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TECHNICAL NOTE			TN. 04
Revision	2	Date:	12th June 2025
Principal's Representative:	Andrew Allsopp-Smith		
Contractor:	Apex Water		
Contract:	Delmore Wastewater Treatment Plant		
Contract No.:	241104		
Subject:	**Technical Note – Engagement Requests for Additional Information**		

Dear Andrew,

Technical Note – Support of Delmore Consent Application

Prepared by: Apex Water

In support of the Delmore fast-track consent application, Apex Water has prepared this technical note in response to engagement feedback provided by stakeholders related to the development of private, on-site wastewater treatment and discharge infrastructure for the Delmore land development project.

This document supports the Wastewater Treatment Plant (WWTP) Design Report and subsequent technical documentation lodged as part of the substantive fast-track application. The responses covered under this document are categorised according to the stakeholder from which the feedback has been provided.

Auckland Council – General – RFI 1 – Reference 2E

Wastewater Treatment Plant (WWTP) - We require a clearer position on which WWTP option is being progressed as this has implications for infrastructure, earthworks, noise etc. Insufficient details and plans provided (dimensions etc) - for example, the earthworks plans reflect the works associated with the 10 dwellings, rather than the WWTP.

Response

Further details about the overall WWTP are provided on page 7.

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Auckland Council – General – RFI 1 – *NO REFERENCE*

WWTP details and plans missing, including details for once it is decommissioned

Response

Please refer to the plans appended in Appendix 30 of the substantive fast-track application as lodged. (wastewater treatment report).

The wastewater treatment plant has been designed with constructability, scalability and decommissioning in mind. This includes the biological process vessels which are modular in nature and similar in dimensions to standard shipping containers. By ensuring the treatment plant is modular and designed with relocation in mind, this allows for offsite construction, rapid deployment, ease of scalability and removal / decommissioning for future repurpose. The balance tank, permeate tank, aeration tank and post anoxic tank have been selected as steel panel tanks due to their ease of construction and potential for repurposing.

The waste disposal infrastructure within the irrigation field has been selected as surface mounted to allow for flexibility in its installation and operation, as well as increased ability to remove and decommission. This approach allows for the installation of driplines by hand, therefore minimising the impact on vegetation in the proposed area.

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EPA Panel – Reference 21

Wastewater discharge: Proposed condition 96: Would the WWTP Discharge Plan need to be certified or approved by Auckland Council?

Response

Conditions of consent are proposed to be amended to provide for Auckland Council certification of management plans.

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EPA Panel – Reference 22

Wastewater discharge: Is Council happy with the proposed wastewater discharge quality criteria of condition 102? Please comment on the apparent disconnect between the number and frequency of wastewater samples required to demonstrate compliance between conditions 102 and 116.

Response

The wording of condition 102 has been revised as follows:

(102) The treated wastewater from the Wastewater Treatment Plant immediately prior to discharge to the land contract infiltration trench must comply with the following criteria:

Parameters	12-month median must not exceed
Total Nitrogen [mg/L]	1.0
Ammoniacal Nitrogen (mg/L)	0.3
cBOD5 [mg/L]	0.5
Total Suspended Solids [mg/L]	4.0
Total Phosphorus [mg/L]	0.07
Escherichia-coli [CFU/100mL]	<4.0
Enterococci [cfu/100mL]	<4.0

Advice note: Compliance is to be calculated based on the median of all samples taken over a 12-month period.

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EPA Panel – Reference 23

Wastewater discharge: Condition 119: Receiving environment monitoring: this appears vague and potentially not particularly useful. Should there be a requirement for some contingency response process by way of reviewing stream quality and health in the event of non-compliance with wastewater quality conditions?

Response

Current
Following the first discharge from the WWTP, the Consent Holder must obtain surface water quality samples on a quarterly basis at the same locations within the unnamed stream. Once the development has been fully utilised and at design capacity for a minimum period of 2 years the in-stream monitoring frequency may be reduced to every 3 years. Water quality monitoring must be undertaken by a suitably qualified and experienced person, who must provide advice to the Consent Holder if results indicate the water quality has deteriorated because of the WWTP discharge

Proposed
Following the first discharge from the WWTP, the Consent Holder must obtain surface water quality samples on a quarterly basis at the same locations within the unnamed stream. Once the development has been fully utilised and at design capacity for a minimum period of 2 years the in-stream monitoring frequency may be reduced to every 3 years provided that there have been no incidents requiring the submission of an investigation report to Auckland Council under condition 102 or 116. *Water quality monitoring must be undertaken by a suitably qualified and experienced person, who must provide advice to the Consent Holder if results indicate the water quality has deteriorated because of the WWTP discharge.*

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AC Policy – Reference 18

Application needs to definitely determine wastewater disposal method.

Response

The proposal currently covers the discharge of treated wastewater on site up to the maximum sustainable volume. The balance of the wastewater that cannot be discharged on site shall be treated to the extremely high level and transported offsite via road tanker and discharged at an appropriate location.

A separate memorandum which provides a comprehensive approach to the disposal of treatment wastewater and any other byproducts that cannot be disposed of on-site is being prepared with input from multiple technical specialists. This will be provided when complete.

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Rodney Local Board – Reference 32

Request that wastewater disposal and systems pose no environmental risk

Response

A full response to Rodney Local Board comments is provided by Barker & Associates.

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Auckland Council Wastewater – Reference 1

Lack of certainty around reverse osmosis waste stream

Response

It is proposed that the reverse osmosis waste stream is partially recycled back to the treatment plant and that which cannot be, will be irrigated or removed from site via road tanker. This process is expected to reduce the reverse osmosis reject stream from 30% to 15% of the flow treated. A separate memorandum which provides a comprehensive approach to the disposal of treated wastewater and other byproducts that cannot be disposed of on-site is being prepared with input from multiple technical specialists. This will be provided when complete.

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Auckland Council Wastewater – Reference 2

Extremely high quality of wastewater proposed makes a MHR Assessment largely pointless.

Response

Apex Water have prepared a technical note where the treatment quality proposed in the substantive fast-track application as lodged is compared to international standards for full wastewater recycling. This technical note presents the proposed treatment plant alongside relevant examples where the treatment process proposed meets or exceeds these international standards. This technical note is appended below for reference.

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Technical Note – Treated Wastewater Quality

Proposed Wastewater Treatment Process

The WWTP proposed for the Delmore development incorporates the following key unit processes:

- Headworks screening and grit removal
- Pre-anoxic zone
- Aerobic zone
- Post-anoxic zone
- Membrane filtration (hollow fibre)
- Ultraviolet (UV) disinfection
- Reverse osmosis (RO) membrane filtration
- Optional chlorine disinfection
- Permeate storage and discharge infrastructure

[Note: if the discharge may enter surface water, chlorination is not carried out due to aquatic toxicity of chlorine]

This configuration aligns with a four-stage Bardenpho Membrane Bioreactor (MBR) process. Performance efficiency is enhanced, system footprint is reduced, and energy consumption is minimized through the integration of gas diffusion membranes within the pre-anoxic stage.

This advanced treatment process is typically sufficient for the discharge of treated effluent to surface water bodies. As such, similar technologies are increasingly adopted across New Zealand for applications involving direct or indirect discharges to water bodies.

As a final treatment step, the effluent is subjected to RO membrane filtration and optional chlorine disinfection (if discharging to land by irrigation) prior to discharge. This polishing stage, which is normally only used for high level drinking water treatment, such as desalination, elevates the treated water quality beyond the highest levels typically achieved by any sewage treatment plant in New Zealand.

Effluent Quality and Benchmarking

The treated effluent produced by this system is expected to be one of, if not the highest quality treated sewage discharge in New Zealand. Its nutrient profile is anticipated to:

- Comply with applicable parameters of the New Zealand Drinking Water Standards, where comparisons can be made.
- Significantly surpass typical stormwater runoff quality as reported in scientific literature.

The comparison to drinking water standards is not intended to suggest reuse as potable water, but rather to demonstrate the exceptional level of treatment proposed. While New Zealand currently lacks a formal regulatory framework for wastewater reuse, international guidelines provide useful benchmarks. The proposed treatment regime aligns with – and in most cases exceeds – international standards for treated wastewater quality and reuse.
This comparison underscores that the treatment system proposed for the Delmore project represents a level of performance that exceeds current best-practice standards for municipal wastewater treatment and discharge in New Zealand.

International Guidelines for the Reuse of Treated Wastewater

Pathogen Removal and Log-Removal Equivalents

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Both locally and internationally, the efficacy of pathogen removal in wastewater treatment processes is commonly evaluated using log-removal equivalents (LREs). This metric quantifies the reduction in the concentration of pathogens and contaminants on a logarithmic scale, offering a standardized framework for comparing treatment performance across jurisdictions and technologies.

A log removal value (LRV) represents the base-10 logarithmic reduction in pathogen concentration achieved by a treatment process. Each additional log unit corresponds to a tenfold reduction in the target organism:

- 1-log removal: 90% reduction
- 2-log removal: 99% reduction
- 3-log removal: 99.9% reduction
- 4-log removal: 99.99% reduction

This methodology is used globally to define the minimum performance criteria required for the safe reuse of treated wastewater, particularly where it is intended for direct or indirect augmentation of potable water supplies.

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Table 1 – Required Pathogen Removal for Potable Reuse Across Jurisdictions Compared with Delmore WWTP Proposal

Jurisdiction / Project	**Enteric Viruses**	**Enteric Protozoa (e.g., *Cryptosporidium*, *Giardia*)**	**Total Coliforms**	**Campylobacter**	**Comment**
California	12-log	10-log	9-log	—	Based on WHO (2017); applies to indirect potable reuse via groundwater recharge
Texas / New Mexico	8-log	5.5–6.0-log	—	—	
Australia	9.5-log	8.0-log	—	8.1-log	National water recycling guidelines for potable reuse
Delmore (Proposed)	15-log	9.5-log	—	17.5-log	No reuse proposed even though performance exceeds potable reuse standards

The pathogen log removal performance proposed for the Delmore wastewater treatment plant significantly exceeds the requirements observed in international jurisdictions for potable reuse. Although the Delmore project does not propose potable reuse of treated effluent, the design demonstrates a level of pathogen control consistent with, or surpassing, the most stringent reuse frameworks globally.

A comparable log credit assessment has been undertaken for the Beenyup Advanced Water Recycling Plant in Perth, Australia. This plant is one of the few full-scale facilities operating under Australia's potable reuse guidelines, and its performance is benchmarked against national targets in Table 2 below.

Table 2 – Beenyup Water Recycling Plant Log credit assessment

Pathogen Class	Australian Guideline Requirement	Beenyup Plant Log-Removal Credit (Achieved)	Treatment Barrier(s)
Enteric Viruses	≥ 9.5-log	~10.0-log	MBR, RO, UV disinfection, advanced monitoring and validation
Enteric Protozoa	≥ 8.0-log	~10.5-log	MBR, RO, UV disinfection
Campylobacter spp.	≥ 8.5-log	~11.0-log	Multi-barrier system including membrane and disinfection stages

While operational management, process validation, and system robustness are critical to ensuring that the final effluent consistently meets quality standards, the Delmore wastewater treatment plant's process configuration demonstrates a high level of technical integrity. Specifically, in terms of treatment train design for pathogen removal, the Delmore plant aligns strongly with international benchmarks established for the reuse of treated wastewater. This positions the proposed system among the highest-performing configurations currently applied in comparable global contexts.

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Chemical Removal

While the membrane bioreactor (MBR) system used in the Delmore wastewater treatment plant effectively removes suspended solids and a substantial proportion of pathogens, producing a high-quality permeate. The subsequent polishing step using reverse osmosis (RO) membranes elevates the treatment to a level typically associated with high-end reuse applications, including potable reuse. Reverse osmosis membranes are capable of removing up to 99% of dissolved salts, organic compounds, and even higher levels of bacteria, viruses, and other microscopic contaminants, making them suitable for applications requiring broad-spectrum contaminant removal to an exceptionally high standard.

RO technology is widely employed in seawater desalination due to its proven ability to eliminate dissolved salts and consistently produce drinking quality water. Its inclusion in the Delmore treatment train underscores the advanced nature of the proposed system.

The World Health Organization's "Guidelines for Drinking-Water Quality – Potable Reuse" (2017) provides a global review of potable reuse schemes and their associated treatment processes. As illustrated in Figure 1 below, several unit processes used in the Delmore plant align with those identified in internationally recognized potable reuse frameworks. This highlights the Delmore treatment process as a robust, multi-barrier system capable of achieving advanced removal of both pathogens and chemical/nutrient contaminants, consistent with best-practice standards in high-performance water treatment.

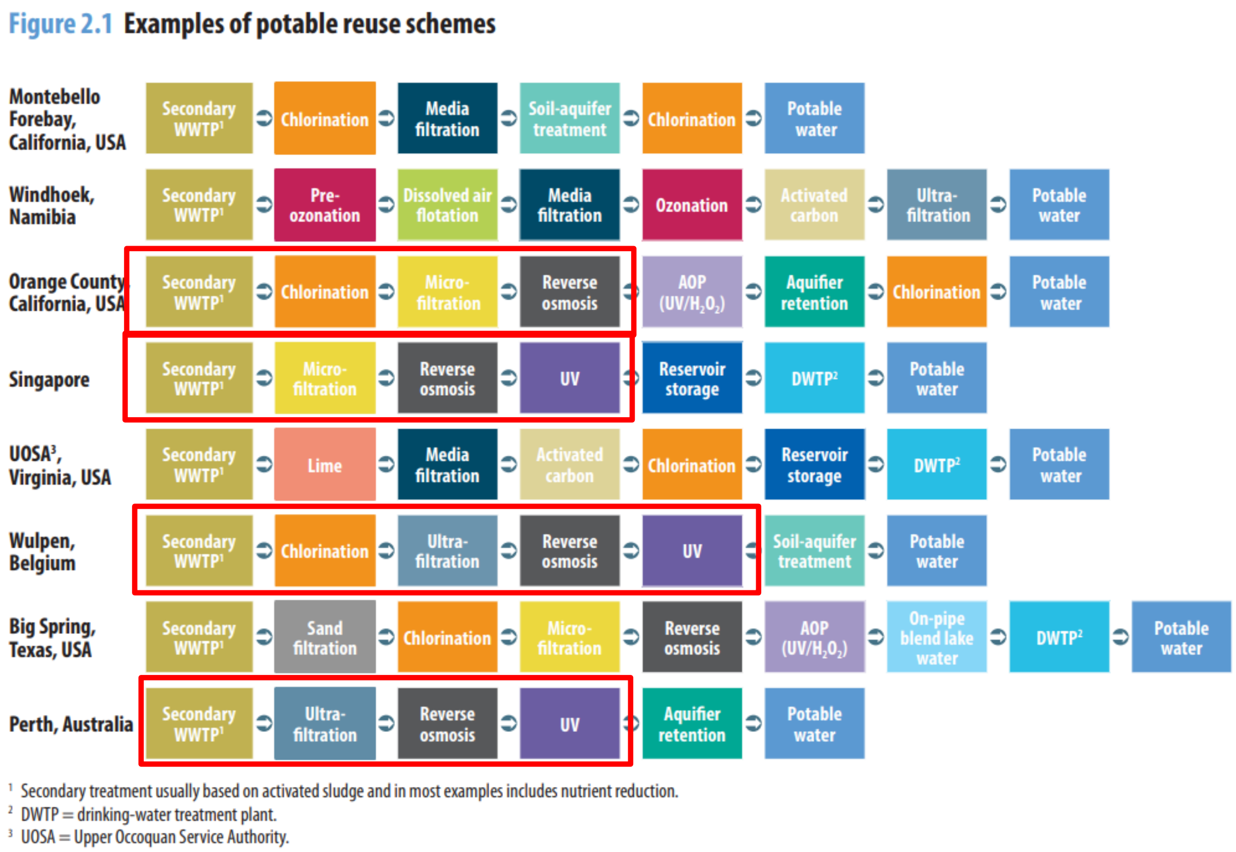

Figure 1 – Potable water re-use schemes covered in the WHO guideline document with Delmore equivalent highlighted in red.

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Delmore - Additional Requirements for Full Potable Water Reuse

As illustrated in Figure 1, full potable reuse schemes—particularly those involving direct or indirect augmentation of drinking water supplies—typically incorporate additional treatment processes or environmental buffers to ensure the safety and reliability of the recycled water. These additional barriers serve to manage residual risks, including those associated with pathogens and trace chemical contaminants and improve aesthetic only parameters such as taste**.**

To render the Delmore wastewater treatment process suitable for full potable reuse, at least one of the following would generally be required:

- An additional advanced treatment step, such as Advanced Oxidation Processes (AOPs), or
- An environmental buffer, such as aquifer recharge or surface water integration, to provide residence time and additional natural attenuation.

If Apex Water were to upgrade the proposed Delmore treatment train for suitability as a feed source to a drinking water treatment plant, the inclusion of an Advanced Oxidation Process would be recommended. AOPs—typically involving combinations of ozone, hydrogen peroxide, and UV light—offer a powerful disinfection and oxidation barrier. This step is particularly effective for the destruction of residual pathogens (including viruses, bacteria, and protozoa) and for addressing Contaminants of Emerging Concern (CECs) such as pharmaceuticals, personal care products, and low molecular weight, uncharged trace organic compounds that may not be fully removed by reverse osmosis membranes.

While CECs are unlikely to pose a significant risk in the Delmore catchment—which comprises exclusively residential lots with no industrial or commercial activities—the addition of AOP would future-proof the treatment system and align it with international potable reuse standards.

While the level of treatment proposed is suitable for potable reuse of the treated water, Apex has not proposed potable reuse as part of the Delmore proposal due to cultural and aesthetic concerns with potable reuse of treated sewage in New Zealand.

Delmore – Comparison to the Proposed National Wastewater Environmental Performance Standards

Public consultation has recently concluded on draft legislation aimed at establishing standardised environmental performance requirements for wastewater discharges. The proposed framework introduces a classification system for receiving environments, such as rivers, lakes, or coastal waters, based on their assimilative capacity relative to the volume of the proposed discharge. This approach considers both the flow characteristics of the receiving environment and the expected dilution of the discharged effluent. Under this classification, a set of environmental performance thresholds is defined, along with associated compliance monitoring requirements to ensure sustained environmental outcomes. Although the legislation has not yet been formally adopted by the New Zealand Government, a comparative assessment against the draft performance criteria is presented in Table 3.

It is noted that the Delmore discharge falls outside the scope of the proposed standards due to limited dilution capacity at the discharge point. However, the draft legislation serves as a valuable indicator of the

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Government's long-term strategic direction for wastewater infrastructure—particularly in the context of the required sector-wide upgrades and capital investment. The Delmore Wastewater Treatment Plant's proposed discharge standards demonstrate a high level of treatment performance, significantly exceeding even the most stringent targets outlined in the draft framework.

Table 3 below provides a comparison of the proposed Delmore Wastewater Treatment Plant discharge quality (expressed as annual medians or 90th percentiles, as appropriate) against the indicative thresholds outlined in the draft national environmental performance standards. The standards are stratified by receiving environment category, reflecting relative dilution potential and ecological sensitivity, ranging from open ocean to low flow freshwater rivers and wetlands.

Table 3 – Delmore proposed discharge quality compared with the proposed wastewater environmental discharge standards (not yet legislation)

Contaminant	Measurement Approach	Delmore (Annual 12-month Median)	Lakes and Wetlands	Rivers and Streams (Low Dilution)	Rivers and Streams (Moderate Dilution)	Rivers and Streams (High Dilution)	Estuaries	Low Energy Coastal
$cBOD_5$ (mg/L)	Annual median	0.5	15	10	15	20	20	50
TSS (mg/L)	Annual median	4.0	15	10	15	30	25	50
TN (mg/L)	Annual median	1.0	10	5	10	35	10	10
TP (mg/L)	Annual median	0.07	3	1	3	10	10	10
Amm-N (mg/L)	Annual 90th %ile	0.3	3	1	3	25	15	20
E. coli (CFU/100mL)	Annual 90th %ile	<4.0	6,500	1,300	6,500	32,500	N/A	N/A
Enterococci (CFU/100mL)	Annual 90th %ile	<4.0	N/A	N/A	N/A	N/A	4,000	400

The Delmore plant's projected effluent quality demonstrates performance significantly exceeding the thresholds set out in the proposed framework. Although the Delmore discharge scenario lies outside the direct scope of the draft regulatory categories due to its limited receiving environment dilution capacity, the most suitable comparisons are *Rivers and Stream (Low Dilution)* for the direct discharge environment *and Estuaries* for the downstream catchment which lies approximately 1.5km away. The treatment performance aligns with or surpasses the most stringent environmental outcomes anticipated in the legislation. This positions the Delmore Wastewater Treatment Plant as a benchmark for high-standard, future-ready municipal wastewater treatment infrastructure.

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Delmore Treatment Train Performance – Literature Review of Pathogen Log Removal

In support of the information presented above, a further review of literature has been carried out to provide additional sources as to the performance of the membrane bioreactor and the subsequent treatment processes proposed in the Delmore application in reducing the concentration of pathogens.

Membrane Bioreactor Log Removal Performance – Hmaied et al (2015)

A 4-stage Bardenpho membrane bioreactor can produce a very high-quality effluent, Hmaied et al (2015) found that a submerged membrane bioreactor, such as proposed for the Delmore wastewater treatment plant provided up to **5.8-Log** (99.99984%) removal of rotavirus with the notable result of no rotaviruses being detectible in the MBR treated effluent during the study.

Ultraviolet Light Disinfection Log Removal Performance – Li et al (2009)

By passing the effluent produced from the membrane bioreactor proposed through a UV reactor, further log removal is achieved. Rotaviruses are double-stranded RNA viruses which are among the most resistant water-borne enteric viruses to UV disinfection and hence are often used as a basis for assessing removal or disinfection processes. Li et al (2009) showed that a **3-Log** (99.9%) reduction in infectious rotavirus is achieved by the standard wastewater treatment UV dose of 30-40 mJ/cm2.

Chlorine Disinfection Log Removal Performance – Vaughn et al (1986)

Vaughn et al (1986) showed that up to **5-Log** (99.999%) reduction (complete removal) of SA-11 Rotavirus was possible by chlorine after 20 seconds of contact time at residual chlorine concentrations of 0.3 mg/L across all pH ranges. [Note: if the discharge may enter surface water, chlorination is not appropriate due to aquatic toxicity of chlorine]

Enteric Viruses, Protozoa and Bacteria – WHO (2017)

The World Health Organization (WHO) in their Guidance for Producing Safe Drinking Water – Potable Re-use have assessed the log removal value for a range of treatment technologies for bacteria, viruses and protozoa. In this assessment they provide two separate values for the log removal value (LRV). The first of the two LRVs, noted as the $LRV_{c\text{-}test}$ represents the log removal that has been demonstrated to occur in controlled conditions, the second LRV, the LRV_{OMS} accounts for the sensitivity of operational monitoring in process plants that are used to validate whether the barriers to pathogens are operating as required. As such, the LRV_{OMS} are lower than the challenge test equivalents.

Treatment Process	Bacteria		Virus		Protozoa	
Log Removal Value	$LRV_{c\text{-}test}$	LRV_{OMS}	$LRV_{c\text{-}test}$	LRV_{OMS}	$LRV_{c\text{-}test}$	LRV_{OMS}
Membrane Bioreactor	5	4	6	1.5	6	2
Reverse Osmosis	6	1.5-2.0	6	1.5-2.0	6	1.5-2.0
UV Disinfection	6	6	6	6	6	6
Chlorine Disinfection	6	6	6	6	0	0
Total	**21-log**	**17.5-log**	**24-log**	**15-log**	**18-log**	**9.5-log**

Auckland Council Wastewater – Reference 3 and Reference 4

Further discussion required regarding ammonia State B resultant from discharge

It would be beneficial to understand how the additional ammonia and phosphorous will affect the estuary.

Response

This is addressed by Viridis Consultants in its response memorandum.

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Auckland Council Wastewater – Reference 5

Impacts of EOCs and metals not discussed.

Response

The potential impact of contaminants of emerging concern (CECs) and trace metals in the Delmore wastewater discharge is assessed as minor, owing to the exceptionally high treatment level provided by the proposed advanced treatment train. Reverse osmosis (RO), a key component of the treatment process, is well-documented to achieve high rejection efficiencies for a broad spectrum of heavy metals, with removal rates ranging from approximately 70% to nearly 100%, depending on metal species and operational parameters.

The Delmore plant services a fully residential catchment including a small number of rural properties, with no commercial or industrial inputs. As such, influent concentrations of trace metals are expected to be low, primarily arising from domestic sources such as personal care products, household cleaning agents, and cosmetic residues. Peer-reviewed literature and international benchmarks indicate that the concentrations of heavy metals in domestic wastewater from such catchments are typically equal to or lower than those found in untreated urban stormwater runoff, which often enters receiving environments following only basic treatment through conventional stormwater management devices.

With respect to CECs, including pharmaceuticals, endocrine-disrupting compounds, and synthetic organics, RO processes consistently demonstrate high removal efficiencies. Given the closed, rural-residential nature of the catchment, the influent CEC load to the Delmore facility is expected to be substantially lower than that received by typical municipal treatment plants with mixed-source inflows including commercial and industrial discharges. Combined with the proposed multi-barrier treatment approach, the Delmore Wastewater Treatment Plant will removal of both trace metals and CECs. Relative to most existing municipal wastewater treatment plants in New Zealand, the Delmore facility will deliver higher contaminant attenuation, offering robust protection for the receiving environment.

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Auckland Council Wastewater – Reference 7

Minimal information provided regarding irrigation field.

Response

The irrigation field shall be divided into a minimum of two discrete zones to promote uniform distribution of treated effluent across the application area. For preliminary assessment purposes, an application area of approximately 1 hectare has been used to inform the spatial design and system capacity.

Treated wastewater will be conveyed from the wastewater treatment plant to the irrigation field via high-density polyethylene (HDPE) pipework. This conveyance system will operate on a pressure loop, regulated at the treatment plant to match the operational requirements of the active irrigation zone. The system will discharge treated effluent through surface-mounted, pressure-compensating dripline installed along the natural contours of each irrigation zone. The pressure-compensating emitters will ensure a consistent discharge rate across varying terrain, promoting even distribution of wastewater and minimising the risk of ponding or over-application.

System control will be fully automated and integrated into the treatment plant's supervisory control and data acquisition (SCADA) system. Irrigation cycles will be initiated once the permeate tank reaches a predefined minimum operating level. Upon activation, treated effluent will be delivered to one of the two irrigation zones via dedicated irrigation pumps operating on a closed-loop pressure control system. The system pressure setpoint will be defined by the specific operational requirements of the dripline emitters.

Each zone will receive treated effluent up to the agreed maximum daily application volume. Upon reaching this threshold, the control system will automatically switch to the alternate zone, placing the initial zone into rest mode until midnight. Volumetric flow will be monitored in real-time using an inline electromagnetic flowmeter located on the effluent delivery line to ensure compliance with consented discharge volumes. Table 1 below outlines the details of the proposed irrigation system.

Table 1 – Irrigation System Details

Description	Unit	Comment
System Type		Land Dispersal
Dispersal Irrigation Area	ha	1.0
Dispersal Type		Surface Drip Irrigation
Lateral and Emitter Type		Pressure Compensated – Netafim or similar
Emitter Discharge	L/h	1.6
Emitter Spacing	m	0.6
Lateral Spacing	m	1.0 (or as appropriate based on topography)
Maximum Daily Application Limit	mm/d	8.5 (also limited by field moisture monitoring)
Maximum Daily Operational Hours	hours	24

In addition to volumetric control, real-time soil moisture data will be acquired from sensors embedded within each irrigation zone. These sensors will provide dynamic feedback to the control system regarding field capacity and soil saturation status. If a zone is deemed too saturated to receive further discharge, the system will automatically divert flow to an alternate irrigation zone or, if necessary, to the infiltration trench.

The application rates determined have been calculated based on 10-years of evapotranspiration records which considers moisture losses to the atmosphere from evaporation and transpiration through vegetation. This method has been used to ensure the maximum sustainable volume of treated wastewater is applied to the irrigation field. This is also coupled with online soil moisture monitoring, as detailed above which allows the control system to automatically tailor the sustainable application rate to the condition of the soil, up to the consented maximum. Table 2 below outlines the theoretical daily application rate across the two irrigation zones, and the flowrates that could be achieved across a 0.5Ha irrigation zone at the spacing and emitter discharge rates specified.

Table 2 – Irrigation zone specimen design flowrates.

Description	Unit	Detail
Irrigation zone maximum daily discharge	m3/d	42.5 (85m3 across both zones)
Zone theoretical maximum discharge rate	m3/hr	13.3 (26.6m3/hr across both zones)

The figures in Table 2 outlines that the maximum daily discharge limit of 8.5mm/day could be theoretically applied to the irrigation field in far less than the 24 hours available in a single day. This allows for flexibility in the design to increase the lateral spacing, decrease the emitter discharge rate or change the emitter spacing to accommodate site conditions, topography or other constraints which still being able to apply the proposed maximum volume.

It is proposed that manual dripper line installation will occur during weed clearing activities already required by the covenant. In line with guidance provided by Auckland Council in its draft guidance for the on-site wastewater management in the Auckland region, the pressure compensating driplines proposed for the irrigation zone *'can be placed on, and pinned to, the ground surface within areas of established trees, or other vegetation, and covered with leaf fall or mulch where practicable.'* This approach will limit any minor damage to native vegetation to that which would normally be unavoidable during required weed clearing activities.

Watercare Services Limited currently operate facilities which include discharges of treated wastewater via surface mounted pressure compensated driplines into wooded or densely planted bushy lots, such as those proposed by the substantive fast-track application as lodged. One such example is the Omaha Wastewater Treatment Plant where wastewater is discharged into both wooded and densely planted bushy areas, as shown in Figure 1 below.

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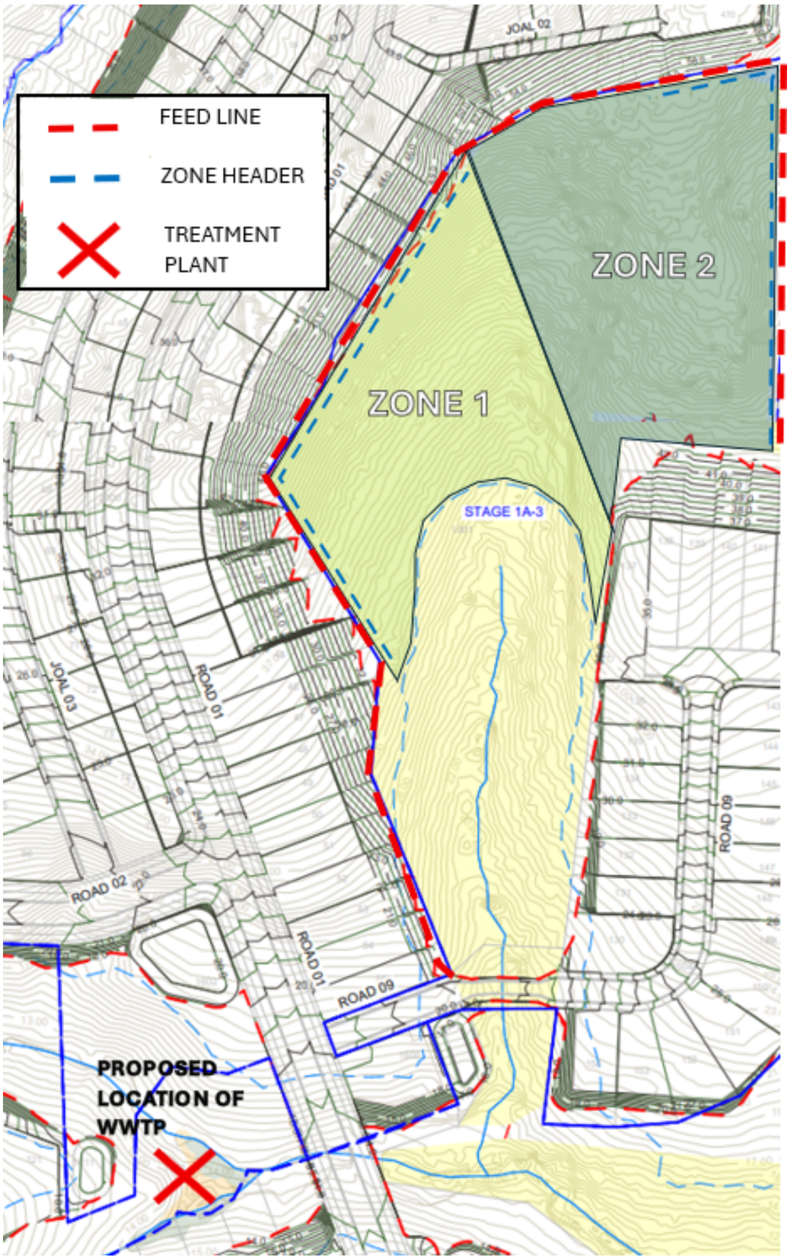
Figure 1 – Omaha Wastewater treatment plant wastewater discharge via surface mounted drip irrigation through both bushy and wooded areas.

A limited indicative layout of the irrigation system is provided in Figure 2 below. This figure illustrates the two irrigation zones and potential header pipe configurations. The alignment of driplines will as best as possible follow along the contour lines of the field at appropriate spacings. The main supply line and distribution headers have been routed to avoid traversing the irrigation area itself. As a result, all work within the irrigation field will be confined to the surface installation of the dripline which can be installed by hand and pinned to the soil.



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Auckland Council Wastewater – Reference 8

Consent Condition 102 - wastewater sampling frequency is on the light side.

Response

With regard to consent conditions 102 and 116, Apex propose the collection of a fortnightly 24-hr composite sample for the monitoring of discharges from the treatment plant. In addition to this, through consultation with the council's technical specialist, we are proposing to include the following supplementary wording.

Should three consecutive samples return results above the median concentration limits for the parameters detailed in Condition XX[1]*, the consent holder shall notify Auckland Council within 5 working days. The consent holder must then conduct an investigation into the cause, supported by a report to be supplied to Auckland Council. The report shall outline the actions being undertaken to address and remedy the cause of the exceedance and detail whether further monitoring is required*.

The collection of 3 consecutive samples has been decided as the appropriate figure, as the testing turnaround timeframes for some of the parameters listed and the response times for biological system could make any reduction of this impractical, or unachievable.

[1] Condition reference relating to the discharge criteria. Numbering will be added as part of final condition set.

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Auckland Council Wastewater – Reference 9

Condition 103, UV dosage – There was no explanation in any of the reports why 16 mWs/cm2 was suggested as the consentable dose.

Response

Recognising that the dose selected will not provide a high level of log reduction for some enteric viruses, due to the high level of treatment provided by the proposed plant, high reject rates of viruses through reverse osmosis membranes and the multi-barrier approach taken, the UV reactor was included to control biofilm growth on the reverse osmosis membrane due to sensitivity to chlorine and other disinfectants. 16mWs/cm^2 was chosen as it is a dose at the bacteria responsible for biofilm development will be appropriately controlled.

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Auckland Council Wastewater – Reference 10

Condition 104 – this condition permits up to 3 mg/L chlorine at the point of discharge. This is relatively high and could be toxic to some organisms. It isn't proposed in the Wastewater Design Report, so I assume this is a mistake

Response

Condition 104 is meant to be read alongside condition 110 which requires that no chlorine dosing can take place when the discharge is directed to the land contract infiltration trench. This has been chosen to protect any sensitive aquatic species and ensure that no residual makes its way into the local waterway. It is noteworthy that the limit of 3mg/L (for water sent to irrigation only), as proposed in substantive fast-track application as lodged is less than the allowable limit of free available chlorine in drinking water which is 5mg/L. It is generally accepted that the irrigation of plants with chlorinated tap water is acceptable and poses little risk to plant life.

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Auckland Council Wastewater – Reference 11

Condition 105 – this condition requires that the irrigation field be sized in accordance with the Wastewater Design Report. However, there is very little information about the field in the reports.

Response

We propose the re-wording of Condition 105, as follows:

The irrigation field shall be designed in general accordance with the "Delmore Wastewater Treatment Plant Design Report" (Ref. 241104, February 2025 by Apex) and further response memo titled "Technical Note – Engagement Requests for Additional Information" (Ref: TN.03, May 2025 by Apex).

This is to capture items such as the sustainable application rates and evapotranspiration modelling carried out.

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Auckland Council Wastewater – Reference 12

Condition 116, sampling – this appears to contradict condition 102.

Response

The wording of condition 102 has been revised as follows:

(102) The treated wastewater from the Wastewater Treatment Plant immediately prior to discharge to the land contract infiltration trench must comply with the following criteria:

Parameters	12-month median must not exceed
Total Nitrogen [mg/L]	1.0
Ammoniacal Nitrogen (mg/L)	0.3
cBOD5 [mg/L]	0.5
Total Suspended Solids [mg/L]	4.0
Total Phosphorus [mg/L]	0.07
Escherichia-coli [CFU/100mL]	<4.0
Enterococci [cfu/100mL]	<4.0

Advice note: Compliance is to be calculated based on the median of all samples taken over a 12-month period.

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Auckland Council Wastewater – Reference 13

Disposal field / disposal trench– There should be a condition requiring monitoring and maintenance of the disposal field and trench.

Response

The disposal field is already subject to regular maintenance requirements under the current covenant. Proposed wording for maintenance of the trench, as follows:

The infiltration trench and irrigation field shall be monitored and maintained by a suitably qualified individual to ensure it continues to perform as intended. A record of any maintenance carried out shall be kept on site and available for review upon request by the council.

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Auckland Council Wastewater – Reference 14

Reject water – see earlier comments. There may need to be additional conditions if reject water from the RO is discharged or utilised anywhere on the development.

Response

There is currently no plan to re-use reject (e.g. by dual reticulation) elsewhere on the development under this application.

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Auckland Council Wastewater – Reference 17

Wastewater will be arguably treated to best residential wastewater standard in the country. It would be helpful to see how the proposed discharge quality compares to the proposed limits in the "Proposed National wastewater environmental standard".

Response

Apex Water have included a technical note above comparing the treatment quality proposed in the substantive fast-track application as lodged to international standards for full wastewater recycling and the proposed new National Standards for Wastewater Treatment. This technical note shows that while falling outside the scope of the proposed new standards, the proposed discharge would be treated to a significantly higher level than required by even the most stringent of the proposed new standards for discharges to rivers and streams with low dilution (Table 3 above).

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Auckland Council Wastewater – Other

Disruption to the irrigation field existing plant life.

Response

The methodology for the installation and removal of the surface mounted pressure compensated driplines is provided below and Viridis Consultants have assessed the effects.

The installation of the surface mounted drip irrigation lines shall be carried out in a manner to mitigate against the disruption of any of the native plant life currently present within the proposed area and installed in a manner that facilitates the removal of the driplines with minimum disruption to plant life upon the decommissioning of the treatment plant.

The installation of surface mounted drip lines shall occur during the weed removal from the covenanted land already required by the conditions of the covenant. By carrying out the drip line installation during a weed removal exercise, damage to underlying vegetation would be largely limited to that which would have already occurred during scheduled weed removal.

The first step for the installation of the irrigation lines shall be the installation of the irrigation header lines, on the surface of each irrigation zone, inset within the existing fence line. Each irrigation zone has its own header from which each of the laterals are connected. The irrigation zone header shall be made from either high-density polyethylene or PVC pipework and shall be pinned to the ground using ground anchors to minimise any movement during discharges. While the main pipeline that conveys the treated wastewater to the irrigation field shall be buried, it is proposed that the header line for each zone is surface mounted to minimise disruption to vegetation during installation and subsequent future removal. Each dripline shall connect to this header either directly or via a small length of polyethylene pipe where exclusion zones require. The connection points for each of the driplines to the header shall be marked up on the pipework. This shall provide a location for the connection point and elevation of the dripline.

The next step shall be to locate the end of each lateral line within the irrigation zone. Each lateral shall run along a relatively level path across the natural contours of the area. Once the end position of the specific lateral line has been determined, a path shall be plotted between the two points to determine the most appropriate path the run the lateral.

The next step shall be to roll out an appropriate length of dripline and begin to pull the line through along the determined path from the header pipework to the end location determined. The intent is to ensure that the dripline is roughly level, avoiding trees and other obstacles. While the dripline is being pulled between the two locations, it is to be pinned at regular intervals (3m) into the soil to hold it in position. The pins used must be of sufficient length and strength to ensure the dripline is appropriately fastened into position.

The final step for the physical installation of the dripline is to walk back along the path it is installed and ensure it is on the ground, or if possible covered with any of the ground covering material, leaf fall or other organic material that is present.

The connection to the header pipework is via proprietary barbs and grommets designed specifically to match the driplines.

Each irrigation zone is controlled by a solenoid operated pressure sustaining / reducing valve that operates on a low voltage 2-wire network. This configuration allows for the transmission of the open and close signal over a long distance

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and via a 2-wire network which is decoded at the valve directly or passed on to further valves on the network. These cables can be direct buried and due to their low voltage pose no risk to personnel.

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Other

Locations where the reject and treated wastewater can go.

Response

The treated wastewater and reject are of exceptionally high-quality meaning that if discharged to a traditional septage receival site, the liquid will contribute hydraulically to the facility's load, however it will not provide a lot of biological load to the treatment process, relative to raw sewage.

A list of some potential locations for the receipt of these liquid waste streams include:

WSL Rosedale
WSL Mangere
WSL Warkworth
WSL Omaha Beach
WSL Snell's Beach
WSL Pukekohe
Wainui Golf Course (Variation to the existing Wainui Gold Course consent for discharge of treated wastewater would be required)

Discharge to these locations would need to be confirmed with the facility operator or under commercial agreement.