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TECHNICAL NOTE			TN. 02
Revision	3	Date:	1st August 2025
Principal's Representative:	Grant Fahey		
Contractor:	Apex Water		
Contract:	Milldale Wastewater Treatment Plant		
Contract No.:	240805		
Subject:	**Technical Note – Response to Requests for Additional Information**		

Dear Grant,

Technical Note – Support of Fulton Hogan Land Development Milldale Consent Application

Prepared by: Apex Water

Section 53(2) of the Fast-track Approvals Act 2024 enables the Expert Consenting Panel to invite written comments on the application from specified persons and groups.

This memorandum has been prepared in response to the technical specialist memorandums issued by Auckland Council as part of their assessment of the Milldale Fast-track Application. It specifically addresses the matters raised by Council and provides clarification, additional assessment, and updates where required.

In particular, this memo provides response to the following:

1. GWE Technical Memorandum to Auckland Council: Milldale Fast Track Application – BUN60446761 (21 March 2025)

   Memorandum of Planning Matters for Auckland Council (29 July 2025)
2. Annexure 5: Wastewater Treatment
3. Annexure 3: Watercare
4. Watercare Response Subject Milldale Fast-Track application number: BUN60446761 & FTAA-2503-1038 Wainui Road, Milldale, Upper Orewa (29 July 2025)

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There is a lack of certainty about the fate of the RO waste stream, which could potentially be a very large volume of water in itself. Proposed Condition 49 has the Applicant applying for 830 m3/d discharge to the Land Contact Infiltration Device (LCID) and on page 73 of the Wastewater Design Report the Designers estimate 30% of the wastewater fed to the RO will be rejected. This means there could potentially be 250 m3/d to 300 m3/d of reject water to be handled. The site plans for the WWTP don't show any storage for this, even though it is stated on page 74 of the Wastewater Design Report that it will be stored on site. At approximately 250 m3/d generation, this would be quite a lot of storage required

Response

It is proposed that the reverse osmosis waste stream be returned to the sewer under a commercial agreement with Watercare Services Limited. This has been agreed in principle with Watercare and a letter to support this has previously been provided to the Panel.

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If Watercare will accept pumping of this highly treated reject stream to Army Bay WWTP, then there is no issue. However, the Wastewater Design report states that that the reject stream would reach A+ recycled water standards, but doesn't state which standard that is. Regulation around uses of recycled wastewater in New Zealand is extremely limited – Auckland Regional Public Health Service should be consulted, but where recycled wastewater use is for landscape irrigation (as stated on Page 73 of the Wastewater Design Report), Auckland Council would consider this as a discharge, requiring a discharge consent. Similarly, if a dual reticulation line were established, Council would likely require certainty on the fate of the water and probably a consent would be needed.

Response

Despite the water meeting recycled water standards, there are currently no plans to recycle this waste stream on site for landscape irrigation, or dual reticulation (third pipe) within the substantive fast track consent application, as lodged. This very high-quality treated water be discharged to the environment via the proposed land infiltration basin.

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Initial comments in this author's memo of December 6, 2024 were that effects on public health due to recreation in surface waters would need to be considered. Normally a Microbial Health Risk Assessment (MHRA) would be conducted, but the extremely high quality of the wastewater due to the RO means this is unnecessary.

Response

We concur with this assessment. In support of this, 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 Milldale 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 Milldale 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. (Noting that the proposed dose on this site is lower than 30-40mJ/cm2)

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.

Table 1 Log removal of pathogens

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
Total	**17-log**	**11.5-log**	**18-log**	**9-log**	**18-log**	**9.5-log**

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& Annexure 5: Wastewater Treatment – Reference 2

Ammonia Effects
Table 13 on page 38 of the AEE report gives a basic mass balance of the discharge across the stream as it relates to the main contaminants. For nearly all of the parameters there will be no change to the stream concentrations. I accept this assessment. However, as low as the ammonia is in the discharge, it will still lead to at least a ten-fold increase in the ammonia concentration in the stream under all scenarios modelled. Table 13 indicates that the ammonia concentration would still be classified as NPSFM State A, but that is for annual 95%ile values. It seems feasible that the discharge will push the stream to State B reasonably frequently. Furthermore, the discharge would push the stream ammonia concentrations to above the ANZGV 2018 value of 0.01mg/L. While overall the indications are that ammonia in the discharge will not cause serious issues, there is little discussion of what the occasional change to NPSFM State B and the exceedance of the ANZGV means in and what can be expected to be witnessed in terms of impacts on the ecology as a result.

This is addressed in detail in Babbage's 6 June 2025 memo 200049853 Milldale WWTP Project – Further Information Request on Resource Consent Application (appended). A summary of their findings are that:

Given the already degraded ecological condition of Waterloo Creek, occasional exceedance of ANZG (2018) trigger values for ammonia, is unlikely to result in acute adverse effects on the present macroinvertebrate community, as these levels are expected to be below the concentration levels that would cause direct harm. However, chronic or frequent exceedances, even to levels consistent with NPSFM State B, may further suppress the limited population of more vulnerable taxa such as Paratya curvirostris and reduce the likelihood of recolonisation by sensitive taxa, including EPT species.

Although occasional transitions to NPSFM State B are not expected to significantly alter the current degraded community structure, they could present a barrier to future ecological recovery and improvements in stream health. It must be noted that, as described in Babbage AEE report, particularly Section 3.2.3.1, the Waterloo Creek presents pH circumneutral ranging from 7.3 to 7.7 with dissolved oxygen within attribute state A (≥ 8 mg/L). This indicates a sufficient amount of oxygen dissolved in the water for aquatic organisms to assist in the breakdown of nutrients and harmful gases like ammonia. Given that Waterloo Creek typically exhibits a circumneutral pH, the dilution of the discharge along the stream will promote the conversion of ammonia to the less toxic ammonium form. With that, the concentration of toxic NH_3 is expected to be approximately 1% of the total ammoniacal nitrogen concentration. Therefore, not only are the resulting concentrations in the receiving environment not expected to significantly alter the current degraded community structure, the concentrations of toxic NH3 will be significantly lower (than total ammoniacal nitrogen) due to the other water physicochemical properties.

GWE Technical Memorandum (21 March 2025) – Reference 1
& Annexure 5: Wastewater Treatment – Reference 2

Effects on the Estuary and Overall impact of the discharge as a percentage of the catchment
In this authors comments of December 6, 2024, it was suggested that dilution modelling on the estuary be done to assess impacts on that water body. This is arguably unnecessary given that there will be no change to the concentration of contaminants to the receiving stream, with the exception of ammonia. However, it would be beneficial to understand how the additional ammonia will affect the estuary (if at all). This could be done under the wider umbrella of an analysis of scale of the discharge in relation to other contributions in the catchment. My comments of December 6 suggested this be done, so that a sense of scale of the discharge in relation to the overall catchment could be realised eg would it be contributing 0.1%, 1%, 10% etc of contaminants to the Orewa Estuary? 0.1% may be considered a small

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contribution, 10% might be considered a large contribution. This is particularly important in this area given the level of development currently taking place upstream of the estuary, and that other wastewater discharges may also be taking place.

Response

This is addressed in detail in Babbage's 6 June 2025 memo 200049853 Milldale WWTP Project – Further Information Request on Resource Consent Application (appended). A summary of their findings are that:

The flow rate of the Orewa Estuary was estimated by scaling the average flow rate of Waterloo Creek according to the ratio of their respective catchment areas. The results indicate that the WWTP's daily ammonia discharge (2 g/day) accounts for approximately 7% of the current median daily ammonia load in the Orewa Estuary (29 g/day). Despite this proportion, the resulting increase in ammonia concentration at the Orewa Coast is minimal—from 0.0006 g/m^3 to 0.00063 g/m^3. When this concentration (0.00063 g/m^3) is converted back to ammoniacal nitrogen, it equates to 0.0128 g/m^3, which remains well below the ANZG 2018 guideline for 99% marine species protection (0.5 g/m^3).

Additionally, based on the biological assessment, with regards to the marine invertebrates, the taxa were comprised of estuarine molluscs, polychaete worms, and crustacea. All species common to the degraded estuarine environments of Auckland have been heavily impacted by the rapid land use changes and sedimentation over the last decades. None of the species recorded are uncommon, and all are adapted to the comparatively hostile environment of the upper intertidal zone. There will be no adverse effects of the ammonia concentrations occasionally dropping into Attribute band B on marine macroinvertebrates located more than a kilometre from the discharge site to the stream.

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5 GWE Technical Memorandum (21 March 2025) – Reference 1

Emerging organic contaminants (EOCs), metals
The impact of EOCs and metals was not discussed. If metal impacts are low because of low solids concentration in the discharge, or if RO is effective at removing EOCs, this should be stated somewhere.

Response

The potential impact of contaminants of emerging concern (CECs) and trace metals in the Milldale wastewater discharge is assessed as minor, and significantly lower than that from other wastewater treatment plants 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.

The Milldale plant treats wastewater from a primarily residential catchment with minimal 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, A study by Incheon National University[1] showed removal rates of CECs such as acetaminophen, Ibuprofen, Diclofenac Ofloxacin, Estriol, Erythromycin and Caffeine ranged from 90 to >99% in membrane bioreactor systems, with many other CECs being removed at rates of 50 – 90%. For less biodegradable CECs such as Indomethacin, mefenamic acid and TCEP, the reverse osmosis system provides a high level of removal due to the large molecular size of these compounds.

Given the closed, residential nature of the catchment, the influent CEC load to the Milldale treatment plant 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 Milldale Wastewater Treatment Plant will removal of both trace metals and CECs. Relative to most existing municipal wastewater treatment plants in New Zealand, the Milldale facility will deliver higher contaminant attenuation, offering robust protection for the receiving environment.

[1] Kwon Y, and Lee D.G. (2018) Removal of Contaminants of emerging concern (CECs) using membrane Bioreactor (MBR): a short review. Global NEST Journal Vol. 21, No.3 pp 337-246

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GWE Technical Memorandum (21 March 2025) – Reference 1

Overflow from the infiltration basin
The drawings show an overflow pipe for the infiltration basin but it isn't clear where this goes. If it goes directly to the stream, a consent condition should be included to permit this.

Response

This query has been addressed by Woods Engineering in their response memo/updated drawings.

GWE Technical Memorandum (21 March 2025) – Reference 1
& Annexure 5: Wastewater Treatment – Reference 2

Discussions with Watercare
A record of discussions held with Watercare confirming that they cannot accept any wastewater from Milldale in the short to medium term should be provided.

Response
Correspondence with Watercare has been appended to this memo.

GWE Technical Memorandum (21 March 2025) – Reference 1

Condition 58, UV dosage – There was no explanation in any of the reports why 16 mWs/cm2 was suggested as the consentable dose.

Response
Due to the high level of treatment provided by the proposed plant, particularly noting the high reject rates of viruses through reverse osmosis membranes and the multi-barrier approach taken, the UV reactor was included primarily 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 which biofilm development will be managed. As such, we acknowledge that the UV dose selected will not provide a high level of log reduction for some enteric viruses.

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Condition 59 , Wastewater Samples – The sampling frequency is reasonable. However, the consent limits given in condition 53 are 12 monthly medians and it would be good to have some visibility around performance within this time period. It is recommended a condition requiring that Council be alerted if (for example) there are two or more consecutive samples that exceed the median values, with an explanation of what will be done to ensure the limit is met.

Response

As noted in Reference 2, a move to load-based discharge conditions has been proposed in order to better represent the actual impact on the receiving environment and allow for a discharge flow which will increase over time to be accounted for in the compliance monitoring.

The originally proposed conditions limited the discharge to the land infiltration basin to the following concentration parameters:

Table 2 Original concentration based limits

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

Based on discussions with Council's Experts (Reference 2), it is proposed to update the compliance condition to a mass loading basis, equivalent to the parameter provided in Table 2 when measured at the full design discharge flow of 829m^3/day. This results in an update of the treated water discharge limit condition values to:

Table 3 Proposed mass load based limits

Parameters	12-month median must not exceed
Total Nitrogen	0.829 kg/day
Ammoniacal Nitrogen	0.24 kg/day
cBOD5	0.40 kg/day
Total Suspended Solids	3.17kg/day
Total Phosphorus	0.059 kg/day
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.

With the following additional note and trigger level:

Should three consecutive samples return results above the median concentration limits for the parameters detailed in Condition XXX [Table 3 above] *the consent holder shall notify Auckland Council within 5 working days of the latest result.*

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 trigger level exceedance and detail whether further monitoring is required.

While at full design flow, these limits still require the discharge to meet the extremely stringent concentration limits in Table 2 (by limiting equivalent mass loading discharged), they do provide some operational flexibility to the wastewater treatment plant as the development grows whilst still maintaining the same low ecological impact in the receiving environment as has been modelled for this discharge.

For example, without changing the mass load discharged or subsequent post-dilution in-stream concentration of the determinants in Table 2, the discharge from the wastewater treatment plant could reach the following median nutrient concentration at different flows without breaching the proposed mass loadings:

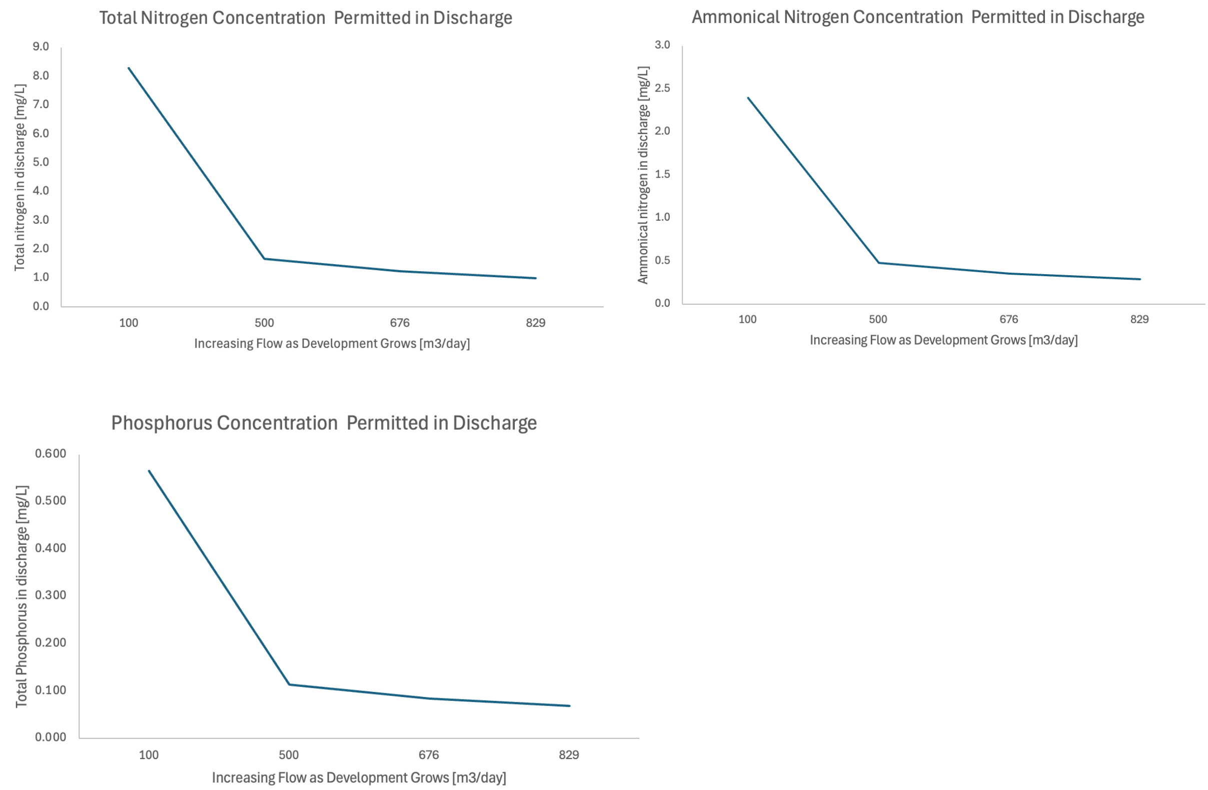

Figure 1 Median concentration of key nutrients permitted in the discharge at different discharge flows under the mass load approach

Even with the full median mass load being discharged, the resultant in-stream concentration of these compounds only changes by around 15% at summer low dilution flows in the stream, and by 7% during winter peak dilution flows between an initial low flow discharge of 100m^3/d up to the dull design flow of 829m^3/day:

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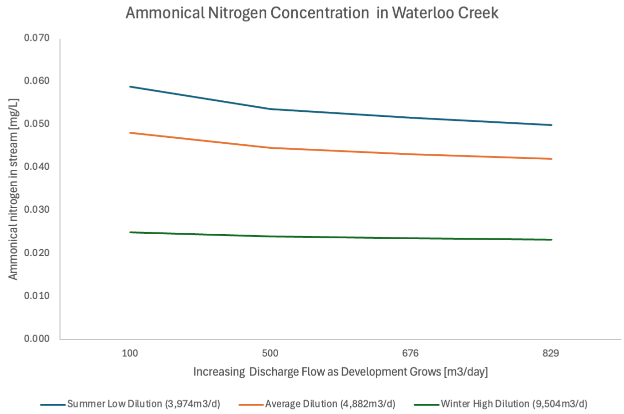

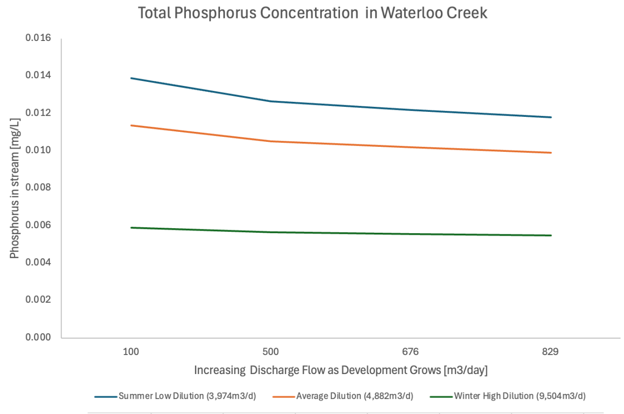

Figure 2 In-stream concentration of key nutrients at peak mass load discharge at different discharge and stream flow rates.

The improvement in in-stream concentrations at higher discharge flows in this case is associated with the additional dilution water entering the stream (from the discharge) at higher discharge flows. Figure 2 also shows that under the mass load approach, seasonal flow variations in the flow of Waterloo Creek have significantly more impact than the daily discharge flow on in-stream concentration of key nutrients.

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GWE Technical Memorandum (21 March 2025) – Reference 1

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

Response

The following condition is proposed in response:

The infiltration basin and irrigation field shall be monitored and maintained by a suitably qualified individual to ensure it continues to perform as intended.

Maintenance of the infiltration trench and disposal field shall be carried out at a minimum 3 monthly and a record of any maintenance carried out shall be kept on site and available for review upon request by the council. At a minimum, maintenance shall include:

- A walkover of the infiltration basin to check for blockage, runoff, overflow, or broken lines
- Inspection of the infiltration trench for weeds or other potential sources of blockages
- Check for odour

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GWE Technical Memorandum (21 March 2025) – Reference 1
& Annexure 5: Wastewater Treatment – Reference 2

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 RO reject (e.g. by dual reticulation) elsewhere on the development under this application.

GWE Technical Memorandum (21 March 2025) – Reference 1

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

Comparison with Proposed National Environmental Performance Standards (NEPS) for Wastewater

While the proposed discharge falls outside the direct applicability of the draft NEPS due to the low dilution capacity at the Milldale outfall location and private ownership, this comparison demonstrates that the treatment system is designed to achieve a significantly higher level of contaminant removal than the most stringent thresholds proposed for freshwater receiving environments with limited assimilative capacity.

Context – Draft National Environmental Performance Standards (NEPS)

The Ministry for the Environment has completed public consultation on draft legislative proposals to establish consistent national standards for the environmental performance of municipal wastewater discharges. The draft NEPS proposes a classification regime for receiving environments—rivers, lakes, estuaries, and coastal waters—based on ecological sensitivity, dilution potential and hydrological characteristics relative to the effluent discharged.

Performance thresholds for key contaminants are proposed for each receiving environment class, with corresponding compliance monitoring requirements. Although the NEPS has not yet been gazetted, it provides a useful indication of regulatory direction for infrastructure investment, particularly in the context of Three Waters reform and the emerging environmental bottom lines.

Applicability to the Milldale Discharge

The proposed discharge from the Milldale Wastewater Treatment Plant does not meet the eligibility criteria for inclusion in any of the NEPS receiving environment categories due to its very low dilution potential at the discharge point. Nonetheless, for the purpose of benchmarking, the most relevant comparator is the "Rivers and Streams – Low Dilution" classification, which applies to freshwater systems with limited assimilative capacity. Additionally, the estuarine environment located approximately 400m downstream provides a secondary point of reference for cumulative effects assessment.

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Table 3 – Benchmarking Milldale Proposed Discharge Against Draft NEPS Thresholds

Contaminant	Assessment Metric	Milldale (12-Month Median)	Lakes / Wetlands	Rivers – Low Dilution	Rivers – Moderate Dilution	Rivers – High Dilution	Estuaries	Low Energy Coastal
$cBOD_5$ (mg/L)	Median	0.5	15	10	15	20	20	50
TSS (mg/L)	Median	4.0	15	10	15	30	25	50
TN (mg/L)	Median	1.0	10	5	10	35	10	10
TP (mg/L)	Median	0.07	3	1	3	10	10	10
Amm-N (mg/L)	90th percentile	0.3	3	1	3	25	15	20
E. coli (CFU/100mL)	90th percentile	<4.0	6,500	1,300	6,500	32,500	N/A	N/A
Enterococci (CFU/100mL)	90th percentile	<4.0	N/A	N/A	N/A	N/A	4,000	400

Commentary

The proposed Milldale effluent quality represents a high standard of treatment, delivering consistently low concentrations of biochemical oxygen demand (BOD_5), suspended solids (TSS), nutrients (TN and TP), ammonia, and microbial indicators. The levels achieved substantially exceed the highest draft performance expectations for sensitive freshwater environments, including those with limited dilution.

The Milldale discharge is to a low dilution stream approximately 400m upstream of an estuarine environment. While the Milldale discharge does not fit within a specific classification under the draft NEPS due to limited dilution in the direct receiving environment, its performance positions the facility at the forefront of wastewater treatment practice in New Zealand, significantly beyond the maximum level of treatment proposed under any of the proposed new standards. The plant design reflects a proactive investment in environmental protection and aligns with the future regulatory direction implied by the NEPS framework. This supports the plant's role as a model for high-performing municipal treatment infrastructure under the proposed three waters framework and future resource management system.

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Annexure 3 – Watercare – Reference 3,
& Watercare Response Letter (29 July 2025) – Reference 4

- Additional information requested regarding discharge of RO Reject to sewer and potential effects on Watercare's network, treatment plants, and discharge

Response

The flow of RO reject to sewer is expected to vary from a low of 200m^3/day during dry weather flows, to approximately 370m^3/day during peak wet weather flows. Equivalent additional raw wastewater flows will be abstracted from the sewer and treated through the treatment plant to ensure that this discharge has no net hydraulic effect on the network or Army Bay treatment plant. These flows correspond to complete build-out of the development and will, in reality, gradually increase from zero to these final values over the initial years over which the development is built out.

A separate response to Watercare, Technical Note TN-03 – Milldale Wastewater Treatment RO Reject Discharge, Apex Water (31st July 2025) is appended to this response to provide additional information on the discharge of RO retentate and its effect on Watercare's network, treatment plant, and discharge.

Annexure 3 – Watercare – Reference 3,
& Watercare Response Letter (29 July 2025) – Reference 4

Section 67 Information Gap

Watercare's comments on the Milldale Fast-track application dated 29 July 2025 requested the following additional detail:

- **The composition and variability of the RO waste stream, including concentrations of salts, nutrients, trace contaminants, and any emerging pollutants.**

  Response:

  Water removed from the sewer is highly treated by the MBR process before being concentrated in the RO system and discharged back to the sewer. While macro-nutrients, organic contamination and solids are largely removed by the MBR process, inorganic salts are likely to remain. These are retained by the RO and returned to the sewer that they were extracted from.

  Figure 3 below shows an example of operation of the treatment plant and Reverse Osmosis system with typical mass balance of macro nutrients and an example of salt loadings from through the process (dependant on incoming salt loading in the sewer).

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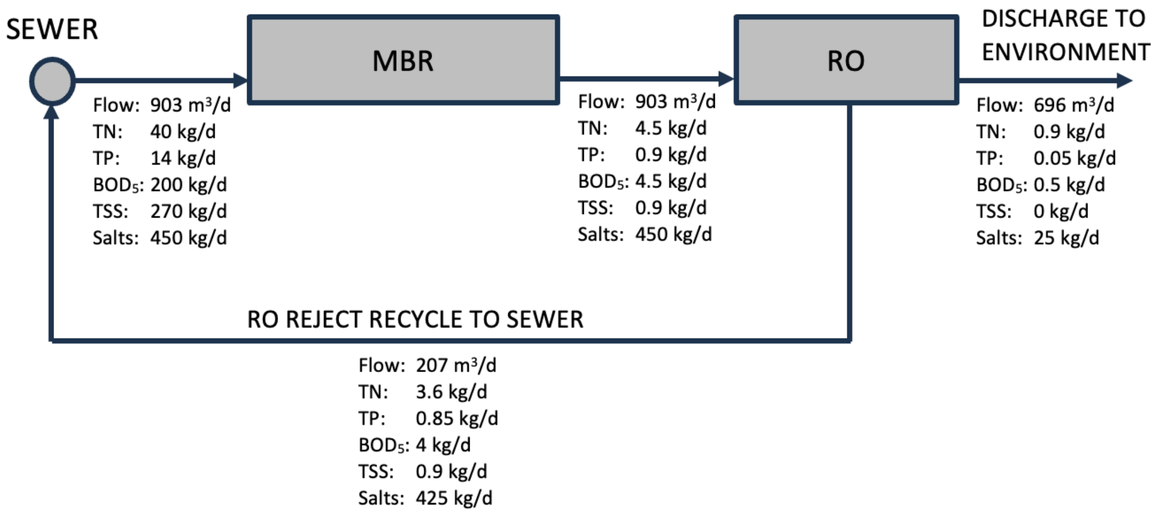

Figure 3 Flow Diagram of the treatment system showing indicative mass balance during typical dry weather flow at full build out.

Based on typical operation of the treatment plant during dry weather flows, the RO reject stream is expected to contain an average of approximately:

Table 4 Expected composition of the RO Reject discharge

Compound	Expected Average Concentration
Total Nitrogen	20 mg/L
Total Phosphorus	5 mg/L
BOD_5	20 mg/L
TSS	5 mg/L
Total Dissolved Salts	2,000 mg/L

- The expected flow volumes of the RO waste stream and how these may interact with or impact the hydraulic performance and treatment processes within the existing Watercare network.

  Response:

  Once the subdivision reaches full occupancy, the flow of RO reject is expected to vary from a continuous discharge of 200m^3/day in dry weather to 370m^3/day during wet weather at a peak discharge rate of 5L/s. Because an equivalent volume of raw sewage will be extracted from the sewer and treated by MBR before being returned as RO reject, the net hydraulic impact on the network is expected to be zero.

- The potential operational impacts on the Army Bay WWTP and the integrity of downstream infrastructure.

  Response:

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The salt loading on the Watercare treatment plant from the RO reject would be the same (actually very slightly lower) than if the abstracted sewage was permitted to flow past without passing through the RO. There would however be a net reduction of approximately 2kg/day Phosphorus, 5kg/day Nitrogen, 36 kg/day of BOD_5, and 60 kg/day of Suspended Solids load on the Watercare treatment plant from abstraction, treatment, and return of the RO reject flow to the network.

While high salt concentrations (typically due to infiltration of sea water into the sewer network, Industrial discharges, or salt water toilet flushing in Island environments) can have a negative impact on activated sludge in the sewage treatment process by inhibiting biological activity and disrupting flocculation processes, this does not typically present below concentrations of 2,000mg/L, which is stronger than the proposed raw RO reject discharge, even before dilution by other flows in the network. This means that even in the unlikely case that RO style treatment plants of this type are more widely adopted the catchment, there would still be no significant impact on the Watercare treatment plant or discharge.

Table 5 Expected sodium chloride profile through the sewer network

Expected Sodium Chloride concentration in the Discharge	1600 mg/L
Expected Sodium Chloride concentration in the sewer at the point of discharge	490 mg/L
Expected Sodium Chloride concentration in the sewer at Orewa pump station	331 mg/L
Expected Sodium Chloride concentration in the sewer at Army Bay	271 mg/L
Assumed background Sodium Chloride concentration sewer catchment	250 mg/L

Effect on the discharge from Army Bay sewage treatment plant.

As detailed above, raw sewage abstraction, treatment, and discharge of RO permeate into the sewer is expected to have a net positive impact on the performance of the Army Bay treatment plant. This carries forward to improved environmental effects of the discharge from the Army Bay treatment plant due to reduced nutrient and organic loads to the plant.

By the time the discharge reaches the Army Bay treatment plant, dilution with other incoming sewage is expected to reduce the increase in total chloride concentration to approximately 16mg/L under dry weather flows (less under wet weather flows).

Given that the discharge occurs via ocean outfall into seawater with a chloride concentration of approximately 19,000mg/L, this is not likely to represent any measurable effect on the receiving environment.

Additional detail is appended in Technical Note TN-03 – Milldale Wastewater Treatment RO Reject Discharge, Apex Water (31st July 2025).

- The monitoring, control, and fail-safe mechanisms proposed to manage this waste stream prior to and during discharge into the Watercare network.

Response:

The key process determining the quality of the RO reject is the membrane bioreactor that also treats the main flow prior to discharge to the environment. Robust and effective operation of this treatment plant is essential to maintain compliance with the extremely stringent conditions of the discharge consent as well as to maintain the quality of RO reject being discharged to Watercare's network. In order to maintain the effective operation of this plant, duty/standby configuration of key items of equipment are provided, and a

permanently installed backup generator is installed to ensure that treatment is not compromised in the event of a power cut. Nutrient and contaminant removal in the MBR plant is continuously monitored, alarmed and controlled by use of equipment such as dissolved oxygen, ORP, and suspended solids meters. Final effluent quality is monitored and alarmed by use of turbidity sensors on the MBR permeate stream.
Regular on-site lab testing of the discharge multiple times per week is also used to optimise the treatment process. RO performance will be continuously monitored via conductivity measurement. All key performance parameters that are continuously monitored include SMS alarms that are escalated to operations management via SMS and / or email if not responded to in a timely manner.

The proposed resource consent conditions for the treatment plant include an early warning trigger clause where if three consecutive compliance samples exceed the very strict target median performance limits, as would occur with any failure of the MBR system, then Auckland Council must be notified and an investigation with appropriate corrective actions carried out and forwarded to council.

- The testing regime required to verify the quality of the RO waste stream, including baseline sampling, target parameters, frequency, and testing responsibilities.

  Response:

  Testing of the treated discharge to the environment for resource consent monitoring and reporting will be carried out by an accredited laboratory once every two weeks in accordance with conditions of consent. It is proposed that the RO reject stream be sampled by the applicant and tested by an accredited laboratory on the same schedule for verification of compliance with a tradewaste agreement with all results forwarded to Watercare. It is proposed that this sampling would test for:

  - Total Suspended Solids
  - $cBOD_5$
  - pH
  - Total Nitrogen
  - Total Phosphorus
  - Total Dissolved Solids
  - Sodium
  - Chloride

  For Total Suspended Solids, $cBOD_5$, Total Nitrogen, and Total Phosphorus, it is proposed that the tradewaste discharge of RO reject be limited to less than the median concentration of these parameters in raw sewage, therefore ensuring that the abstraction from sewer, treatment by MBR and return of the flow to the sewer as RO reject has a net positive effect on the Army Bay sewage treatment plant. Because the RO system simply removes the inorganic salt load from the sewer, concentrates it (by approximately 4x) and returns it to sewer in a smaller volume of otherwise cleaner water, it is proposed that the discharge limits for total dissolved solids, sodium, and chloride be set following baseline monitoring of existing flows in the sewer during detailed design of the proposed treatment plant, while also considering limits for these compounds required to ensure resilience in the network and health of the Army Bay sewage treatment plant.

  It is proposed that baseline monitoring of the catchment, and the existing inflow to the Army Bay Sewage Treatment Plant for the above parameters be carried out over a period of 4 weeks, including during at least one rainfall event to determine inorganic salt concentrations for calculation of RO reject composition.

- A detailed characterisation of the RO waste stream under a range of operational scenarios. This should include concentrations of key parameters such as salts, nutrients, heavy metals, organic compounds, emerging contaminants, and any other substances of concern.

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Table 6 Expected composition of the RO reject stream

Compound	Expected Average Concentration	Expected Range
Total Nitrogen	20 mg/L	8 – 30 mg/L
Total Phosphorus	5 mg/L	2 – 10 mg/L
BOD_5	20 mg/L	4 – 60 mg/L
TSS	5 mg/L	0 – 16 mg/L
Total Dissolved Salts	2,000 mg/L	1,000 – 3,200 mg/L

Information on contaminants of emerging concern and heavy metals in this catchment are not available, but due to being an almost purely domestic catchment with no industrial contributors, these are expected to fall at the lower end of the range for typical domestic sewage.

ESR has evaluated typical concentrations of these compounds in domestic sewage with the following findings for heavy metals:

Table 7 Typical concentrations of heavy metals in raw sewage from ESR (2023)[2] [μg/mL]

Country	Al	As	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	Reference
France			0.6	9	65	650			12	18		Buzier et al. (2006)^
Italy	786±46%	4˙	<LOD	8.1±11%	9.9±56%	515±29%	1.5±58%			8*	348±31%	Carletti et al. (2008)#
Italy	1,940±8%	<LOD	8.7±13%	56.4±24%	9.8±44%	361±10%	0.7±8%			8.6*	1,233±20%	Carletti et al. (2008)#
Poland			20		100					50	450	Chipasa (2003)
France	1,300 Max. 3,400	1.0 Max. 1.5	0.2 Max. 0.4	15 Max. 70	75 Max. 110	600 Max. 1,500			20 Max. 90	8 Max. 15	200 Max. 400	Choubert et al. (2011)
China		6.2±4.8 Max. 95	15±9 Max. 78	170±64 Max. 650			0.67±1.5 Max. 38			160±100 Max. 940		Du et al. (2020)
UK		12	1.7	35	300		2.5		40	600	290	Goldstone et al. (1990a, 1990b, 1990c)
India		1.12±0.66 Max. 2.22		3.5±1.3 Max. 5.5	14.2±13.9 Max. 38	235±56 Max. 298			4.1±1.8 Max. 6.5	0.18±0.09 Max. 0.31	19.8±4.3 Max. 26.9	Joshua et al. (2017)
Greece			3.3±1.1	40±12	79±35	480±87		67±12	770±200	39±9.4	470±140	Karvelas et al. (2003)
Spain			5 Max. 5				0.37 Max. 0.37		47.5 Max. 107.6	2.5 Max. 17.6		Teijon et al. (2010)
Turkey	1,891±872 Max. 3,753		19±40 137	1,086±509 2,120	60±43 Max. 179	1,975±712 3,580		126±33 Max. 217	100±41 Max. 202	84±100 Max. 385	533±209 Max. 982	Üstün et al. (2009)

Data are shown as mean values, with standard deviation and maximum concentration shown where that data was available. LOD – limit of detection.
˙only one sample above LOD; ^ combined sewer network; # data shown as mean ± variation coefficient; ~WWTPs receiving municipal or municipal and hospital effluent.

Most heavy metals are associated with particulates in the sewage and overall 80-90% of heavy metals tend to be removed as sludge in the wastewater treatment plant (Agoro et al. 2020)[3], which in this case will be dewatered by decanter centrifuge and disposed of off-site separately as a solid waste.

After 80-90% removal in the MBR system, followed by a 4-fold concentration by the RO unit, heavy metals in the RO reject stream are expected to be 20 – 60% lower overall than in the raw sewage abstracted from the sewer, therefore resulting in a net improvement in the load of heavy metals entering, and subsequently discharged from the Army Bay treatment plant.

[2] Coxen S, and Eaton C, Review of contaminants of potential human health concern in wastewater and stormwater, Report No. FW23016, ESR (2023)

[3] Agoro MA, Adeniji AO, Adefisoye MA, et al. 2020. Heavy metals in wastewater and sewage sludge from selected municipal treatment plants in Eastern Cape Province, South Africa. Water 12: 2749. 19p.

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Study into contaminants of emerging concern is ongoing, and due to the broad range of compounds covered by this description, generalisations are difficult to make.

Per- And Polyfluoroalkyl Substances (PFAS) are a range of the contaminants of emerging concern that have garnered significant attention lately due to their persistent nature and resistance to treatment by traditional sewage treatment technologies. International studies[4] have shown PFOA and PFOS concentrations were up to 22 and 15 times greater, respectively, at a Singaporean WWTP receiving 60% industrial and 40% domestic wastewaters, compared with another plant receiving 95% domestic wastewater. This indicates that in a purely domestic catchment such as Milldale, concentrations of these compounds can be expected to be significantly lower than in most larger mixed catchments.

Table 8 Typical concentrations of PFAS in raw sewage from ESR (2023)[5] [ng/mL]

Country	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFDA	PFNA	PFBS	PFHxS	PFOS	Reference
Spain	4.8# Max. 20.9 31%	2.1# Max. 27.0 8%	1.8# Max. 23.3 8%	1.9# Max. 7.5 31%	3.4# Max. 5.9 100%	nd	nd	nd	6.9# Max. 51.8 38%	11.1# Max. 63.1 54%	Lorenzo et al. (2019)
USA					135# Max. 202	34# Max. 47	6# Max. 11			6# Max. 10	Sinclair and Kannan (2006)
Japan				4.7*	22.5 Max. 41	<1 Max. 1.7	29 Max. 70			20.5 Max. 336	Murakami et al. (2009)
Belgium	18.5 Max. 108 100%	27.5 Max. 295 100%	7.0 Max. 185 94%	6.2 Max. 155 94%	7.25 Max. 2,726 100%	0.90 Max. 8.3 94%	0.58 Max. 8.6 81%	7.15 Max. 23 100%	3.35 Max. 7.6 94%	6.3 Max. 101 100%	Jeong et al. (2022)
Australia	5.35 Max. 52.1 100%	<LOQ Max. 47.3 86%	8.65 Max. 33.5 100%	2.80 Max. 10.4 100%	4.35 Max. 40.5 100%		<LOQ Max. 2.60 91%	2.55 Max. 33.3 100%	2.30 Max. 142 91%	6.96 Max. 129 97%	Coggan et al. (2019)
Australia			9.5±15# 71%	2.5±3.3# 79%	4.8±6.9# 50%	0.36±0.68# 29%	0.64±2.0# 14%		20±54# 86%	17±35# 86%	Gallen et al. (2018)
Australia		4.1 Max. 31 91%	7.1 Max. 119 100%	3.1 Max. 17 96%	5.6 Max. 33 99%	3.2 Max. 6.3 35%	1.8 Max. 3.3 14%	6.5 Max. 87 99%	5.9 Max. 509 91%	7.7 Max. 137 92%	Nguyen et al. (2022)
Denmark					8.7 Max. 23.5 72%	nd	1.7 Max. 8.4 82%		4.8 Max. 32.8 72%	3.3 Max. 10.1 91%	Bossi et al. (2009)
China#	0.95±0.08 0.45±0.08	1.76±0.09 2.10±0.09	1.48±0.04 1.03±0.18	0.73±0.03 0.51±0.01	3.73±0.20 3.04±0.09	0.38±0.08 0.30±0.10	1.74±0.19 1.29±0.21	1.29±0.14 14.4±0.83	nd nd	7.50±0.22 6.45±0.79	Pan et al. (2016)
NZ#	nd nd	nd 1.4±0.3	6.9±0.2 2.3±0.7	1.3±0.1 0.6±0.0	4.0±0.2 1.7±0.4	0.7±0.1 0.3±0.0	0.6±0.2 0.2±0.2	7.1±0.0 2.1±0.1	1.6±0.2 0.8±0.2	7.7±1.1 1.7±0.2	Lenka et al. (2022)

Data are median values unless otherwise indicated, with maximum concentration and detection frequency shown below, where that data was available. Where two sets of data are shown together, the study had reported data for individual WWTPs separately. nd – not detected. A blank space means a study did not assess the compound.

# indicates data is presented as a mean value, with standard deviation where that information was available. * only one sample for which data was available.

While the concentration of PFAS in the catchment is expected to be at the bottom of the ranges described above, it is reasonable to expect that aside from some minor adsorption onto biomass and subsequent removal with waste activated sludge, most PFAS abstracted from the sewer in the raw sewage stream is likely to be partitioned into the smaller volume RO reject stream and returned to the sewer.

A study by Incheon National University[6] showed removal rates of pharmaceutical CECs such as acetaminophen, Ibuprofen, Diclofenac Ofloxacin, Estriol, Erythromycin and Caffeine ranged from 90 to >99% in membrane bioreactor systems, with many other pharmaceutical or personal care CECs being removed at rates of 50 – 90%. This shows that abstraction from the network, treatment by MBR and return to the network will have a net positive effect on loading of these biodegradable CECs in the discharge from the Army Bay sewage treatment plant

[4] Yu J, Hu J, Tanaka S, et al. 2009. Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in sewage treatment plants. Water Research 43: 2399-2408

[5] Coxen S, and Eaton C, Review of contaminants of potential human health concern in wastewater and stormwater, Report No. FW23016, ESR (2023)

[6] Kwon Y, and Lee D.G. (2018) Removal of Contaminants of emerging concern (CECs) using membrane Bioreactor (MBR): a short review. Global NEST Journal Vol. 21, No.3 pp 337-246

- What plans are in place for the disposal of other concentrated waste streams generated by the wastewater treatment system, such as those produced during routine backwash and chemical cleaning cycles (Clean-In-Place waste stream), and centrate or filtrate produced during dewatering of waste activated sludge?

  Waste activated sludge is dewatered on-site and removed separately from site as a solid waste. Membrane CIP waste, backwashes and centrifuge centrate is returned to the headworks of the treatment plant where it is mixed with raw wastewater prior to being treated in the on-site treatment plant.

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Assessment against Auckland Tradewaste Controls 2019

To aid in carrying out a risk assessment of the impact of the RO reject stream on the network and treatment plant, the expected composition of this stream is compared against the limits specified in the Watercare Tradewaste Control 2019. Where a specified compound is not expected to be present in the discharge at a significant concentration this is noted as "not expected". These values will be confirmed by baseline monitoring of the sewer catchment during detailed design.

Parameter	UNITS	Limit	Expected Value
Ammonia	mg/L	50	5
Anionic Surfactants - Methylene blue active substance (MBAS)	mg/L	200	not expected
Bio-chemical Oxygen Demand (BOD_5)	mg/L	1000	20
Boron	mg/L	25	not expected
Bromine as Br_2	mg/L	5	not expected
Chemical Oxygen Demand (COD)	mg/L	2000	50
Chlorine (Cl_2 free chlorine)	mg/L	3	not expected
Colour	mg/L	—	not expected
Cyanide (weak acid dissociable) as CN^-	mg/L	3	not expected
Fluoride as F^-	mg/L	20	3
Oil and grease	mg/L	200	<5
pH (units)	mg/L	6.0 to 10.5	6.5 - 8
Settleable solids	mg/L	Less than 50 mm/min	<1
Sulphate	mg/L	500	200
Sulphide	mg/L	5	~0
Sulphite	mg/L	15	<1
Suspended Solids	mg/L	1000	20
Temperature (°C)	°C	40	25
Total Nitrogen as N	mg/L	200	20
Total Phosphorus as P	mg/L	50	5
Antimony	mg/L	10	not expected
Arsenic	mg/L	1	0.004
Barium	mg/L	5	not expected
Cadmium	mg/L	1	0.04
Calcium	mg/L	60	60
Chromium (Total)	mg/L	25	0.06
Chromium (VI)	mg/L	5	not expected
Cobalt	mg/L	10	not expected
Copper	mg/L	10	0.2
Lead	mg/L	2	0.08
Manganese	mg/L	20	0.28
Mercury	mg/L	0.03	0.0028
Molybdenum	mg/L	10	not expected

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Parameter	UNITS	Limit	Expected Value
Nickel	mg/L	5	0.08
Selenium	mg/L	5	not expected
Silver	mg/L	5	not expected
Tin	mg/L	10	not expected
Vanadium	mg/L	25	not expected
Zinc	mg/L	15	1.6
Acetone	mg/L	100	not expected
Acetaldehyde	mg/L	30	not expected
Benzene	mg/L	1	not expected
Butanone	mg/L	100	not expected
Ethylbenzene	mg/L	5	not expected
Ethylene glycol	mg/L	50	not expected
Formaldehyde	mg/L	30	not expected
Gluteraldehyde	mg/L	30	not expected
Methane		10% of LEL	not expected
Methane (dissolved)	mg/L	0.14	not expected
Methyl ethyl ketone (MEK)	mg/L	100	not expected
Alcohols	mg/L	500	not expected
Phenol (Total)	mg/L	50	not expected
Toluene	mg/L	1	not expected
Xylene	mg/L	5	not expected
Total Petroleum Hydrocarbons C7–C14	mg/L	30	not expected
Total Petroleum Hydrocarbons C7–C36	mg/L	50	not expected
Acrylates	mg/L	10	not expected
Amines	mg/L	5	not expected
Cresols	mg/L	5	not expected
Ethylene	mg/L	5	not expected
Methyl acetate	mg/L	100	not expected
Pyridine	mg/L	1	not expected
Semivolatile organic compounds (SVOC)	mg/L	1	not expected
Siloxane	mg/L	1	not expected
Volatile organic compounds (VOC)	mg/L	5	<1

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Summary of impacts of the discharge on the Army Bay Discharge consent DIS60331146

In order to aid assessment of the impact of the discharge on the Army Bay wastewater treatment plant's discharge consent compliance, the following evaluation is provided against the relevant conditions of the discharge consent DIS60331146:

Standards - Short Term Discharge

6. From the date of the commencement of this consent, the requirements of this condition, and Conditions 7 and 8 below, apply to the ongoing operation of the existing Army Bay Wastewater Treatment Plant (WWTP) until the Army Bay WWTP - Stage 1 upgrade has been commissioned, but in any event for no longer than 7 years from commencement of this consent:
   (a) Annual average dry weather flow shall not exceed 13,500 m^3 per day., and
   (b) The maximum daily treated wastewater discharge volume from the Wastewater Treatment Plant to the coastal marine area shall not exceed a maximum daily discharge of 39,825 m^3 per day (at peak dry weather flow), and a maximum instantaneous flow of 750 L/s (at peak wet-weather flow).
   (c) The Consent Holder shall ensure that a validated (in accordance with USEPA UV Disinfection Guidance Manual 2006 or another suitable method as approved by Auckland Council) Ultraviolet (UV) dose of 25 mJ/cm^2 is delivered by the UV disinfection facility for 99% of the time (calculated based on a 15-minute average) over each calendar month.

Because an equivalent additional volume of raw sewage will be drawn out of the sewer before being treated and returned as RO permeate, the discharge will have no net negative effect on compliance with condition 6a or 6b of the consent.

Because the discharge of RO reject will have no net hydraulic impact on the Army Bay wastewater treatment plant, and is treated by membrane bioreactor prior to discharge, there will be a small net improvement in UV transmissivity of the wastewater, therefore resulting in either no, or a small positive impact on compliance with Condition 6c.

7. Treated wastewater discharges from the existing Army Bay Wastewater Treatment Plant shall be equal to or less than the limit specified for that parameter as set out in Table 1 below. The collection of treated wastewater samples shall occur weekly (using a 24-hour composite sample) and take place following treatment and prior to discharging to the outfall pipeline.

Table 1: Short Term Treated Wastewater Quality Standards

Parameter	Units	Median limit[1]	92^{nd} percentile limit[2]
Carbonaceous Biochemical Oxygen - Day Demand (cBOD5)	mg/L	20	35
Total Suspended Solids (TSS)	mg/L	35	75
Ammoniacal - N (NH4-N)	gN/m^3	15	n/a

Note:

1. *The median limit shall be based on a rolling 12-month period using the weekly sample results.*
2. *The 92^{nd} percentile shall be calculated annually using a rolling 12-month period as a concentration based on 11 out of 12 monthly samples meeting the stipulated limit.*

Because the proposed discharge will typically be cleaner than the limits listed in Condition 7 in and of itself, and due to the fact that there will be a net reduction of these contaminants in the influent to the Army Bay treatment plant resulting from the extraction and treatment of raw sewage from the network before returning it as RO Reject (Table 6), the discharge will have a net positive effect on compliance with Condition 7. While high levels of sodium chloride in sewage can impact settling in activated sludge (and therefore SBR) type treatment processes, the proposed discharges is only expected to result in an increase of approximately 25mg/L of sodium chloride in the feed to the treatment plant which is not sufficient to have a detectable impact on either biological processes or sludge settling characteristics in the treatment plant.

Standards - Long Term Discharges

9. Clauses (a) to (f) of this condition, and Conditions 0 and 11, below apply to the long- term operation of the Army Bay WWTP following the staged upgrades to the WWTP:

Stage 1

(a) Prior to the Average Dry Weather Flows into the Army Bay Wastewater Treatment Plant (WWTP) reaching 13,500 m^3 per day, the Consent Holder shall commission sufficient upgrades at the Army Bay WWTP to meet the Stage 1 discharge quality standards outlined in Table 3 below;

(b) Under the Stage 1 operations, the discharge volume from the wastewater treatment system to the coastal marine area shall not exceed the flow rates outlined in Table 4 below.

Because an equivalent additional volume of raw sewage will be drawn out of the sewer before being treated and returned as RO permeate, the discharge will have no net negative effect on compliance with condition 9 of the consent, or the timing by which the trigger level of 13,500m^3/day ADWF is reached. Moreover, the point of the proposed RO Reject discharge is to allow temporary on-site treatment and disposal of larger flows from the catchment to specifically help defer triggering of Condition 9 of this consent.

Table 3: Treated Wastewater Quality Standards from the Staged Upgrades to the Army Bay WWTP.

Parameter	Units	Stage 1		Stage 2		Stage 3	
		Median 1	92 %ile2	Median 1	92 %ile2	Median 1	92 %ile2
Carbonaceous Biochemical Oxygen Demand (cBOD5)	g/m³	5	20	5	20	5	20
Total Suspended Solids (TSS)	g/m³	15	30	15	30	5	20
Total ammonia - N	g N/m3	5	15	5	15	5	15
Total Nitrogen	g N/m3	15	30	10	20	10	20

Note:

1. *The median limit shall be based on a rolling 12-month period using the weekly samples results.*
2. *The 92nd percentile shall be calculated annually, using a rolling 12-month period, as a concentration based on 11 out of 12 monthly samples meeting the stipulated limit.*

Table 4: Treated Wastewater Discharge Volumes from the Staged Upgrades to the Army Bay WWTP.

Flow Type	Stage 1	Stage 2	Stage 3
Average Dry Weather Flow	22,500 m3/d	31,500 m3/d	42,410 m3/d
Peak Dry Weather Flow	65,400 m3/d	92,000 m3/d	129,000 m3/d
Maximum Instantaneous Flow (Peak Wet Weather Flow)	1,010 L/s	1,417 L/s	1,964 L/s

Condition 9, Table 3 of the discharge consent sets out the treatment limits that must be reached once condition 9 is triggered. Condition 9, Table 4 sets out the flow limits of the consent once Condition 9 is triggered. As this discharge is temporary in nature and will be discontinued once the Stage 1 upgrade is complete, the discharge of RO Reject to the network will have no negative impact on compliance with any of the Stage 1 or subsequent treatment or flow limits set out in Condition 9.

Conditions 10 – 12 also only apply once the Stage 1 and subsequent upgrades are triggered and therefore do not apply to this temporary discharge.

16. The Consent Holder shall ensure that no new trade, industrial, non-domestic or other strong wastes shall be permitted to be received into the existing or upgraded Wastewater Treatment Plant except in accordance with the Trade Waste Bylaw / Te Ture a Rohe Waiparui a Mahi 2013 or any Operative Trade Waste By-law that may supersede this.

To maintain compliance with Condition 16 of the discharge consent, the applicant seeks to apply for a tradewaste consent in accordance with the Trade Waste Bylaw / Te Ture a Rohe Waiparui a Mahi 2013. For this purpose a comparison of the expected composition of the discharge against the trade waste controls 2019 is presented above.

Emerging Contaminants Risk Assessment - Long Term Discharges

22. The Consent Holder shall engage a suitably qualified person to undertake an Emerging Contaminants Risk Assessment of the treated wastewater from the upgraded Army Bay Wastewater Treatment Plant (WWTP) within six months of each upgrade becoming operational and subsequently at five yearly intervals thereafter following the Stage 3 upgrade. The Emerging Contaminants Risk Assessment shall as a minimum include:
    a. A review of changes in the state of knowledge of emerging contaminants relevant to the WWTP either since the assessment of emerging contaminants included in the Application for these consents or the previous Emerging Contaminants Risk Assessment, whichever is more recent.
    b. Identification of any new or changed emerging contaminants which need to be included in this Emerging Contaminants Risk Assessment.
    c. Measurement of any new or changed emerging contaminants identified in Condition 22(b).
    d. An assessment of the risks to the environment from all emerging contaminants in the treated wastewater discharged from the upgraded WWTP.
23. The Emerging Contaminants Risk Assessment shall be forwarded to the Auckland Council by 30 September of each year that it is required for certification that it meets the requirements of Condition 22.

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In order to aid Watercare in compliance with Condition 22c, the applicant will carry out baseline monitoring of CECs in the sewer catchment of the RO plant in accordance with Condition 22a and b, and once the RO system is operational conduct an analysis of partitioning of the compounds identified in Condition 22a and b into the RO reject stream.

Air Quality Management Conditions

24. The Consent Holder shall ensure that all processes on site are operated, maintained, supervised, monitored and controlled to ensure that emissions to air authorised by this consent are maintained at the minimum practicable level.
25. Beyond the boundary of the site, there shall be no odour or dust caused by discharges from the site which, in the opinion of an enforcement officer, is noxious, offensive or objectionable.
26. All processes on site shall be operated in accordance with the certified Odour Management Plan submitted in accordance with Condition 30 of this consent.
27. All sludge removal from the storage ponds, and the subsequent de-watering and disposal, shall be carried out in a manner that minimises odour to the extent practicable.
28. No discharges from any activity on the site shall give rise to visible emissions, other than water vapour, to an extent which, in the opinion of an enforcement officer, is noxious, offensive or objectionable.
29. No later than one month following the implementation of the Stage 1 upgrades to the Wastewater Treatment Plant, the Consent Holder shall install and operate a meteorological monitoring station to measure wind speed, wind direction, temperature and rainfall at the site. The monitor shall continuously log these meteorological conditions in real-time so that the readings are available to site staff and be of a type and in a location agreed to by the Auckland Council.

The reduction in organic load in the influent to Army Bay treatment plant from removing flow from the sewer and treating it in an MBR before returning it to the sewer as RO reject will result in a minor reduction in risk of odour from the site resulting due organic overloading of the treatment plant, therefore having a very slight positive impact on compliance with Air Quality Management Conditions.

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Conclusion

Because the discharge of RO reject to sewer from the proposed onsite treatment plant at Milldale includes the extraction of an equivalent volume of raw sewage from the sewer network and treatment via a highly advanced Membrane Bioreactor (the same technology proposed for the stage 1 and subsequent upgrades of the Army Bay treatment plant), prior to discharging this flow back to the sewer as RO reject, the discharge is expected to have a net positive impact on the operation and consent compliance of the Army Bay sewage treatment plant.

While concentrated salts and other corrosive compounds in the wastewater such as chloride and sulphate can have detrimental effects on the network and treatment plants, concentrations of these compounds in the network are expected to be well below the levels required to impact asset life. The expected sulphate concentration in the RO Reject discharge is expected to be 200mg/L which is significantly lower than the 500mg/L limit in the Trade Waste Controls 2019 implemented to prevent concrete corrosion due to attack of the interstitial material in concrete or any operational effect at the Army Bay treatment plant.

The chloride concentration in the network is not limited by the Tradewaste Controls 2019, but is expected to peak at 380mg/L at the point of discharge, reducing to 266mg/L at the Army Bay Treatment Plant, only around 16mg/L above expected baseline values in domestic sewage. This will ensure that the discharge has no negative effect on the network or treatment plant.

While high levels of sodium chloride in sewage can impact settling in activated sludge (and therefore SBR) type treatment processes, the proposed discharges is only expected to result in an increase of approximately 25mg/L of sodium chloride in the feed to the treatment plant which is not sufficient to have a detectable impact on either biological processes or sludge settling characteristics in the treatment plant.

This analysis confirms that the proposed discharge will not negatively impact the capacity or durability of the network or treatment plant, health and safety of operators and maintenance staff, or compliance under the current discharge consent.