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Central Hawke's Bay District Council
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Attention: Darren de Klerk

Dear Darren

Pōrangahau and Te Paerahi Wastewater – Water Quality Assessment (Beca, 2021, P:D.25)

Section 92 Response

Please see below a response to question 7 of the HBRC request for further information regarding consent application APP-126770:

"7. The basis of the staged mass balance and load estimates assessment (Section 6 of Pōrangahau and Te Paerahi Wastewater – Water Quality Assessment, Beca, 2021:P:D.25) needs to be checked, and that a clearer description of its purpose, methods, assumptions, results, and limitations of that assessment be provided."

Mass-load and mass-balance calculations are commonly used tools for freshwater quality effects assessments and WWTP discharges.

This can be described at a high-level as follows:

- The mass-balance calculation is used as an assessment of mixing characteristics based on chosen parameters for any one time and calculates predicted concentration increases downstream as the result of the discharge of a contaminant. For this reason, usually a typical scenario (typical or average river flows) and a worst-case scenario (low river flows) are calculated are calculated to give information on these circumstantial scenarios. This assessment is used to calculate near-field water quality effects.
- The mass-load calculation gives an indication of the averaged nutrient loading to the river/catchment across an entire year based on water quality and flow of the river and the WWTP discharge. This assessment is used to calculate far-field catchment wide nutrient water quality effects.

Historical fortnightly water quality data provides suitable insights into the general water quality effects of a WWTP discharge, however, the likelihood of that regular monitoring coinciding with an extreme low-flow or high rainfall event scenario is low. Furthermore, that event-based sample point is usually averaged into an annual mean.

A mass-balance assessment under median flow conditions can be compared to historical water quality datasets to assess whether the mass-balance calculation is estimating downstream concentrations that are

concordant with the measured values. Provided the results of this initial test are satisfactory, the mass-balance approach allows for an estimate of water quality mixing conditions under specific flow scenarios (i.e. low river flow, median WWTP discharge). As such they are useful for “stress-testing” the realistic worst-case conditions of WWTP discharges. Finally, the mass-balance approach can be utilised to understand the future effects of the WWTP, under set water quality and flow conditions that are informed by historical data.

The parameters employed for each calculation, at each stage, include flow rates and water quality parameter concentrations for the River and the WWTP discharge. These have been estimated from existing CHBDC and HBRC datasets from the last five hydrological years. For each of the scenarios assessed, water quality parameters of the River and the WWTP discharge stay largely the same with an adjustment of River and WWTP flows to assess current worst-case and future scenarios informed by the concept design.

The assumptions stated in the water quality assessment, including using a Mean annual low-flow (MALF) statistic, are based on a “realistic” worst-case scenario, acknowledging that the assessment is conservative event-based scenario. The mass-load assessment compliments the mass-balance assessment as it provides a temporally averaged understanding of overall nutrient loading in the catchment.

Relating to specific queries in the Coast & Catchment Memo – *Consent to shift discharges from the Pōrangahau and Te Paerahi wastewater treatment plants* (Kelly, 2021), the following points are noted:

The concept design of discharge parameters across each of the development stages was refined further following the water quality assessment in Beca, *P:D.25*. While the estimated discharges and their underlying assumptions are robust and present in the report, a clarification of the stages and their discharge implications is provided below:

- Stage 0 – assessment of the existing discharge from the Pōrangahau WWTP into the Pōrangahau River at median and MALF river flows (Stage 0 MALF – Table 27 in Beca, P:D.25).
- Stage 1 – No change from Stage 0. Continued existing discharge conditions (Stage 0 MALF – Table 27 in Beca, P:D.25).
- Stage 2 – Discharge to land when river is below median flow, discharge to river when river is above median flow (Stage 1 & 2b – Table 27 in Beca, P:D.25).
- Stage 3 – All discharge to land (Stage 2a & 3 – Table 27 in Beca, P:D.25).

An updated Table 27, with regard to the stages is presented below.

Table 27. Comparison of mass-balance mixing analyses for each development stage

200 m Upstream Concentration			Downstream Concentration			Downstream Percentage Increase from Upstream		
Parameter			Stage 0 & 1 MALF	Stage 2b	Stage 2a & 3	Stage 0 & 1 MALF	Stage 2b	Stage 2a & 3
$cBOD_5$	mg/L	1.000	1.420	1.050	1.000	42%	5%	0%
TSS	mg/L	31.000	30.951	30.994	31.000	0%	0%	0%
NH_4-N	g/m3	0.010	0.373	0.053	0.010	3632%	429%	0%
NO_2+NO_3-N	g/m3	0.005	0.028	0.008	0.005	452%	53%	0%
TN	g/m3	0.660	0.965	0.696	0.660	46%	5%	0%
TP	g/m	0.055	0.103	0.061	0.055	87%	10%	0%
FC	cfu/100 mL	44	317	143	120	164%	19%	0%

Note: Orange highlight indicates the ANZECC physical and chemical stressor trigger or MAC Grade D is exceeded, red highlight indicates the ANZECC toxicity trigger is exceeded, red text indicates the national bottom line guidelines are exceeded and **bold text** indicates the regional river guidelines (PC6) are exceeded (See Table 8).

The results drawn from the above assessments are presented in Section 6.2, 6.3 and summarised in Section 6.4 of Everitt, 2021. Of greatest importance was the presentation of the relative changes at each stage of the WWTP transition development and the stepwise reduction of nutrient contribution to the Pōrangahau River at each subsequent stage. Of additional note, was the relative contribution of the WWTP discharges to the overall nutrient budget in the Pōrangahau River, showing the discharges make up a contribution of less than 2.5%.

Yours sincerely

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