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Attention: Darren de Klerk

Dear Darren,

Takapau WWTP Long Term

Takapau WWTP Discharge Consent Application – Disposal to Land Upgrade - Outline of Intended Treatment Plant improvements

1 Background

Central Hawkes Bay District Council (CHBDC) is in the process of preparing for the renewal of resource consents for the Takapau Wastewater Treatment Plant (WWTP). The wastewater currently undergoes treatment in a single oxidation pond. Pond effluent is discharged to the Makaretu River.

The current discharge consent was granted for 3 years to allow time for investigations of wastewater treatment process upgrade and discharge options. The community has been engaged with to express their views on desirable wastewater treatment and discharge method as well as address the concerns or implications on cultural values.

As a result of the community engagement process, the preferred option for long term management of collected wastewater at Takapau is to continue treating in the oxidation pond system, with some enhancements, and to irrigate the majority of the treated effluent to land on adjacent farmland and to discharge to the Makaretu River when storage has been exhausted and flow in the river is above a predetermined minimum.

The long-term solutions are based on a design horizon to year 2048 with projected population growth of approximately 245 people.

This memorandum outlines the concept intended for minor upgrades to the treatment plant to meet the likely needs of the irrigation system and occasional high flow discharges to the river.

2 Current Site

2.1 Site location

Takapau Wastewater treatment plant is located in Burnside Road adjacent to Makaretu River Bridge in the Central Hawkes Bay District Council (CHBDC), approximately 2 km North-East of Takapau.

Figure 1 - Takapau WWTP location (aerial picture taken from Google maps)

2.2 Site Description

Wastewater from the community is pumped to the Takapau wastewater treatment plant (WWTP), which consists of one clay-lined stabilization pond of approximately 0.6 ha, and discharges through a small wetland drain. Incoming flow monitoring and screening facilities have recently (2020) been installed by Veolia. Part of the residual solids settles at the bottom of the pond in the sediment layer, where non-aerobic conditions prevail, and further treatment occurs. The portion of solids which remains in suspension along with the nutrients and soluble wastes is treated by the combination of bacteria and algae in aerobic conditions. The bacteria assist with the breakdown of contaminants under aerobic conditions. Oxygen, for the process (respiration of microbial population), is provided by algae and one mechanical surface aerator. Treated effluent is discharged to a wetland drain, which provides additional treatment (solids removal, nutrient uptake during the growing season by vegetation) before eventual discharge through a combination of evaporation and transpiration from the wetland drain, plus the underground and overland flow to the river.

Figure 2 - Takapau WWTP Stabilization Pond

The effluent is discharged to the wetland drain via an effluent chamber, where the outgoing flow is monitored. A perforated basket is installed in the effluent chamber to catch eels and debris which didn't settle in the pond.

Figure 3 - Effluent discharge chamber and flow meter Transducer

The wetland drain was re-furbished in 2014 and operated by Higgins contractors until 30th November 2018. Since that time, a Joint Venture of Recreational Services and Veolia Water have been providing maintenance servicing. The effluent undergoes final polishing in the natural wetland drain before entering the Makaretu River.

2.3 Performance 2011 to 2020

Performance data is reported more fully in Beca 2020[1]

BOD: The minimum $cBOD_5$ for the eight-year period was 7 g/m^3 and the maximum was 76 g/m^3. Annual averages for compliance years ranged between 19 g/m^3 and 40 g/m^3.

[1] Beca 2020: Takapau Options Report

TSS: The maximum was 433 g/m^3 in November 2014. Annual averages for compliance years ranged between 47 g/m^3 and 89 g/m^3.

Nitrogen: Nitrogen currently has no consented discharge limits. Some data was available (December 2018 – March 2020) for total nitrogen, ammonia, nitrate and nitrite. The ammonia showed a typical trend for oxidation pond effluent, where in the winter months the nitrification decreases due to low temperatures and high flows, improving in the warmer months with lower flows and higher water temperature. The average effluent ammonia was approximately 10mg/l and total nitrogen approximately 13mg/l. In future the rate of nitrogen loading to the irrigated farmland is likely to become a consented parameter. Therefore, nitrogen is likely to become a more important operational parameter for the future treatment plant. However, this does not mean that additional nitrogen removal will be required, just that it will need to be monitored more closely to verify loading to the irrigated land.

Phosphorus: Total phosphorus (TP) and dissolved reactive phosphorus (DRP) are on average comparatively low in the pond effluent. Phosphorus is a discharge parameter without consented limits. Again, limited (December 2018 – March 2020) effluent data is available. Effluent TP shows increases in the summer months with the elevated TSS due to algae growth, and the phosphorus contained in the algae cells. Average effluent TP has been approximately 3.5mg/l and DRP 3mg/l.

Faecal Coliforms: A large body of effluent FC data exists. But only a small amount of e.coli data, insufficient to make valid statistical analysis to determine a correlation. FC performance is fairly typical of single pond wastewater oxidation ponds with a median of 24,000 cfu/100ml (Fig 4 black line) and 90th%ile of 65,000 cfu/100ml Fig 4 red line). Performance in this regard has been reasonably constant since pre-2011 as shown if figure 4.

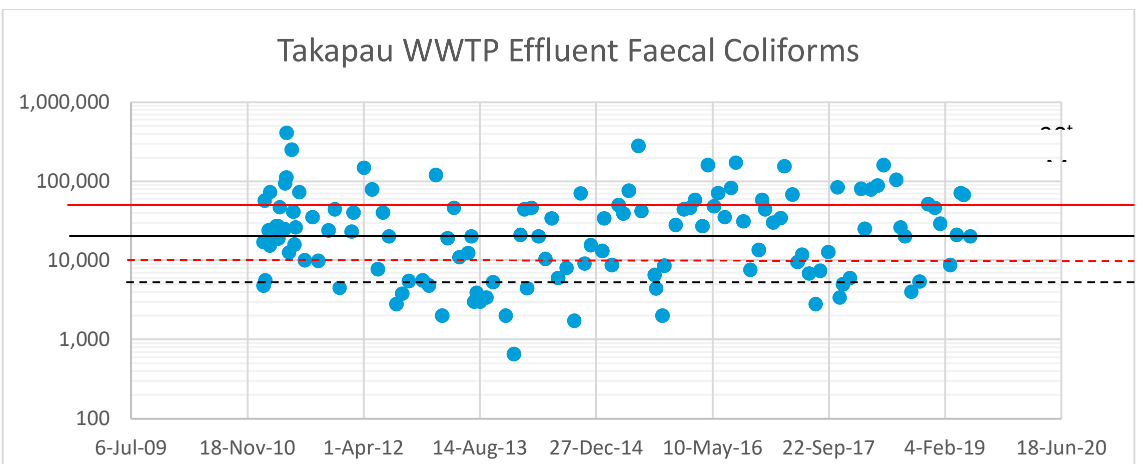

Figure 4: Historical effluent faecal coliform performance

2.4 Effects

The assessed effects of the current discharge are described in detail in "Takapau WWTP - Surface Water Assessment of Environmental Effects, 28 April 2021, Doc ID: Beca, 2020 - T:D.25".

In short, the assessed effects on the riverine system/environment, from a western science perspective, are negligible. The key assessed effects are therefore from a cultural and social perspective with fairly strong engagement feedback being provided, along with indications of strong interest in beneficial reuse of the effluent water for irrigation.

3 Upgrade Needs

3.1 Future Use

Screened effluent will enter what will remain a single stage oxidation pond. Treated effluent will then be irrigated to adjacent farmland through pivot irrigators, potentially at the same time as fresh water extracted from the river. The applicable farmland will not require irrigation all year or be able to accept irrigation water all year round. The design average day flow to the plant is 185m^3/d. When storage or irrigation are not possible, and there is sufficient flow in the Makaretu River, treated effluent will pass to the river.

The required interventions at the treatment plant will be as follows:

3.1.1 Flow

Influent flow measurement has recently been installed so that both influent and effluent can be monitored.

Three stages of development are proposed:

- Stage 0: allows for the current discharge to occur for up to 3 years while the system amendments to facilitate effluent irrigation are implemented.
- Stage 1: involves the provision of approximately 2,000 m^3 of storage within the current oxidation pond and development of 5 ha of application system, allowing for irrigation of approximately 60% of the current average annual wastewater discharge volume to irrigation and 40% to the high-rate discharge system when the river flow exceeds half median flow. The additional storage would be provided through a combination of measures including consumption of some of the existing freeboard, by levelling up the existing lagoon coping and possibly by a slight raising of the embankment level. The total water level increase required is approximately 300mm.
- Stage 2: involves development of an additional 15ha and up to 25 ha of irrigation. A new storage pond is required. A volume of 18,000m^3 is proposed. This represents approximately 100 days of storage at year 2048. This storage lagoon, plastic lined, would be constructed immediately adjacent to the existing oxidation pond. These changes allow for irrigation of approximately 90% of the future (2048) average annual wastewater discharge volume and 10% to the high rate discharge system when the river exceeds median flow.

3.1.2 Gross Solids

An influent screening facility has been installed in 2020 to minimise the amount of nuisance, gross solids material that can through to subsequent pumping and other tertiary process facilities.

3.1.3 BOD

Upgrade would only be required to maintain the ability to adequately stabilize the raw waste. At approximately 0.6ha, the pond theoretically has almost sufficient capacity to manage stabilization of the design loading of approximately 40kg BOD_5/day that is likely to be applied in future. If required, supplementary aeration will take the form of small surface aerators such as the Reliant Lagoon Master, preferably repurposed from Waipawa or Waipukurau which are likely to be receiving larger machines to make up their required oxygen demand. A single 2kW surface aerator would provide capacity for approximately a further 35kg BOD_5 /day (Based on 0.9kgO_2/kW.hr AOTR and 1.2kgO_2/kg.BOD_5) or which may also help with some ammonia nitrogen oxidation. Similarly, 2 x 2KW surface aerators, together with the natural aspiration could provide for up to 110kg BOD_5/day or a population of approximately 1,400 people. The design horizon (2051) population for Takapau, under a high growth scenario, is approximately 1,100 persons[2].

The pond water volume is approximately 7,200 m^3. If 4kW of supplementary aeration was eventually added, this would provide a mixing energy of (4,000/7,200) of 0.6 W/m^3, well below the threshold for turning the oxidation pond into an aerated lagoon.

3.1.4 Disinfection

To improve the system performance with regard to the disinfection status of the water release to the wetland drain / HRLP and applied to crops through the irrigation system, it is proposed to install a UV disinfection system that treats water leaving the oxidation pond. It is intended to reduce the 90^{th} percentile faecal coliform count from 65,000cfu/100ml to approximately 10,000 and the median from 24,000 to approximately 5,000 cfu/100ml as shown in figure 4 above. The target kill is a further 1 $\log_{10}$ in addition to the (approximately) 2 $\log_{10}$ disinfection already provided by the oxidation pond. It is also likely that the additional residence time in the pond and storage (described above) and exposure time to natural UV light, will increase the kill further.

At the time of writing, and partly because of the potentially fluid nature of the storage lagoon location and level, no decision has been taken as to whether the disinfection system will be open channel or an enclosed reactor. Either way, the intent is that effluent will be passed through a UV disinfection system after passing through the oxidation pond and prior to final discharge.

3.1.5 Suspended Solids

The effluent from the oxidation pond will typically have elevated suspended solids. Typically, these will be in the range of 10 to 115mg/l (historical median 58 & 90^{th} %ile 98mg/l) and will be comprised mainly of neutrally buoyant algae. The algal particles will act to the detriment of a UV disinfection system by shielding micro-organisms from the UV irradiation. UV disinfection will struggle to produce much more than 1 $\log_{10}$ disinfection on unfiltered oxidation pond effluent.

Further, the growth of filamentous algae in the pond, if it occurs, can lead to blockages in the irrigation system nozzles. Other larger detritus can also get through the pond leading to irrigation system problems. This includes wind blown leaves and twigs, aquatic snails, and material that makes it through or bypasses or pre-dates the inlet screen.

For these reasons it is intended to provide some effluent filtration prior to disinfection and discharge. No mechanical filter is known to be highly effective at removing algae. However, choosing a filter of around 20-micron nominal pore size, it will be possible to exclude many algae and at least maintain the feed to the UV disinfection system reasonably consistent. Perfect removal is not required. As with several other effluent irrigation schemes around NZ (e.g Cardrona, Kingston, Wanaka), Arkal Spin Klin or equivalent are the anticipated style of filter. These also assist in protecting the irrigation system from the larger solid masses described above.

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[2] Beca, February 2021 – Growth Impact Assessment – Small WWTPs

3.1.6 Cost Allowances

Cost allowances have been made for minor upgrade works at Takapau as follows:

Preliminary & General	Contractor's: establishment costs, insurance, internal project management, overheads and the like
Filters	Basic 20-micron disc filtration or equivalent
UV	Probably in pipe reactor (tbc) targeting 1 log10 faecal coliform inactivation
Power	Upgrade to power pumps, UV, ancillaries and, if required, 2nd aerator
Pumping	Irrigation pumps and rising main
Storage	Additional 18,000 m^3 effluent storage
Irrigation	Pivot irrigator
Miscellaneous	Miscellaneous items
Risk Items	Allowances for design development, Construction contingency, foreign exchange risk etc
Fees and Charges	Council costs, consenting costs, investigations, miscellaneous charges
Total	

Yours sincerely

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