Environmental Consultants

Auckland Surf Park Community – Stage 2

Wastewater Discharge Assessment

Prepared for: AW Holdings 2021 Ltd

January 2026

DOCUMENT CONTROL AND REVISION HISTORY

Document title	Auckland Surf Park Community – Stage 2
	Wastewater Discharge Assessment
Prepared for	AW Holdings 2021 Ltd
Version	Final 1
Date	27 January 2026
Document number	10034-014-1

Version	Issue date	Document number
Draft A	22 December 2025	10034-014-A
Draft B	23 January 2026	10034-014-B
Final 1	27 January 2026	10034-014-1

Author(s)	
	Amanda Good
	Environmental Scientist
Reviewer(s)	
	Dr Grant Allen
	Director | Lead Environmental Scientist

Reference: Viridis 2026. Auckland Surf Park Community – Stage 2 Wastewater Discharge Assessment. A report prepared for AW Holdings 2021 Ltd by Viridis Limited. January 2026.

Cover photo: The proposed Auckland Surf Park Community development site, pictured in July 2025 from 105 Lascelles Drive, Dairy Flat.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

1 STATEMENT OF QUALIFICATIONS AND EXPERIENCE

Amanda Good (Author)

I am an Environmental Scientist employed by Viridis Limited (Viridis), a New Zealand-based environmental and ecological consultancy. Viridis specialises in the provision of environmental monitoring, assessment of environmental effects, and regulatory compliance services. I have been employed by Viridis since February 2023.

I hold a Bachelor of Engineering (Honours) degree in Chemical and Materials Engineering from the University of Auckland, which I completed in 2019. I am a full member of the Environmental Institute of Australia and New Zealand (MEIANZ).

I have approximately five years of professional experience in the environmental consulting field. My professional experience includes the assessment, monitoring, interpretation, and reporting of water quality and environmental data across a range of sectors, including mining, manufacturing, local government, and residential development. I have prepared and reviewed water quality assessments and contributed to Assessments of Environmental Effects for resource consent applications, including projects currently undergoing assessment under the Fast-track Approvals Act 2024. My work has included the evaluation of surface water and stormwater discharges, ecotoxicity considerations, and the assessment of potential effects on receiving environment.

I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand’s Code of Conduct for Expert Witnesses Practice Note 2023.

Grant Allen (Reviewer)

I am a Director and Lead Environmental Scientist at Viridis. I have been employed at Viridis since December 2022.

I hold a Doctor of Philosophy (PhD) in Chemistry and am a full member of the Environmental Institute of Australia and New Zealand (MEIANZ) and the Royal Society of New Zealand (MRSNZ).

I have approximately 20 years’ experience in environmental consulting, having commenced my consulting career in 2007. During this time, I have worked across the mining, natural resources, power generation, industrial, and government sectors, providing technical leadership, environmental advice, and expert review services.

My professional experience includes the management and delivery of complex environmental monitoring programmes, the preparation and review of Assessments of Environmental Effects, and leadership of multidisciplinary teams supporting resource consent applications. I have overseen and reviewed assessments relating to wastewater discharges, stormwater discharges, water abstractions, leachate, and silt pond discharges, with a particular focus on effects on receiving environments and compliance with consent conditions.

In my role as reviewer of this report, I have provided senior technical oversight and quality assurance. My review has focused on the appropriateness of the methodologies applied, the robustness of the assessment undertaken, and the validity of the conclusions reached.

I confirm that, in my capacity as reviewer of this report, I have read and abide by the Environment Court of New Zealand’s Code of Conduct for Expert Witnesses Practice Note 2023.

2 INTRODUCTION

AW Holdings 2021 Limited Partnership (AW Holdings) is developing a surf park and associated facilities at several properties located alongside Dairy Flat Highway ('the site'). A private, on-site wastewater treatment plant (WWTP) is proposed to service the development. Wastewater will be treated through a membrane bioreactor (MBR) followed by two stages of reverse osmosis (RO), then discharged to land via an infiltration bed and various irrigation areas. Water discharged to the infiltration bed is expected to ultimately reach an unnamed tributary of the Rangitōpuni Stream, which runs through the site (Figure 1). For the reasons outlined under Section 2.2, irrigated flows are not expected to reach the unnamed stream and, as such, do not form part of this assessment.

To support a substantive application for Stage 2 of the project under the Fast-track Approvals Act 2024 (FTAA), AW Holdings engaged Viridis Limited (Viridis) to assess the potential effects of the proposed WWTP discharge on the receiving environment. To support the assessment, Viridis undertook a baseline monitoring survey of the Rangitōpuni Stream tributary and modelled the downstream effects of projected contaminant loads. This report presents the results of receiving-water modelling for three discharge scenarios (representative of summer low-flow, average, and peak wet-weather conditions) and interprets these results in the context of the stream's baseline ecological condition. Proposed ecological monitoring conditions are also outlined to verify effects and support adaptive management. This report is intended to be read in conjunction with the Ecological Impact Assessment (EcIA) prepared by Viridis (2025).

VIRIDIS
Environmental Consultants

Figure 1. Site overview and monitoring sites.

Auckland Surf Park Community - Stage 2

Legend

- Monitoring sites
- Streams
- Site boundary

SOURCES

Nearmaps Aerial Imagery (2025)

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information should be independently verified on site before taking any action.

SCALE **1:3,000** @ A4

PROJECT NO.	10034
DRAWN BY:	A.G.
DATE:	23 Jan 2026

3 METHODOLOGY

3.1 Baseline Survey

3.1.1 Overview

To evaluate the baseline condition of the main environmental receptor for the discharge, Viridis undertook a survey of the unnamed tributary of the Rangitōpuni Stream on 17 September 2025. Three representative sites were selected for in-stream habitat assessment, water quality monitoring and invertebrate sampling. These sites are described in Table 1 and presented in Figure 1. The monitoring sites were chosen based on the proposed location of the WWTP infiltration bed (Figure 1).

Table 1. Location and site description for each monitoring site.

Site	Type	Description
US01	Control	Situated within the main tributary branch, approximately 400 m upstream of its confluence with the main stem.
Trib	Control	Located on the tributary's northern branch, approximately 50 m upstream of its confluence with the main stem.
DS01	Impact	Situated approx. 50 m downstream of the stream's confluence with the northern branch.

A more detailed description of the monitoring activities undertaken at each site are provided in Sections 2.1.2 through 2.1.4.

3.1.2 In-stream habitat assessment

At each monitoring site, a survey reach of approximately 50 m was established. Estimates of in-stream habitat characteristics included measurements of water depth, channel width, streambed substrate composition, riparian shading and hydrological heterogeneity. The species of aquatic flora (i.e., periphyton or macrophytes present (if any) was noted.

3.1.3 Water quality

Spot measurements of dissolved oxygen (DO), water temperature, specific conductance (conductivity at 25 °C) and pH were recorded at each site using a calibrated hand-held meter.

In addition to in-situ measurements, a water quality sample was collected from each monitoring site and stored on ice, in a chilly bin, before being sent to an IANZ accredited laboratory for analysis of physicochemical parameters, nutrient concentrations, microbiological indicators, and suspend solids.

3.1.4 Macroinvertebrate sampling

Sampling

The semi-quantitative' kick-net sampling method (NEMS 2022) was generally followed. A composite sample was collected using a kick net (400 mm wide, 0.5 mm mesh), with sampling actions adapted to the local substrate and habitat types present. This included jabbing or sweeping the net through bank margins, edge vegetation, or macrophytes, and lightly disturbing soft substrates immediately upstream of the net to dislodge organisms. Each sampling action was followed by cleaning sweeps of the water column to collect dislodged organisms.

Substrates were sampled in proportion to their prevalence along the reach, with sampling undertaken at multiple locations within the survey reach. All samples were preserved in 70% ethanol for later identification and inventory.

Analysis

Benthic macroinvertebrates were identified and counted to a level suitable for calculating taxa richness, abundance, EPT taxa richness and % EPT, macroinvertebrate community index (MCI) and quantitative MCI (QMCI) following protocols outlined in NEMS (2022). EPT is the number of taxa that belong to the Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxonomic groups.

Taxa richness is a measure of the number of invertebrate taxa in a sample. In general, watercourses that support a high number of invertebrate taxa are more likely to be of a higher environmental quality than watercourses with few taxa present. However, interpretation of taxa number data as an environmental indicator is dependent on the pollution sensitivity or tolerance of taxa present.

Abundance is a measure of the total number of invertebrates in a sample. Invertebrate abundance tends to increase in the presence of organic or nutrient enrichment and decreases in the presence of toxic contaminants.

EPT taxa are generally sensitive to changes in water and habitat quality[1]. Percent EPT (%EPT) is a measure of the proportion of EPT taxa making up the community. EPT and % EPT values can provide a good indication of stream health, with high values indicating good water/habitat quality and low values indicating poor water/habitat quality.

The MCI and QMCI are biological indices that are based on species indicator scores between 1 and 10, which are assigned to each taxon based on their sensitivity to organic enrichment. Different indicator scores have been developed for hard-bottom (stony riffle) and soft-bottom (fine-sediment/silt dominated) stream habitats, recognising that community composition and tolerance patterns differ between these habitat types. Accordingly, the soft-bottom variants of these indices (MCI-sb and QMCI-b) were used for this assessment to reflect the fine-sediment streambed of the Rangitōpuni tributary.

MCI scores are based on presence/absence data, while the QMCI incorporates abundance data. Higher MCI and QMCI indicate better habitat and water quality. Scores were compared to the attribute bands and national bottom line (NBL) defined in the National Policy Statement for Freshwater Management 2020 (NPS-FM) (MfE 2024). The relevant NPS-FM attribute bands and NBLs are reproduced in Table 2.

Table 2. NPS-FM estimates of stream health using MCI and QMCI indices.

NSP-FM attribute band	Description	Numeric attribute ranges	
		MCI	QMCI
A	Pristine conditions	>130	≥6.5
B	Mild pollution	≥110 and <130	≥5.5 and <6.5
C	Moderate pollution	≥90 and <110	≥4.5 and <5.5
National bottom line		90	4.5
D	Severe pollution	<90	<4.5

[1] The caddisflies Oxyethira and Paroxyethira are not sensitive to nutrient enrichment so are excluded from EPT calculations.

3.2 Surface Water Quality Modelling

3.2.1 Overview

Receiving water flows in the unnamed stream are expected to vary through the year due to seasonal changes, as will wastewater volumes generated by the development. To represent this variability, three discharge scenarios were modelled to capture the anticipated range of operational and hydrological conditions. These scenarios are representative of summer low-flow, average, and peak wet-weather conditions.

Employing a mass balance approach, the resulting water quality of the stream in each discharge scenario was estimated with the following equation:

$$Donwstream\ concentration = \frac{(Stream\ flow\ \times\ Background\ concentration) + (Discharge\ \ flow\ \times Discharge\ concentration)}{Stream\ flow + Discharge\ flow}$$

3.2.2 Assumptions and Limitations

The surface water quality modelling was based on the following assumptions and limitations:

- Treated discharge flow estimates were provided by Lamason (2025), based on the capacity of the site's accommodation precinct, surf lagoon, village centre, work terraces, data centres and three residential neighbourhoods (Table 3). Under Scenario 3, peak wet weather flows were modelled as the average flows diluted by a factor of 1.2 (Apex 2025), with the dilution water assumed to be of a quality equivalent to that of the unnamed tributary.
- Discharge quality weas presumed to be consistent irrespective of discharge scenario and based on the median output quality quantified by Apex (2025) for combined MBR and two-stage RO treatment (Table 4).
- Under each scenario, the flow distribution between the infiltration bed and irrigation areas were assumed to be 85% to 15%, respectively. These flow distributions were informed by the WWTP design (Apex 2025), and the assimilative capacity of the unnamed tributary.
- All water discharged to the infiltration bed was assumed to eventually reach the stream.
- The RO reject stream, and a portion of treated flows, are proposed to be managed by irrigation (Apex 2025). Irrigation is proposed to be applied at sustainable agronomic rates consistent with soil infiltration capacity, slope, and vegetation demand. On this basis, irrigated flows are assumed to be retained within the root zones or soil profile, with no overland runoff or subsurface drainage recharging the unnamed stream. This assumption is conditional on irrigation being designed, operated, and maintained in accordance with the proposal and specialist recommendations. A separate investigation is currently being undertaken to assess irrigation effects (J. Jubber, pers. comm., 15 January 2026).
- Stream flows under each scenario were obtained from WWLA (2025), based on simulated long-term flow statistics. These flow estimates range from 0.91 L/s (i.e., the 7-day mean annual low flow, MALF) to 127 L/s (the 90^{th} percentile flow) (Table 3).

- The effects associated with the use of the site's stream abstraction consent (WAT60429183) were not assessed. This consent allows abstraction of up to 1.75 L/s during low-flow conditions (subject to a minimum flow of 0.77 L/s), and up to 75 L/s or 40% of stream flow when flows exceed 15.6 L/s. The abstraction was excluded from the assessment on the basis that the proposed discharge will not operate concurrently with an active water take.
- The background quality of the stream was based on the water quality measured at the downstream site ('DS01') during the September 2025 survey (refer Section 3.2.3). The analysis report has been included in Appendix A. Values below detection limits were modelled as half the detection limit, as is standard practice.
- The receiving water quality was modelled for the key contaminants of most concern, where Apex was able to quantify for the discharge. As reported in Apex (2025), RO treatment provides very high removal of other constituents, including emerging organic contaminants and metals. On this basis, concentrations of these substances in the treated effluent are expected to be very low, and their potential effects on the stream were not assessed further.

The three discharge scenarios that were modelled are summarised in Table 3, together with the corresponding stream flow conditions.

Table 3. The three modelled scenarios and corresponding discharge and stream flows.

Scenario	Description	Discharge		Unnamed stream	
		Total flows (L/s)	Directed to infiltration bed (L/s)	Statistic	Flow (L/s)
1	Dry weather low flow	6.8	5.8	7-day MALF	0.91
2	Average weather	6.8	5.8	Median	16.5
3	Peak wet weather	8.1*	6.9*	90th percentile	127

Notes: *Allowing for a peaking factor of 1.2.

Table 4. Discharge median quality (Apex 2025).

Parameter	Concentration
Total suspended solids	4
Soluble cBOD5 (g O2/m3)	1
Escherichia coli (MPN/100 mL) *	<4
Ammoniacal nitrogen	0.11
Nitrate nitrogen	0.3
Total nitrogen	1
Dissolved reactive phosphorus	0.019*
Total phosphorus	0.019

Notes: Units g/m^3 unless stated; Values rounded to 2 significant figures; $cBOD_5$ = carbonaceous five-day biochemical oxygen demand; *based on the conservative assumption that the majority of phosphorus discharged from the WWTP will be dissolved reactive phosphorus.

3.2.3 Guidelines

Existing stream water quality and projected quality under each scenario were compared against the following guidance:

- NPS-FM attribute bands (A to E, with A representing best water quality, and lower bands showing declining quality) (MfE 2024).
- Australia and New Zealand Guideline (ANZG 2018) default guideline values (DGVs) for physicochemical stressors (based on the 80th percentile of minimally impacted reference site data).
- Ministry for the Environment (MfE 1992) guideline for soluble five-day carbonaceous biochemical oxygen demand (soluble $cBOD_5$) to limit the growth of sewage fungus.

These guideline values have been reproduced in Table 5. While such benchmarks are ideally applied to datasets spanning at least a full year to account for temporal variability (and noting the limitations of comparing guideline statistics to single baseline measurements), they have been used here as a proxy to provide context for interpreting modelled downstream effects.

Table 5. Guideline values for various water quality parameters.

Parameter	NPS-FM attribute bands[1]					ANZG DGV[2]	MfE (1992)
	A	B	C	D	E		
Total suspended solids						8.8	
Soluble $cBOD_5$ (g O_2/m^3)							2
Escherichia coli (MPN/100 mL)*	≤130	≤130	≤130	>130	>260		
Total ammoniacal nitrogen	≤0.03	>0.03 and ≤0.24	>**0.24** and ≤1.3	>1.3		0.32**	
Nitrate nitrogen	≤1	>1 and ≤2.4	>**2.4** and ≤6.9	>6.9		0.065	
Total nitrogen						0.292	
Dissolved reactive phosphorus	≤0.006	>0.006 and ≤0.01	>0.01 and ≤0.018	>0.018		0.014	
Total phosphorus						0.024	

Notes: Units are g/m^3 unless stated otherwise; Values in **bold** indicate the national bottom line, where applicable; [1]as an annual median, unless stated otherwise; [2]physical or chemical stressors, for the 80th %ile, unless stated otherwise and are based on the unnamed tributary's river environment classification (REC) of a warm wet, low elevation stream (Whitehead & Brooker 2020); *assessed against numeric attribute band for median concentrations, based on risk of *Campylobacter* infection for human contact. Whether values fell within Bands A-B determined based on other metrics – refer MfE (2024); ** toxicant DGV for 99% species protection.

4 EXISTING ENVIRONMENT

4.1 Rangitōpuni Catchment

The Rangitōpuni Stream lies in a low-gradient rural valley north of Auckland, draining west and south from the Dairy Flat plateau toward its tidal arm in the Upper Waitematā Harbour. The catchment spans approximately 8,370 ha, of which the predominant land use is rural residential living and pastoral farming (LAWA 2025). As with many agricultural landscapes, dominant pressures on stream condition include nutrient enrichment and fine-sediment delivery from grazed paddocks, stock access, and modified drainage networks that can intensify runoff responses during rainfall events. These rural stressors occur alongside an evolving planning context: parts of Dairy Flat are identified for staged future-urban growth, meaning increases in impervious area and new stormwater inputs are likely over time.

4.2 Unnamed Tributary of Rangitōpuni Stream

4.2.1 Habitat description

Approximately 14 km upstream of the Rangitōpuni Inlet, an unnamed tributary of the Rangitōpuni Stream intersects the proposed surf park development site at 1350 Dairy Flat Highway. The tributary is fed by several small headwater branches draining adjacent residential and rural properties to the north and east. One branch flows through properties along Lascelles Drive before converging with the main channel, which traverses the site from east to west. The tributary then passes through a road culvert beneath Dairy Flat Highway and discharges into the Rangitōpuni Stream approximately 100 m downstream of the culvert.

As described in Viridis (2025), the tributary exhibits clear evidence of extensive historical modification, including channel deepening and straightening, likely undertaken to improve drainage associated with the site's former pastoral land use. At the time of the site visit, representative sites within the main channel were found to be soft-bottomed, dominated by silt-sand and clay substrate. The watercourse was relatively shallow (<0.2 m), narrow (<1 m) and slow flowing. The stream had limited hydrological heterogeneity, consisting of only run habitat, of relatively uniform depth and velocity. Riparian vegetation was limited to exotic species and shrubs, which offered moderate to high shading to some reaches (Figure 2). Macrophyte growth was present at all sites, with species such as willow weed and buttercup observed. Some periphyton growth was also observed, including occasional short brown filamentous algae at sites US01 and DS01, and long green filamentous algae in the northern branch (Trib). In general, the water at each site was murky, and evidence of sediment deposition was noted.

4.2.2 Flows

A water level sensor was installed in the unnamed tributary in June 2023, approximately 20 m downstream of DS01. Based on a recent flow gauging event, long-term flow estimates indicate the stream flow is highly variable and "flashy", with flows rising rapidly in response to rainfall events and a strong seasonal signal (WWLA 2025). Baseflows are typically low over summer, aside from short-lived storm peaks, while winter periods show more sustained flows. To capture the range of hydrological conditions expected within the stream, the flow statistics summarised in Table 3 were adopted for the receiving water quality assessment.

a) b) c)

Figure 2. The unnamed tributary, facing upstream from the bottom of the survey reach at sites a) US01 b) Trib and c) DS01.

4.2.3 Water quality

A summary of spot water quality measurements and laboratory analyses for samples collected during the September 2025 survey are presented in Table 6. The full analytical report has been included as Appendix A. The key findings from the water quality data were:

- pH was circumneutral across all sites and within the range generally considered protective of New Zealand freshwater biota (6.5–8.0) (Davies-Colley *et al.* 2013).
- Water temperature at all sites was well below the 24°C threshold identified by Davies-Colley *et al.* (2013) for New Zealand freshwater fauna.
- DO concentrations were within NPS-FM attribute bands A or B (for a 1-day minimum), with the highest concentration recorded at the downstream site. Concentrations within these bands indicate oxygen conditions are generally suitable to support aquatic life, with no more than occasional minor stress expected for fish and macroinvertebrates.
- Specific conductance (i.e., conductivity at 25 °C) was elevated, particularly at the downstream site, where values were well above the 95th percentile of 2005 medians reported for the National River Water Quality Network (NRWQN)[2] (MfE 2006). Although Auckland Council has reported elevated conductivity at its Rangitōpuni River monitoring site (AC 2023), the magnitude of elevation recorded during the September survey is atypical. The field result may have been influenced by

[2] The NRWQN is a long-running national monitoring network (operating since 1989) that samples a selection of rivers across New Zealand to provide an assessment of state and trends in river water quality at the national scale.

suspended fine sediment at the time of sampling and/or increased dissolved ion concentrations arising from catchment inputs.

- Soluble five-day carbonaceous biochemical oxygen demand ($cBOD_5$) concentrations were below the laboratory limit of detection at each site, indicating minimal risk of oxygen depletion or sewage fungus growth.
- Turbidity and total suspended solids (TSS) were elevated, reflecting the site's pastoral land-use, with TSS exceeding the ANZG DGV for the relevant REC class (Whitehead & Brooker 2020). This result was consistent with visual observations of high sedimentation (refer Section 3.2.1).
- Microbiological indicators were elevated across the catchment, particularly at the northern branch, consistent with nearby animal inputs. *Escherichia coli (E. coli)* counts met NPS-FM attribute band E (Red), indicating a high human health risk.
- Total nitrogen in the stream was largely present in organic forms, particularly at the upstream site. This is indicated by TKN comprising a large proportion of total nitrogen, combined with low ammoniacal nitrogen concentrations, suggesting nitrogen inputs are primarily associated with dissolved organic matter (e.g., decaying vegetation or animal wastes).
- Ammoniacal nitrogen fell within NPS-FM attribute band A at US01 and Trib, and within band B for at DS01. For the downstream extent, this indicates potential effects for up to 5% of sensitive species (MfE 2024). However, concentrations at all sites complied with the ANZG toxicant DGV of 0.32 g/m^3 for 99% species protection.
- Nitrate nitrogen concentrations for each site were within NPS-FM attribute band A, indicating that nitrate is not a key driver of ecological effects at the reach scale (considered a 'high conservation value system' under the NPS-FM). However, concentrations exceeded the more conservative ANZG DGV for nitrate as a physicochemical stressor.
- Phosphorus in the stream was predominantly present in particulate forms. However, dissolved reactive phosphorus (DRP), the most bioavailable form of phosphorus, comprised a substantial proportion of total phosphorus, accounting for up to half at the upstream site. At all sites, DRP fell within NPS-FM attribute band D and exceeded the ANZG DGV. At such concentrations, ecological communities are expected to be impacted by substantial phosphorus enrichment (MfE 2024).

Overall, while some spatial variability was evident, the water quality sampling undertaken in September 2025 indicates that the baseline receiving environment condition is generally poor, particularly in relation to microbiological indicators and phosphorus, consistent with its pastoral/rural setting.

4.2.4 Macroinvertebrate community

The macroinvertebrate community provides an integrated indicator of the stream's ecological condition over time. The results of the macroinvertebrate sampling in the Rangitōpuni Stream tributary are summarised in Table 7, with raw taxonomic data provided in Appendix B.

The benthic community was dominated by pollution-tolerant taxa, particularly freshwater snails with low soft-bottom indicator scores (e.g., *Physa*, *Gyraulus* and *Potamopyrgus*). EPT taxa were limited to a single taxon (*Acroperla*), recorded only at the downstream site and in low relative abundance. The dominance of hardy grazing taxa, and the near-absence of sensitive EPT groups are characteristic of lowland, slow-flowing streams subject to organic enrichment and fine-sediment habitat conditions typical of pastoral catchments. MCI-sb and QMCI-sb scores at all sites fell within NPS-FM attribute band D for ecosystem health, below the NPS-FM NBL. Band D reflects environments subject to severe organic pollution or nutrient enrichment, with communities dominated by taxa insensitive to such stressors (MfE 2024). Overall, the macroinvertebrate results indicate a degraded ecological condition, consistent with the poor water-quality conditions identified in Section 3.2.3.

Table 6. Water quality at sites within the unnamed tributary of the Rangitōpuni Stream.

Parameter	Monitoring site		
	US01	Trib	DS01
In-situ measurements			
pH	6.6	6.6	6.9
Temperature (°C)	13.4	14.2	14.7
Dissolved oxygen (g/m^3)	5.6	6.1	8.3
Dissolved oxygen (%)	54	60	82
Specific conductance (µS/cm)*	481	317	718
Laboratory analysis			
Turbidity (NTU)	10.9	12	12.7
Total suspended solids	8	12	13
Soluble $cBOD_5$	< 2	< 2	< 2
Enterococci	81	46	70
Faecal coliforms	1,300	9,200	5,400
Escherichia coli	1,300	9,200	5,400
Total Kjeldahl nitrogen	1.2	0.72	0.79
Total ammoniacal nitrogen	0.019	0.027	0.111
Nitrite nitrogen	0.003	0.003	0.016
Nitrate nitrogen	0.035	0.141	0.23
Total nitrogen	1.24	0.86	1.04
Dissolved reactive phosphorus	0.045	0.017	0.019
Total phosphorus	0.093	0.058	0.063

Notes: All units are in g/m^3 unless state otherwise; $cBOD_5$ is five-day carbonaceous biochemical oxygen demand; *conductivity at 25°C.

Table 7. Macroinvertebrate results for the unnamed tributary of the Rangitōpuni Stream.

Parameter	Monitoring site		
	US01	Trib	DS01
Abundance	33	56	106
Taxa richness	9	10	7
EPT taxa richness	0	0	1
% EPT abundance	0%	0%	5%
% EPT taxa	0%	0%	14%
MCI-sb	54	53	51
MCI NPS-FM attribute band	D	D	D
QMCI-sb	1.9	2.1	1.6
QMCI NPS-FM attribute band	D	D	D

Notes: EPT is the number of taxa that belong to the Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxonomic groups, which are generally more sensitive to changes in water and habitat quality.

5 ASSESSMENT OF EFFECTS

5.1 Receiving Water Quality Assessment

The results of surface water quality modelling are presented in Table 8, alongside the baseline water quality of stream, as measured at DS01, and the expected median quality of treated wastewater. The resultant tributary water quality under each scenario was compared against the guidance outlined in Section 2.2.3. Cells in Table 7 have been shaded to illustrate which of the NPS-FM attribute bands a scenario falls within. Exceedances of an ANZG DGV (or, in the case of soluble $cBOD_5$, MfE guidance for preventing sewage fungus growth) have been shown in red text, and compliance has been shown in green[3].

Table 8. Input data and results of modelling under each discharge scenario.

Parameter	Baseline stream	Treated discharge quality	Tributary water quality after discharge		
			Scenario 1: Dry	Scenario 2: Average	Scenario 3: Wet
Flow (L/s)	Varies based on scenario (Table 3)		6.7	22	134
Total suspended solids	13	4	5.2	11	13
Soluble $cBOD_5$ (g O_2/m^3)	1	1	1	1	1
Escherichia coli (MPN/100 mL) *	5,400	2	740	4,000	5,200
Ammoniacal nitrogen	0.11	0.11	0.11	0.11	0.11
Nitrate nitrogen	0.23	0.3	0.29	0.25	0.23
Total nitrogen	1	1	1	1	1
Dissolved reactive phosphorus	0.019	0.019**	0.019	0.019	0.019
Total phosphorus	0.063	0.019	0.025	0.052	0.061

Notes: Units g/m^3 unless stated; Values rounded to 2 significant figures; $cBOD_5$ = carbonaceous five-day biochemical oxygen demand; Values meeting NPS-FM attribute A are presented in light green, attribute B in blue, attribute C in light orange, attribute D in light red and attribute E (where applicable) in dark red; Exceedances of an ANZG DGV for a physiochemical stressor (or, in the case of BOD, MfE guidance for preventing sewage fungus growth) have been shown in red text, and compliance has been shown in green; *compared against median concentrations, based on *Campylobacter* infection risk for human contact; **based on the conservative assumption that the majority of phosphorus discharged from the WWTP will be dissolved reactive phosphorus.

The modelling demonstrates that, across all assessed scenarios, concentrations of most contaminants are maintained at, or improved relative to, baseline stream conditions. This outcome reflects the close alignment between existing receiving water quality and the quality of the proposed treated discharge. Reductions are observed for TSS and *E. coli* and total phosphorus, indicating a net improvement with respect to key stressors.

Nitrate nitrogen is the only parameter for which an increase is predicted, and this occurs under dry weather and average flow conditions (Scenarios 1 and 2). While projected nitrate nitrogen concentrations continue to exceed the ANZG DGV for a physicochemical stressor, they remain within NPS-FM attribute band A for toxic effects. At these concentrations, the stream is classified as a high conservation value system under the NPS-FM, for which effects are considered unlikely, even for

[3] While these guidelines can help assess ecological impacts, they are best applied to comprehensive data sets rather than single data points. For example, NPS-FM Attribute Bands for annual medians should be based on the median of at least 12 data points collected over the course of a year.

sensitive species (MfE 2024). Importantly, other key drivers of eutrophication and fauna toxicity, including ammoniacal nitrogen and DRP, are predicted to be maintained.
As discussed in Section 3.2.4, the macroinvertebrate community within the tributary is strongly dominated by pollution-tolerant taxa, with MCI and QMCI scores indicative of a degraded system. While one EPT taxon was recorded at DS01, it accounted for less than 5% of total community abundance. Given this exiting community condition, and the small and temporary nature of increases in nitrate nitrogen, no adverse effects to the stream's benthic ecosystem health is expected. For the same reasons, and the absence of a step change in other key eutrophication or toxicity drivers, the discharge's effects on the stream's fish community are also expected to be negligible.

5.2 Effects of Land Use Change

The receiving-water modelling presented in Section 4.1 is intentionally conservative, in that it treats the discharge as an additional point-source input to the tributary to test worst-case instream concentrations during discharge events. For catchment-scale context, however, it is also relevant to consider the proposal as a land use change, whereby the discharge largely replaces (and is materially smaller than) the diffuse nutrient losses historically generated from the site under pastoral use.

Until recently, at least 40 ha of the development site, draining to the Rangitōpuni tributary, was used for beef grazing, stocking up to 100 cattle (Jubber 2025). Using national average export coefficients (Monaghan *et al.* 2021a) and conservative assumptions for land-retirement effects (Monaghan *et al.* 2021b), the site's former land use is estimated to have contributed approximately 480 kg N/year and 32 kg P/year to surface waters[4]. By comparison, the proposed discharge under typical conditions (Scenario 2; excluding effects of irrigation) is modelled to contribute approximately 181 kg N/year and 3.4 kg P/year. Considered in this context, the proposal represents a net reduction in nutrient loading to the tributary and downstream catchment, particularly for phosphorus.

Given the discharge is to a small headwater tributary, additional downstream attenuation (uptake, sedimentation, and in-stream assimilation) is expected prior to confluence with the Rangitōpuni Stream and ultimately the Upper Waitematā Harbour. Accordingly, the proposal is not expected to contribute to cumulative nutrient effects within the wider catchment and instead represents an improvement relative to baseline land use conditions.

[4] Presumed to be total nitrogen and total phosphorus loads.

6 PROPOSED CONSENT CONDITIONS

AW Holdings proposes to implement ecological and water quality monitoring conditions to as part of its consent, to provide a verification and adaptive-management framework. These conditions are intended to verify discharge effects remain consistent with predictions, enabling early detection of any unforeseen changes, and requiring an appropriate management response where necessary. Accordingly, AW Holdings proposes the following conditions for inclusion in the consent:

- The consent holder must undertake water quality monitoring and ecological surveys at the following locations[5] within the unnamed tributary of the Rangitōpuni Stream:
    - A control site, 'US01', situated at least 100 m upstream from the infiltration bed discharge.
    - A second control site, 'Trib' situated approximately 50 m upstream of the northern stem's confluence with the main channel on site.
    - An impact site, 'DS01', situated approximately 50 downstream the northern stem's confluence with the main channel.

  Monitoring should be undertaken by a suitably qualified ecologist or environment scientist.
- Surface water quality sampling shall be undertaken:
    - For a period of at least 12 months prior to commencement of discharge, at quarterly intervals, to establish baseline conditions and seasonal variability.
    - At quarterly intervals following the commencement of the discharge.
    - Once the development has been operating at design capacity for a minimum of two years, the sampling frequency may be reduced to once every three years, in consultation with the Consent Authority, provided monitoring demonstrates no significant discharge-related reduction in surface water quality.
- All surface water quality samples must be tested for the following parameters:
    - pH
    - Total suspended solids
    - Total ammoniacal nitrogen
    - Nitrate-nitrogen
    - Total nitrogen
    - Dissolved reactive phosphorous
    - Total phosphorous
    - *Escherichia coli*
    - Soluble carbonaceous five-day biochemical oxygen demand (soluble $cBOD_5$)

  Sample analyses must be undertaken by an IANZ accredited (or equivalent) laboratory.

[5] Subject to change, depending on the final discharge location.

- Ecological surveys shall be undertaken:
    - Once, prior to the commencement of the discharge, during summer.
    - Annually, following the commencement of the discharge, during summer.
    - Once the development has been operating at design capacity for a minimum of two years, the sampling frequency may be reduced to once every three years, in consultation with the Consent Authority, provided monitoring demonstrates no significant discharge-related deterioration in ecological condition.
- Each ecological surveys will include, at each monitoring site:
    - A qualitative assessment of physical habitat characteristics.
    - Collection and analysis of a composite macroinvertebrate sample.
- Where monitoring identifies a deterioration in water quality and/or ecological health that is attributable to the WWTP discharge, the Consent Holder shall:
    - Investigate the cause and extent of the deterioration.
    - Provide a report to the Council within 20 working days of becoming aware of the deterioration, including recommended actions.
    - Implement any remedial measures required to address discharge-related effects.
- Monitoring results shall be compiled, interpreted, and reported in an Annual Environmental Monitoring Report, to be submitted to the Consent Authority by each anniversary of consent commencement. The report shall include:
    - The results of ecological and surface water quality monitoring undertaken in the preceding 12-month period.
    - A comparison of these results against baseline conditions (including seasonal variability), historical monitoring and relevant guideline values.
    - As assessment of whether any observed changes are attributable to the WWTP discharge.

7 CONCLUSION

Baseline ecological investigations of the receiving environment for AW Holdings proposed discharge indicate that the unnamed tributary of the Rangitōpuni Stream is a highly modified watercourse in a degraded ecological state. The stream was characterised by fine-sediment loading, elevated phosphorus and microbiological indicators, and as a result, its macroinvertebrate community was dominated by pollution-tolerant taxa.

The results of modelling illustrate that under summer low flow, average and peak wet weather flow conditions, the proposed discharge of treated wastewater is unlikely to result in significant adverse effects on receiving water quality. The small increases in nitrate-nitrogen predicted under Scenarios 1 and 2 are not expected to cause material ecological harm, as concentrations remain within NPS-FM attribute band A, which is considered protective of most species. The receiving macroinvertebrate community is dominated by pollution-tolerant taxa and is, therefore, unlikely to respond measurably to these small nitrate increases. Potential effects on fish are likewise expected to be negligible given the limited magnitude and duration of predicted changes.

In the context of land use change, the proposal represents a net reduction in nutrient loading relative to the former pastoral use, replacing a larger diffuse source with a smaller, controlled discharge. The monitoring programme outlined in Section 5 is recommended to confirm these predictions and provide early warning of any unforeseen effects.

Overall, the proposal is expected to provide appropriate protection of receiving water quality and associated ecological values.

REFERENCES

AC 2023. River Water Quality in Tāmaki Makaurau / Auckland 2022 Annual Reporting and National Policy Statement for Freshwater Management Current State Assessment. Technical Report 2023/16. Auckland Council. July 2023.

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at: www.waterquality.gov.au/anz-guidelines.

Apex 2025. Surf Park Water and Wastewater Treatment Plant Design Report – For Consenting. A report, prepared by Apex Water Limited for AW Holdings Ltd. 28 October 2025. Revision 1.

Davies-Colley R, Franklin P, Wilcock B, Clearwater S, Hickey C 2013. National Objectives Framework - Temperature, Dissolved Oxygen & pH: Proposed thresholds for discussion. Report prepared by NIWA for Ministry for the Environment. NIWA Client Report No: HAM2013-056, November 2013.MfE 1992. Water Quality Guidelines No. 1: Guidelines for the Control of Undesirable Biological Growths in Water. Ministry for the Environment.

Jubber 2025. Re: Surf Park: Irrigation flows & groundwater modelling. An email from Jody Jubber (Inovo Limited) addressed to Amanda Good (Viridis Limited), Matt Savage (Apex Water Limited) and Jack Taylor (Apex Water Limited), copied to Scott Lamason (McKenzie & Co Limited), James Kitchen (McKenzie & Co Limited) and Grant Allen (Viridis Limited). 4 December 2025.

Lamason 2025. [#3325-2] Updated Water & Wastewater Calcs. An email from Scott Lamason (McKenzie & Co Limited) to Matt Savage (Apex Water Limited), Jack Taylor (Apex Water Limited) and Amanda Good (Viridis Limited), copied to Jody Jubber (Inovo Limited). 5 December 2025.

LAWA 2025. Rangitōpuni River. Land Air Water Aoteraroa. Retrieved from https://www.lawa.org.nz/explore-data/auckland-region/river-quality/rangitopuni-river on 17 December 2025.

MfE 1992. Water Quality Guidelines No. 1: Guidelines for the Control of Undesirable Biological Growths in Water. Ministry for the Environment.

MfE 2006. State and Trends in the National River Water Quality Network. A report prepared by the National Institute of Water and Atmospheric Research Ltd for the Ministry for the Environment. Wellington, New Zealand. November 2006.

MfE 2024. National Policy Statement for Freshwater Management 2020 - Amended in October 2024. Ministry for the Environment. Available at: https://environment.govt.nz/assets/publications/Freshwater/NPSFM-amended-october-2024.pdf.

Monaghan RM, McDowell RW, Wilcock RJ 2021a. Nitrogen and phosphorus losses from New Zealand agriculture – National estimates and management strategies. New Zealand Journal of Agricultural Research, 64(4), 510–544. https://doi.org/10.1080/00288233.2021.1936572

Monaghan RM, Smith LC 2021b. Quantifying contaminant losses to water from pastoral land uses in New Zealand: A review of recent research and future challenges. New Zealand Journal of Agricultural Research, 64(3), 365–386. https://doi.org/10.1080/00288233.2021.1876741

NEMS 2022. National Environmental Monitoring Standards Macroinvertebrates Collection and Processing of Macroinvertebrate Samples from Rivers and Streams, Version 1.0.0. National Environmental Monitoring Standards.

Viridis 2025. Auckland Surf Park Community – Stage 2 Development. Ecological Impact Assessment. Prepared for AW Holdings 2021 Ltd by Viridis Limited. 2 December 2025. Document no: 10034-010-1.

Whitehead AL, Booker DJ 2020. NZ River Maps: An interactive online tool for mapping predicted freshwater variables across New Zealand. NIWA, Christchurch. https://shiny.niwa.co.nz/nzrivermaps/4-010-1.

WWLA 2025. Auckland Surf Park Streamflow Monitoring. A memorandum, prepared by Williamson Water & Land Advisory Limited, for Inovo Limited dated 30 September 2025.

Appendix A
Water Quality Analysis Report

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Viridis Limited	**Lab No:**	3987410 SPv1
Contact:	Spencer Potbury C/- Viridis Limited PO Box 301709 Albany Auckland 0752	**Date Received:**	17-Sep-2025
		Date Reported:	25-Sep-2025
		Quote No:	139358
		Order No:	10034
		Client Reference:	
		Submitted By:	Spencer Potbury

Sample Type: Aqueous

Sample Name:		Trib 17-Sep-2025 8:30 am	US01 17-Sep-2025 9:00 am	DS01 17-Sep-2025 9:30 am
Lab Number:		3987410.1	3987410.2	3987410.3
Individual Tests				
Turbidity	NTU	12.0	10.9	12.7
pH	pH Units	6.8	6.8	7.3
Electrical Conductivity (EC)	mS/m	24.0	37.8	56.6
Total Suspended Solids	g/m^3	12	8	13
Total Nitrogen	g/m^3	0.86	1.24	1.04
Total Kjeldahl Nitrogen (TKN)	g/m^3	0.72	1.20	0.79
Total Phosphorus	g/m^3	0.058	0.093	0.063
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	g O_2/m^3	< 2	< 2	< 2
Enterococci	MPN / 100mL	46 #1	81 #1	70 #1
Faecal Coliforms and E. coli profile				
Faecal Coliforms	MPN / 100mL	9,200 #1	1,300 #1	5,400 #1
Escherichia coli	MPN / 100mL	9,200 #1	1,300 #1	5,400 #1
Nutrient Profile				
Total Ammoniacal-N	g/m^3	0.027	0.019	0.111
Nitrite-N	g/m^3	0.003	0.003	0.016
Nitrate-N	g/m^3	0.141	0.035	0.23
Nitrate-N + Nitrite-N	g/m^3	0.145	0.038	0.25
Dissolved Reactive Phosphorus	g/m^3	0.017	0.045	0.019

Analyst's Comments

Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand Soluble (cBOD5Soluble) analyses on the day that the samples arrived at the laboratory. The analyses were performed as soon as possible using appropriately stored samples.

#1 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Glass Fibre for Soluble BOD	Sample filtration through glass fibre filter.	-	1-3
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-3
pH	pH meter. APHA 4500-H^+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) : Online Edition.	3 g/m^3	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3. In-house calculation.	0.05 g/m^3	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) : Online Edition.	0.010 g/m^3	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.002 g/m^3	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m^3	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) : Online Edition.	0.002 g/m^3	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, automated phenol/hypochlorite colorimetry. APHA 4500-N_{org} D (modified): Online Edition.	0.10 g/m^3	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m^3	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m^3	1-3
Dissolved C-Biochemical Oxygen Demand ($CBOD_5$)	Filtered sample (1.2um glass fibre filter), Incubation 5 days, $CBOD_5$, DO meter, nitrification inhibitor, seeded. APHA 5210 B (modified) : Online Edition.	2 g O_2/m^3	1-3
Enterococci	MPN count using Enterolert, Incubated at 41°C for 24 hours. MIMM 12.4, APHA 9230 D : Online Edition.	1 MPN / 100mL	1-3
Nutrient Profile		0.0010 - 0.010 g/m^3	1-3
Faecal Coliforms and E. coli profile			
Faecal Coliforms	MPN count in LT Broth at 35°C for 48 hours, EC Broth at 44.5° C for 24 hours. APHA 9221 E : Online Edition.	2 MPN / 100mL	1-3
Escherichia coli	MPN count in LT Broth at 35°C for 48 hours, TBX confirmation. APHA 9221 F (modified) : Online Edition.	2 MPN / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 18-Sep-2025 and 25-Sep-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

K Harrison

Kim Harrison MSc
Client Services Manager - Environmental

Appendix B
Raw Macroinvertebrate Results

Table B1. Macroinvertebrate results for sites situated in the unnamed tributary of the Rangitōpuni Stream.

Group	Taxa	MCI-sb score	US01	Trib	DS01
Plecoptera	*Acroperla*	5.1	0	0	5
Trichoptera	*Oxyethira*	1.2	2	1	14
Coleoptera	*Liodessus*	4.9	1	2	0
Diptera	*Austrosimulium*	3.9	1	0	7
Diptera	*Chironomus*	3.4	0	3	0
Diptera	Orthocladiinae	3.2	0	7	0
Crustacea	Cladocera	0.7	1	1	0
Crustacea	Isopoda	4.5	1	0	0
Crustacea	*Paraleptamphopus*	5.5	0	3	0
Mollusca	*Gyraulus*	1.7	0	16	44
Mollusca	*Physella (Physa)*	0.1	8	14	26
Mollusca	*Potamopyrgus*	2.1	14	5	9
Mollusca	Sphaeriidae	2.9	3	0	0
Oligochaeta	Oligochaeta	3.8	2	4	1

Address | Unit A1, 72 Apollo Drive, Mairangi Bay, Auckland 0632

Post | PO Box 301709, Albany, Auckland 0752

Telephone | 64 9 475 5750

Email | contact-us@viridis.co.nz

www.viridis.co.nz