Technical Memorandum
Pokeno Housing and Tourism Project

Wastewater Discharge
Pokeno Developments NZ Ltd

TO:	Joel McKinlay – Pokeno Developments NZ Limited	**REF:**	J7237
FROM:	Dylan Walton, GWE Consulting Ltd	**DATE:**	6 November 2025

INTRODUCTION

Pokeno Developments NZ Limited proposes a staged development across various sites in and around Pokeno for the Pokeno Housing and Tourism Project using the Fast Track Approvals Act 2024 ("FTAA"). The Project will take place across three precincts located west, south and southwest between Pokeno and the Waikato River and will include (amongst others): a tourism resort, farm showground, residential subdivision, and commercial activities. The development will be supported by appropriate servicing, which includes wastewater treatment and discharge. In addition to the development, accommodation may also be made for Pokeno township and other growth to connect to the wastewater system.

GWE has been asked to investigate how a discharge from a wastewater treatment plant (WWTP) servicing the Project can be accommodated by the receiving environment, and how discharge to to a combination of land and water (via a wetland/land contract device) could be used to mitigate potential effects. This is against the background of Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy) and Plan Change 1 to the Waikato Regional Plan, whereby restoration of the river is the objective. Consequently, the approach adopted for the Project is to look to high quality of treatment and with no direct discharge to the river (rather via land or land-contract devices). The assessment contained within this report, however, is based on a worst case scenario of direct discharge of treated wastewater to the Waikato River. This memo provides a summary of those findings and has been prepared to support a fast track referral application for the Project. It is based on parameters and high level design given in the report "Pokeno Housing and Tourism Project Wastewater Servicing Report" by GWE, dated October 2025 (herewith referred to as the " WW Servicing Report" where MBR / Hybrid MABR/MBR WWTP is recommended to ensure high quality treatment of wastewater prior to discharge. This is similar to the technology adopted by Waikato District Council recently in Te Kauwhata and Raglan.

PROPOSAL

Proposed Development

The Project will take place across several landholdings located around Potter Road, Bluff Road, Helenslee Road, Hitchen Road, and Munro Road. As well as the items described in the Introduction, the Project will include enhancement of important ecological areas, and full servicing for water wastewater and stormwater. A concept Masterplan has been prepared.

The Wastewater solutions outlined by the GWE WW Servicing Report anticipates that the full build out will equate to 5,000 Housing Unit Equivalents (HUEs) (which includes allowance for a wider servicing catchment beyond the scope of the Project). The GWE WW Servicing Report also provides for the scenario of a discharge of 10,000 m3 from the Project with provision to provide for the growth of Pokeno as a whole.

Proposed Wastewater Treatment and Discharge

It is proposed to treat wastewater from the development to a high level and discharge through:

i. A wetland/land-contact device with the treated wastewater ultimately passing to the Waikato River via the surface drainage network (likely).

ii. Directly to land irrigation (possible in part). Or,

iii. Discharge direct to the Waikato Rover (extremely unlikely).

The general location of the WWTP and discharge is shown in Figure 1 below:

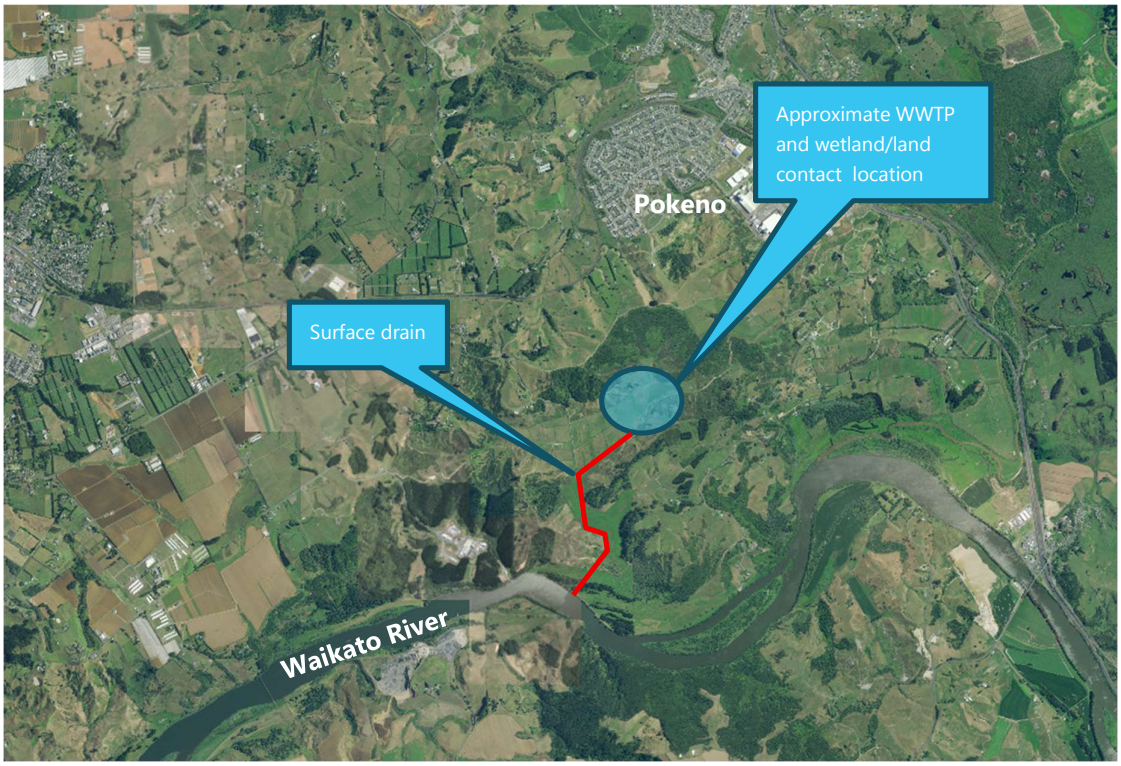

Figure 1: Approximate Discharge Location

As above, and as shown in Figure 1, the preferred discharge route is for treated wastewater to pass through a wetland or other land contact device, before passing to surface drainage a minimum of 1.2 km from the confluence with the Waikato River.

GWE has prepared a report *"Pokeno Housing and Tourism Project Wastewater Servicing Report"* (dated October 2025 and also provided as part of this Referral Application package) in which an estimate of the design flows and treated wastewater quality has been provided. The design treated wastewater flow rate has been estimated at **4,713 m^3/d**, based on 3 people per HUE with a water usage of 180 L/p/d. An allowance of 1,000 m^3/d for commercial discharges has been included in the estimate. An additional allowance of 5,000 m^3/d for Pokeno (and other possible developments) to connect has also been made (a total of approx. 10,000 m3 for the purpose of evaluation of that scenario).

A summary of the anticipated treated wastewater quality is given in Table 1. These levels of treatment, and better, are readily achievable with standard treatment techniques.

Table 1: Anticipated Treated Wastewater Quality

PARAMETER	RAW COMBINED INFLUENT	TREATED DISCHARGE (AVERAGE)	95TH PERCENTILE	REMOVAL % (AVERAGE)
5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	400	10	15	97%
Total Suspended Solids (TSS)	450	10	15	97%
Total Nitrogen (TN)	90	5[1]	10	92%
Total Phosphorus (TP)	50	1	3	97%
Faecal Coliforms (FC)	>1x10^8 CFU/100 mL	<10 CFU/100 mL	<50 CFU/100 mL	>99%

Note: *[1]Modern treatment plants are capable of near full nitrification i.e. conversion of ammonia to nitrate. Similarly, plants can be configured for enhanced nitrate removal so that nearly all nitrogen is removed from the wastewater*

We note that Taumata Arowai have released advice on proposed standards for discharges to water ("Technical Advice on Discharge to Water Standards Advice on Proposed Standards", Taumata Arowai, 25 February 2025). The confirmed anticipated treated wastewater will exceed any final standards issued by Taumata Arowai.

ASSESSMENT OF EFFECTS ON THE RECEIVING ENVIRONMENT

This section provides a brief description of the receiving environment (the Waikato River) and a high level assessment of the anticipated impacts on it. For the purpose of this assessment we have considered the Waikato River as the main receiving environment (providing a worst case scenario). The drain to which it is anticipated the land contact device will empty is a historic and highly modified waterbody, and falls across a low lying area. It is likely, like other lowland farm drains, that it is somewhat degraded by the agricultural and horticultural practises taking place in the catchment. A full assessment of effects on the drain will, however, be conducted on the drain (as well as the Waikato River) as part of the substantive application and the level of treatment adjusted.

Description of the Waikato River at the Discharge Location

The Waikato River is New Zealand's longest river with a catchment of approximately 14,250 km^2, and flows 340 km from Lake Taupo to the coast at Port Waikato. Due to the gently rolling catchment, porous soils, and control gates at Lake Taupo, the flow regime is relatively stable. In the location of Pokeno, Mercer, and Tuakau, the river is between 100 m and 300 m wide with a mid-channel depth of 3 m to 6 m.

The nutrient load to the lower Waikato River is predominantly through nutrient discharges, runoff, and leaching through farming. A number of dairy ponds discharge to the river, as do treated wastewater from Hamilton and the townships of Huntly and Ngaruawahia. A Waikato Regional Council monitoring station is located at the Mercer Bridge, approximately 5 km upriver from the location of discharge. Flow and water quality is measured at this station and this is summarised in Table 3. Water quality median figures have been taken from the Land Air Water Aotearoa (LAWA) website. Comments are also provided on how the water quality compares with the National Policy Statement for Freshwater Management 2000 (NPSFM) attribute bands and the Australian and New Zealand Environment and Conservation Council (ANZECC) guideline document "Australian and New Zealand Guidelines for Fresh and Marine Water Quality" (2000).

Table 2: Waikato River Water Characteristics at Mercer Bridge

PARAMETER	MEDIAN[1]	5%ILE	95%ILE	COMMENT
Flow (at Mercer Bridge, Oct. 2021 to August 2025)	25,920,000m^3/d (est.)	17,280,000 m^3/d (est.)	47,520,000 m^3/d (est.)	
Escherichia Coli (E. coli)	160 n/100mL	Approx. 100 n/100mL[2]	Approx. 1,000 mg/L	NPSFM attribute band D - average infection risk of >3%
Total Nitrogen (TN)	0.67 mg/L	Approx. 0.5 mg/L[2]	Approx. 1.1 mg/L	ANZECC 2000 trigger level is 0.614 mg/L
Ammonia Nitrogen (Amm. N)	0.01 mg/L	0.01 mg/L[2]	Approx. 0.02 mg/L	NPSFM attribute band A - 99% species protection level
Nitrate Nitrogen (Nit. N)	0.44 mg/L	Approx. 0.35 mg/L[2,3]	Approx. 0.08 mg/L	NPSFM attribute band A - 99% species protection level
Total Phosphorous (TP)	0.046 mg/L	Approx. 0.04 mg/L[2]	Approx. 0.08 mg/L	ANZECC 2000 trigger level is 0.033 mg/L
Dissolved Reactive Phosphorous (RP	0.016 mg/L	Approx. 0.008 mg/L[2]	Approx. 0.02 mg/L	NPSFM attribute band C – ecological communities could be impacted

Notes:

[1]The figures for water quality are five year medians, taken from the LAWA website.

[2]Estimate are visual based on historical graphs provided at the LAWA website.

[3]Nitrate Nitrogen figures were not available. These numbers are based on "Total oxidised nitrogen" (TON) data at LAWA website. Nitrite is an intermediary species and not common in the environment. Further, the LAWA data showed median TON as the same as Nit. N. The TON data was therefore used as a substitute for Nit. N.

The lower Waikato River has historically been utilised for boating, fishing and swimming. However, poor water quality (as evidenced in Table 2) has meant that these activities are no longer as popular as they were.

Effect on Water Quality after Discharge

In this section we have assumed that the water quality that ultimately enters the Waikato River will be the same as that which would enter the new wetland/land contact device. This is considered a worst case scenario as wetlands and other land contact devices often act to 'polish' treated wastewater, providing a natural form of additional treatment. The level of treatment is dependent on a number of factors (mainly retention time), and these will be established during process design. We have also modelled two scenarios; one for the design flow from the development of 4,713 m^3/d and a scenario in which also includes for an additional 5,000 m^3/d from Pokeno and other possible developments (rounded up to 10,000 m^3/d total).

Table 3 describes the impact on the Waikato River quality after the discharge and reasonable mixing. The table illustrates an average condition i.e. median flow and concentrations.

At approximately 5,000 Housing Unit Equivalents, the total wastewater generated has been estimated at 4,713 m^3/d. This volume is approximately 1/5000th (0.018%) of the daily flow of the Waikato River. At a design wastewater volume of 10,000 m^3/d, the discharge would comprise approximately 0.039% of the average daily flow of the Waikato River.

As described in the note to Table 1, it is entirely feasible that nearly all ammonia can be removed from the wastewater. For the purpose of this assessment we have assumed a discharge ammonia concentration of 1.5 mg/L, with 3.5 mg/L nitrate being the balance of the total nitrogen in the treated wastewater. Also note that we have assumed that Total Phosphorous (TP in the discharge approximates Dissolved Reactive Phosphorous (DRP); this is a not unreasonable assumption for this exercise as most phosphorous in treated wastewater is in the soluble form.

Table 3: Change in River Concentrations after Discharge – Average Condition

PARAMETER	BACKGROUND RIVER CONCENTRATION	CONCENTRATION AFTER DISCHARGE (4,713 m^3/d)	CONCENTRATION AFTER DISCHARGE (10,000 m^3/d)
E. coli (n/100mL)	160	160	160
TN (mg/L)	0.67	0.67	0.67
Amm. N (mg/L)	0.01	0.01	0.01
Nit. N (mg/L)	0.44	0.44	0.44
TP (mg/L)	0.046	0.046	0.046
DRP (mg/L)	0.016	0.016	0.016

In the interests of conservatism we have modelled the concentration after the discharge for 5%ile river flow and 95%ile river water quality figures. This is a very conservative condition which would simulate a summer condition where river flow is low but background concentrations of nutrients and micro-organisms is high. Table 4 shows the results:

Table 4: Change in River Concentrations after Discharge – Conservative Condition

PARAMETER	BACKGROUND RIVER CONCENTRATION (95%ILE)	CONCENTRATION AFTER DISCHARGE (4,713 m^3/d)	CONCENTRATION AFTER DISCHARGE (10,000 m^3/d)
E. coli (n/100 mL)	1,000	1,000	1,000
TN (mg/L)	1.1	1.1	1.1
Amm. N (mg/L)	0.02	0.02	0.02
Nit. N (mg/L)	0.08	0.08	0.08
TP (mg/L)	0.08	0.08	0.08

PARAMETER	BACKGROUND RIVER CONCENTRATION (95%ILE)	CONCENTRATION AFTER DISCHARGE (4,713 m^3/d)	CONCENTRATION AFTER DISCHARGE (10,000 m^3/d)
DRP (mg/L)	0.02	0.02	0.02

Under both modelled scenarios, an at discharge rates of both 4,713 m^3/d and 10,000 m^3/d there will be no measurable impact on the parameters listed after reasonable mixing.

While it is clear there will be very little impact on concentrations in the Waikato River (largely due to the very low rate of flow compared with the river; at median river flow the discharge will contribute only 0.018% / 0.039% (or less than one five thousandth) of the total flow), it is important to consider the percentage contribution of contaminants compared with the Waikato River. Table 5 summarises this at median river flows at maximum discharge flow rate:

Table 5: Summary at Median River Flows at Maximum Discharge Flow Rate

PARAMETER	WAIKATO RIVER LOAD	DISCHARGE LOAD AT 4,713 m^3/d	CONTRIBUTION FROM DISCHARGE AT 4,713 m^3/d	DISCHARGE LOAD AT 10,000 m^3/d	CONTRIBUTION FROM DISCHARGE AT 10,000 m^3/d
E. coli (total n)	4,147,200,000	47,130	0.001%	100,000	0.002%
TN (g/d)	17,366,400	23,565	0.14%	50,000	0.29%
Amm. N (g/d)	259,200	7,070	2.7%	15,000	5.8%
Nit. N (g/d)	11,404,800	16,496	0.14%	35,000	0.30%
TP (g/d)	1,192,320	4,713	0.40%	10,000	0.84%
DRP (g/d)	414,720	4,713	1.14%	10,000	2.40%

While the ammonia nitrogen contribution appears to be elevated it must be noted that ammonia presents in water as an ammonia-ammonium equilibrium dependent on pH. The toxic form of ammonia in water is as NH_3. At lower pHs the less harmful ammonium ion NH_4^+ prevails, and at the pH of 8 approximately 90% of ammonia is in the ammonium form; the relationship between pH and ammonia is very well established. The pH of the Waikato River at Mercer Bridge averaged 7.5 and ranged from 6.7 to 8.1 for the period 2012 to 2020[1]so it is extremely likely that most ammonia would be rapidly converted to the less toxic ammonium ion, with the result that there would be less than negligible to no impact on aquatic ecology.

DISCUSSION

The effects on the Waikato River quality described above are predicated on a direct discharge from the WWTP to the river (i.e. no consideration of the proposal to discharge to land and/or wetland/land-contact devices which will provide further opportunities for treatment). Therefore, this presents a worst case as there is land available for a land based discharge methodology, such as via a constructed wetland, discharge trench, or bottomless filter, and the proposal provides for passing of treated wastewater through a land contact device, as well as the minimum of 1.2 km of existing surface drain. Such land contact technologies will typically act to further reduce contaminants (particularly nutrients), and the passage through the land contact device and the existing drains at the site will act to further reduce pathogens through exposure to sunlight,

[1] From Table 5-1 in the report "Waikato River Water Take and Discharge Proposal - Board of Inquiry River Ecology Assessment" by Tonkin and Taylor, dated December 2020.

predation by other organisms, and natural die-off before reaching the Waikato River. All of the land contact options remain a possibility as design progresses with the substantive application and further consultation with mana whenua is undertaken.

A similar method of mechanical treatment followed by wetlands is used at the nearby Pukekohe WWTP, where wastewater is first treated through mechanical means, before discharging to constructed wetlands and ultimately to a drain which feeds into the Waikato River. The concentrations given in Table 1 approximate the consent levels for Pukekohe WWTP[2], which similarly provides for a mechanical wastewater treatment process followed by wetlands with final discharge via a rain to the Waikato River.

It is not an option to pump the treated wastewater to Pukekohe WWTP; if it were, the net impact with regard to total contaminants released to the Waikato River would be no more than what is permitted under the Pukekohe WWTP discharge consent, given the similarity in standards. It is therefore anticipated that there will be little to no impact on river users, such as fishermen, swimmers, or boaters.

The above assessment demonstrates, however, that using the wastewater treatment technologies that are readily available and well proven, the wastewater can be treated to a level that will not degrade the Waikato River and will even result in minor improvement in pathogen concentration. Further, where the discharge would enter any freshwater tributary **prior to** entry into the Waikato River the existing water quality will be assessed to determine the required quality of treatment to be applied to any discharge. As described in the "Proposal" Section of this memo, the level of treatment can be improved to better than that described in Table 1. Incorporation of land based disposal/treatment into the wastewater handling process to provide further risk mitigation remains the preferred option.

The site boundary is approximately 150 m upriver from the Tuakau Drinking Water take, which supplies drinking water to Auckland. One of the issues with the discharge is how this will be impacted, particularly with respect to pathogens. As shown above, the concentration of E. coli in the Waikato River will not increase after the discharge (consistent with all other measure contaminants), largely due to the relatively small volume of discharge compared to the river flow rates, as well as the large reduction in bacteria. However, viruses are often as much an issue as bacteria and can be much more difficult to kill, remove, or disinfect. Modern pathogen reduction techniques, such as ultraviolet treatment, membrane filtration, and ultra filtration are capable of reducing all pathogens to near undetectable levels. The ultimate level of disinfection required will be defined during design for the substantive application (taking into consideration the risk posed by viruses and other pathogens), although it is anticipated that the minimum level of treatment to be provide will be to the level described in Table 1. As part of this work, however, a Quantitative Microbial Health Risk Assessment (QMHRA) will be undertaken to define the level of risk to downstream users of all waterways and to subsequently confirm the level of disinfection necessary.

CONCLUSION

The proposed Pokeno Housing and Tourism Project, to be located south and southwest of Pokeno, will require wastewater servicing. At approximately 5,000 Housing Unit Equivalents, the

[2] While the BOS, TSS, and nitrogen limits are comparable, the phosphorous limit in the Pukekohe WWTP consent is given as a daily load (i.e. kg/d) while the *E. coli* limit is 126 cfu/100mL.

total wastewater generated has been estimated at 4,713 m^3/d. The potential addition of wastewater from Pokeno and other surrounding developments could result in up to 10,000 m^3/d of wastewater being generated. It is proposed to treat the wastewater to a very high level and discharge either to land irrigation or (preferably) incorporate a wetland / land-contact discharge process, before treated wastewater enters site drains and ultimately the Waikato River.

An assessment of the effect of the proposed discharge on water quality in the Waikato River at both 4,713 m^3/d an 10,000 m^3/d shows that there will be negligible effect on background concentrations in the river, even under conservative conditions. This is partly due to the very high level of treatment that will be provided, together with the low proposed discharge rate compared with the flow in the river (approximately 1/5000th (0.018%) for 4,713 m^3/d and 0.039% at 10,000 m^3/d). A Quantitative Microbial Health Risk Assessment will be undertaken to confirm the level of disinfection necessary as the design progresses, and a full assessment of effects will be conducted across all receiving water bodies.

The Tuakau Drinking Water take is approximately 150 m down river from the site boundary. While the assessment contained within this memo shows that E. coli concentrations in the river will not be affected by the proposed discharge, viruses will need to be accounted for. Several disinfection and viral removal techniques are available that can reduce pathogen counts to near undetectable levels. The Tuakau Drinking Water take is treated again by Watercare to potable water levels, and the Project is not expected to result in any effects on this process.

ABOUT THE AUTHOR

Dylan Walton is an Environmental Engineer with over 23 years of specialized experience in the wastewater engineering sector. He holds a Bachelor of Technology in Environmental Engineering (Honours) and a Master of Philosophy (with Distinction) in Earth Sciences.

Throughout his career, Dylan has worked across both the private and public sectors - serving both as a consultant and as a regulator. His expertise spans the entire lifecycle of wastewater systems, including strategic planning, environmental impact assessments, concept and detailed design, operational management, and regulatory compliance.

LIMITATIONS

This report has been prepared for the sole benefit of **Pokeno Developments NZ Ltd** as our Client, and appointed representatives, and those reviewing/evaluating the application for Referral under the FTAA according to their instructions, for the specific objectives described herein. This report is qualified in its entirety and should be considered in the light of our Terms of Engagement with the Client and the following:

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c. GWE has relied on information provided by the Client and by third parties to produce this document and arrive at its conclusions.

Prepared by:	**Reviewed and Approved by:**
	
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