TO:	Watercare Services Limited	Date:	18 April 2024
FROM:	Laura Drummond	Job No:	67064

TE PURU STREAM WWTP DISCHARGE ASSESSMENT OF EFFECTS ON STREAM HABITAT

Bioresearches were engaged by Watercare Services Limited (**WSL**) to undertake an ecological assessment of the effects of discharging up to 6,000 m^3 per day of treated wastewater to the Te Puru Stream. WSL currently discharges treated wastewater from a trickle system, through a vegetated area to a farm pond that then discharges to a permanent tributary of the Te Puru Stream at a daily volume of 2,000 m^3. WSL is proposing to increase this daily volume to 6,000 m^3.

This memorandum describes the current ecological condition of the Te Puru Stream Tributary throughout six "impact" sites and one control site (Figure 1), associated with the Biological Monitoring programme (Bioresearches, 2024[1]). It then assesses the potential effects on stream habitats of the proposed of up to 6,000 m^3 per day on those stream sites by reference to the control site, and monitoring data from sites downstream of the existing discharge. For the avoidance of doubt, this assessment of effects does not assume effects from the existing treated wastewater discharge of 2,000 m^3 per day from part of the existing environment.

[1] Bioresearches (2024). Water Quality and Biological Assessment, Te Puru Stream Tributary, Maraetai. Report for Watercare Services Limited. pp 68

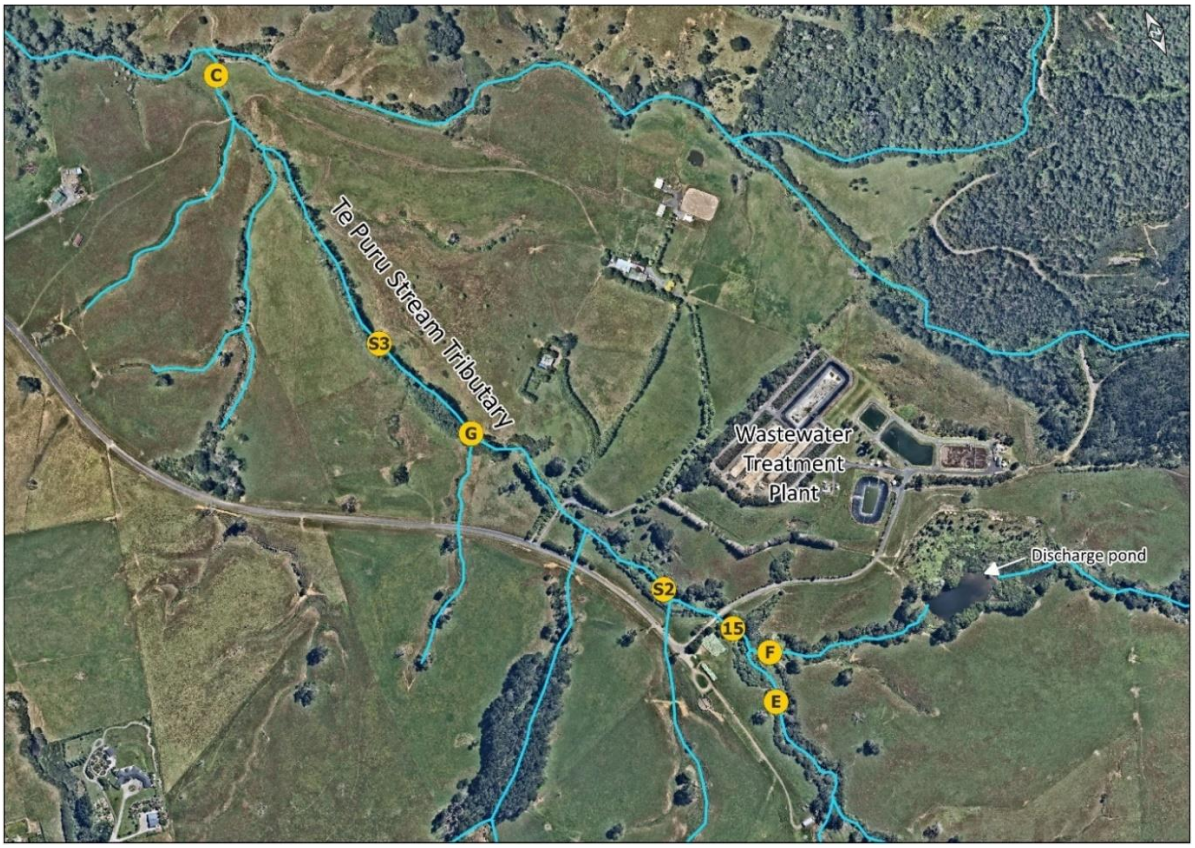

Figure 1. Map of the Te Puru Stream Tributary and the associated monitoring sites references within this memorandum.

Methodology

A site assessment was undertaken over the 31st January to 2nd February, 2024, throughout six impact sites (Site F, 15, S2, G, S3 and C) and one control site (Site E) within a permanent tributary to the Te Puru Stream, in association with the biotic monitoring programme[1]. The impact sites referenced within this memorandum, are located downstream of the discharge point. The control site is located within a separate tributary and upstream of the discharge point.

During the site assessment, stream characteristics were recorded, including water quality, width, depth, flow velocity, instream macrophytes and periphyton. General notes regarding substrates, deposited sediments, stream bank condition riparian yard condition and were taken.

Ecological Impact Assessment Methodology

Guidelines for undertaking Ecological Impact Assessments have been published by the Environmental Institute of Australia and New Zealand (EIANZ; Roper-Lindsay *et al.*, 2018). Chapter 5 of the Guidelines provides criteria for assigning value to habitat for assessment purposes. Ecological values have been assigned based on Table 1, adapted from Tables 5 and 6 of EIANZ 2018 (Appendix 2). Criteria for describing the magnitude of effects are given in Chapter 6 of the EIANZ Guidelines (Table 2.)

The level of effect can then be determined through combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing level of effects (Table 3). The cell in italics in Table 3 represent 'significant' effect under the EIANZ 2018 guidelines. Cells with low or very low levels of effects requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures need to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay *et al., 2018).*

Current Stream Conditions

The control site, Site E tributary consisted of a wide (average 2.16 m) and slow flowing stream with an average depth of 0.23 m. The stream banks were relatively incised and vertical and may not be inundated during regular flood flows. Substrates throughout Site E were predominantly comprised of silt and cobbles; and the hydrological heterogeneity relatively low, mainly consisting of run habitat with some small riffles upstream. Riparian vegetation was poor and consisted of herbaceous ground-cover with occasional exotic and native woody vegetation. However, due to the surrounding topography, shade was considered to be moderate.

The Te Puru Stream Tributary was considered to be of **moderate** ecological value.

The Te Puru Stream Tributary was wide, with an average width of 2.16 m (1.82 m – 2.69 m), and an average depth of 0.25m (0.12 m – 0.51 m), generally flowing within incised, vertical banks. Substrates were made up of silt with cobble and gravels. High silt proportions were recorded at effect sites downstream of the discharge pond, generally decreasing with distance from the discharge and gravels becoming more abundant. However, sediment plumes were present when the substrate was disturbed. Fish habitat/cover types observed during the survey comprised macrophytes, instream debris (e.g. wood), undercut banks and bankside vegetation. Hydrological variation throughout the tributary was considered to be moderate, with slow runs, fast runs, pools and riffle habitat present throughout the entire length.

Riparian vegetation throughout the Te Puru Tributary was variable, with the upstream reaches consisting of mixed exotic and native vegetation which transitioned to pastoral land and exotic trees towards the downstream reach. Due to this variability, riparian yard functions, particularly bank stability and shade were variable, with the lower reaches containing no significant riparian yard and evidence of bank erosion.

Photo 1 and Photo 2. Control Site E

Photo 3. Site F

Photo 4. Site 15

Photo 5. Site S2

Photo 6. Site G

Photo 7. Site S3

Photo 8. Site C

Potential Effects

This part of the memorandum assess the potential ecological effects of the proposed discharge of up to 6,000 m^3 per day of treated wastewater.

Water Quality Effects

As regards water quality, the proposed discharge of up to 6,000 m^3 of treated wastewater per day is expected to have a low magnitude of effect on the Te Puru tributary. In this respect, it is noted that while the volume of the discharge will increase, the quality of wastewater discharged is expected to improve reducing the concentrations of Total Nitrogen and nitrate-N. As discussed in *Water Quality and Biological Assessment, Te Puru Stream Tributary Maraetai 2024*, water quality parameters such as temperature, nitrogen species[2] and phosphorus species[3] experienced a spike immediately following discharge from the pond and decreased as water flows downstream. Conductivity was elevated and dissolved oxygen was low throughout the entire Te Puru Stream Tributary and the Control Site. By contrast, faecal coliforms and enterococci were higher at the most downstream sites (Site G and Site C) and the control site, than the sites closest to the discharge point. The surrounding pastoral and agricultural land use practices contribute to the enriched waters of the Te Puru Stream Tributary, and enrichment was not solely from the discharge of treated wastewater. As such, the quality of water associated with the discharge of 6,000 m^3 of treated wastewater to the Te Puru tributary and stream is expected to have a very level of effect.

[2] Total Nitrogen, Total Ammoniacal Nitrogen, Nitrate-N, Nitrite-N, Total Kjeldahl Nitrogen, Dissolved Inorganic Nitrogen.

[3] Total Phosphorus, Dissolved Reactive Phosphorus

Water Quantity Effects

The Control site, Site E, is of similar bank width and depth to the stream reaches downstream of the discharge point, however flow on average was between 5 L/s to 61 L/s slower. The volume of water discharged from the farm pond forms a significant proportion of the stream flow for the Te Puru Stream Tributary. The proposed discharge volume of 6,000 m^3 per day equates to an additional 0.067 m^3 per second or an additional 67 L/s under normal flow conditions (not allowing for attenuation or retention), and is considered to be of low magnitude. During the wetter seasons and rain events, the stream flow velocities will be higher with stream velocity calculations undertaken by Pattle Delamore Partners[4] (**PDP**) showing stream velocities at Site 15 to currently be 0.7 m/s during typical (90th percentile) rain events, with these modelled velocities increasing to 0.8 m/s following the increase in discharge. The most significant effect of the increase in discharge volume on the Te Puru Tributary is the potential for increases in erosion and scour effects, particularly during flood and storm events.

The proposed discharge of up to 6,000 m^3 per day may result in increases in depth and stream velocity. This in turn may result in a decrease in suitable fish habitat preferences, with velocities over 0.5 ms^{-1} and depths above 0.2 m – 0.3 m correlating in a decrease in suitable bully (*Gobiomorphus* sp.) habitat[5]. Bullies were selected for as the exemplar fish, as they have the lowest velocity threshold of the fish species present within the study area. The fastest flowing site within the Te Puru Stream Tributary was Site G, with an average flow velocity of 66 L/s, or 0.066 ms^{-1}. With the propose discharge of 6,000 m^3 per day, Site G is estimated to have an increase in flow velocities to approximately 133 L/s or 0.133 ms^{-1}, well below the 0.5 ms^{-1} threshold for bully habitat preference. The proposed daily discharge volume will be a minor shift in ecological baseline values, resulting in a low magnitude of effects and should not result in flow velocities throughout the tributary being permanently affected and result in a reduction of native fish habitat.

The increase in volume of water moving through the Te Puru tributary as a result of the discharge of 6,000 m^3 of treated wastewater per day is expected to have a low-level of effect on the aquatic ecosystem.

PDP assessments on bed and bank erosion show the majority of erosion will occur during storm events, and will be largely localised to meanders within the tributary. To minimise this potential erosion and scour during flood events, it is recommended infill riparian planting with deep rooting vegetation is undertaken within these more vulnerable meandering reaches. Recent work by Auckland Council[6] has shown cabbage

[4] Pattle Delamore Partners Limite (2024). Beachlands Maraetai WWTP Resource Consent Renewal: Stream Hydraulic Assessment.

[5] Ian G. Jowett & Jody Richardson (1995) Habitat preferences of common, riverine New Zealand native fishes and implications for flow management, New Zealand Journal of Marine and Freshwater Research, 29:1, 13-23.

[6] Auckland Council (2023) New Zealand Riparian Species and Streambank Stability. Report by Auckland Council and Stantec. 22pp.

trees / tī kōuka (*Cordyline australis*) to be particularly effect in slope stabilisation, both within slopes and at the toe of slopes, and is recommended to be included within the riparian planting mix. This planting should first be concentrated within the meandering reaches within Watercare property boundaries. Further planting on the downstream reach will required to be discussed with the private property owners.

Summary

WSL is proposing to discharge up to 6,000 m³ per day of treated wastewater, to a permanent tributary of the Te Puru Stream. Currently, the tributary consists of a wide and slow stream with incised and scoured banks and poor condition riparian yard. The proposed discharge is expected to have a very low magnitude of effect on stream bank conditions, and native fauna habitats through the tributary under normal flow conditions, resulting in a very low level of effect. The proposed treated wastewater discharge will be of a higher quality than the present discharge, with reduced concentrations of Nitrogen species compared to current levels expected to occur. Increased velocities, and therefore the potential for scour and erosion, are likely to occur during high rainfall and flood events. To minimise the degree of erosion and scour to the Te Puru Stream Tributary, it is recommended in-fill and enhancement planting, for the purpose of bank stabilisation, is undertaken throughout meanders within Watercare property boundaries.

Regards,

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Appendix 1. Stream characteristic summary table. Adapted from the Water Quality and Biological Monitoring report[1].

Control Site			Te Puru Stream Tributary				
Site	**E**	**F**	**15**	**S2**	**G**	**S3**	**C**
Date	31 January 2024	31 January 2024	Not assessed	31 January 2024	31 January 2024	31 January 2024	31 January 2024
Average Width (m)	2.16	2.36		2.36	2.17	2.69	1.82
Average Depth (m)	0.23	0.12		0.12	0.25	0.51	0.27
Flow (L/s)	10.24	15.8		31.73	66.39	22.62	40.49
Dominant substrate	Silt and cobble	Thick layer of fine organic material and silt, cobble		Bedrock, cobble	Silt, cobble and gravel	Silt, cobble and gravel	Silt, cobble and gravel
Fish Cover	Macrophytes, instream debris, undercut banks, bank vegetation	Macrophytes, instream debris, bank vegetation		Instream debris, bank vegetation	Macrophytes, instream debris, bank vegetation	Instream debris, bank vegetation, undercut banks	Macrophytes, instream debris, undercut banks, bank vegetation
No. of species	3	1		Not assessed	3	Not assessed	4
No. of fish	19	1			25		14
Fish IBI	26 - Poor	14 – Very Poor			26 - Poor		26 - Poor
Species recorded	Common bully, unidentified eel, koura	Unidentified eel			Mosquito fish, common bully, longfin eel		Common bully, mosquito fish, longfin eel, unidentified eel

Appendix 2. EIANZ methodology rubric

Table 1. Criteria for assigning value to habitat/species for assessment.

Value	Determining Factors
Very High	Nationally Threatened species found in the 'zone of influence' (ZOI) either permanently or seasonally. Area rates 'High' for at least three of the assessment matters of Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context. Likely to be nationally important and recognised as such.
High	Species listed as At Risk – Declining found in the ZOI either permanently or seasonally. Area rates 'High' for two of the assessment matters, and 'Moderate' and 'Low' for the remainder OR area rates 'High' for one of the assessment matters and 'Moderate' for the remainder. Likely to be regionally significant and recognised as such.
Moderate	Species listed as At Risk – Relict, Naturally Uncommon, Recovering found in the ZOI either permanently or seasonally. Locally uncommon or distinctive species. Area rates 'High' for one of the assessment matters, 'Moderate' or 'Low' for the remainder OR area rates as 'Moderate' for at least two of the assessment matters and 'Low' or 'Very Low' for the remainder. Likely to be important at the level of the Ecological District.
Low	Nationally and locally common indigenous species. Area rates 'Low' or 'Very Low' for majority of assessment matters, and 'Moderate' for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Exotic species including pests, species having recreational value. Area rates 'Very Low' for three assessment matters and 'Moderate', 'Low' or 'Very Low' for the remainder.

Table 2. Criteria for describing the magnitude of effects (EIANZ 2018)

Magnitude	Description
Very High	Total loss of, or a very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss of major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances and patterns; AND/OR Having minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.

Table 3. Criteria for describing the level of effects (EIANZ 2018). Where text is italicised it indicates 'significant effects' where mitigation is required.

Magnitude of Effect	Ecological Value				
	Very High	High	Moderate	Low	Negligible
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of WSL as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions. Where opinions or judgements are to be relied on they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of Investigation

Babbage has performed the services for this project in accordance with the standard agreement for consulting services and current professional standards for environmental site assessment. No guarantees are either expressed or implied.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of matrix sampled away from the sampling points are inferred and it must be appreciated that actual conditions could vary from the assumed model.

There is no investigation that is thorough enough to preclude the presence of materials at the site that presently, or in the future, may be considered hazardous. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants present and considered to be acceptable may in the future become subject to different regulatory standards, which cause them to become unacceptable and require further remediation for this site to be suitable for the existing or proposed land use activities.