Calculations

Darcy's law says that the discharge rate is proportional to the gradient in hydraulic head and the hydraulic conductivity:

$$q = \frac{Q}{A} = -K\,(\frac{dh}{dl})$$

The assumptions outlined in Table 1 below have been used to estimate the discharge of groundwater across the width the existing treatment pond system.

Table 1: Parameters used to calculate discharge of groundwater system.

Parameter	Value	Notes	Source
Hydraulic gradient	0.0084	The hydraulic gradient was calculated using the change in water level (74.28 – 72.81mRL) and distance between BH4 and BH5.	**Water Levels:** WSP (2021) Page 5 **Distance:** GIS (Figure 1)
Hydraulic conductivity	$6.35x10^{-3}$ m/day	The hydraulic conductivity values were derived from slug tests within BH4 and BH5. The values derived from BH4 and BH5 were averaged.	WSP (2021) Page 12
Area	$1,750m^2$	The area was derived by using the width and depth of the ponds (350m x 5m).	**Width** GIS (Figure 2) **Depth** Estimated

Using these parameters, the expected discharge of groundwater (across the width of the ponds system) is $0.0933m^3$/day.

Figure 1: Distance between BH4 and BH5

Figure 2: Width of ponds

Using the calculated daily discharge of groundwater and the groundwater quality results measured down gradient of the ponds, the load of contaminants entrained in the groundwater has been calculated and compared to the total contaminant load from the pond discharge. The assumptions used in this assessment are outlined below in Table 2.

Table 2: Parameters used to calculate load within groundwater and effluent discharge.

Parameter	Value	Notes	Source
Groundwater TN	6.26 g/m^3	Average values measured in BH4 and BH5 (TKN + nitrite-nitrogen + nitrate-nitrogen)	WSP (2021) Page 14
Mean effluent load	1720.6m^3/day	Mean daily effluent flow from pond system.	WSP (2018)
Effluent TN	8.8 mg/L	Total Nitrogen measured in WWTP effluent.	WSP (2018)

The TN load discharged via groundwater has been calculated as 77.1 kg/year (0.211 kg/day), while the total load from the effluent is 5527 kg/year (15.14 kg/day). The TN contaminant load from groundwater is therefore only ~1.4% of the total daily discharge.

3 References

WSP, 2018: Woodville Wastewater Treatment Plant – Flow and Effluent Load Summary. Prepared by Springer, A. on behalf of Tararua District Council.

WSP, 2021: Woodville Wastewater Treatment Plant – Additional Information Request APP-2010014267.02. Prepared by Warner, B., Boam, E. and McConchie, J. on behalf of Tararua District Council.

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