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CONSULTING ENGINEERS

BEACHLANDS SOUTH FAST-TRACK SUBSTANTIVE APPLICATION WASTEWATER CONCEPT DESIGN AND ASSESSMENT

Beachlands South
Beachlands, Auckland

BEACHLANDS SOUTH LIMITED PARTNERSHIP
June 2026 | V2

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EXECUTIVE SUMMARY

This report presents a wastewater concept design and Assessment of Environmental Effects (AEE) for the proposed Beachlands South development to support the Substantive Fast-Track application.

The development is a large-scale, staged greenfield urban development located south of Beachlands, Auckland, comprising approximately 2,000 household unit equivalents (HUEs) at full development. The development will be delivered progressively, with an initial stage of approximately 750 dwellings, two schools, and limited commercial activity. Wastewater flows will increase over time in line with development staging.

Proposed Wastewater Servicing Strategy

A staged, centralised wastewater servicing strategy is proposed. Wastewater will be collected via a communal gravity sewer network and conveyed via pump stations to a centralised treatment plant.

The proposed treatment system is a Combined Works (CW) technology developed by Raath and Associates, which integrates primary, secondary, and tertiary treatment processes within a single enclosed unit and provides high-quality effluent under varying loading conditions.

The treatment plant will be constructed and expanded in two stages:

- Stage 1: Construction of a 450 m^3/day treatment module, with treated effluent discharged to land;
- Stage 2: Expansion to an ultimate capacity of 1,383m^3/day through the installation of a second treatment module, with transition to marine discharge via a long sea outfall.

Transition to Stage 2 will be triggered when wastewater inflows reach approximately 70–80% of Stage 1 capacity.

Stage 1 – Land-Based Disposal

During Stage 1, treated wastewater will be discharged to land via a communal pressure compensating dripper irrigation (PCDI) system.

Site-specific investigations confirm soils are predominantly Category 5/6 under Auckland Council Technical Publication 58: On-site Wastewater Systems: Design and Management Manual (TP58) characterised by clay-rich soils with moderate to slow drainage. A conservative loading rate of 3 mm/day has been adopted, requiring an indicative disposal area of approximately 150,000 m^2, with additional reserve capacity.

Stage 2 – Marine Outfall

The long-term wastewater servicing strategy includes provision for discharge of tertiary treated effluent to the Coastal Marine Area (CMA) via a submerged marine outfall located within the Whitford Embayment. The marine discharge pathway has been assessed by Tonkin & Taylor (2026) through specialist marine ecological investigations and hydrodynamic modelling.

The assessment included baseline investigations of benthic ecology, sediment quality, water quality, marine habitats, fish, coastal avifauna and marine mammals, together with modelling of treated wastewater dispersion and dilution within the receiving environment.

The modelling demonstrates a high level of dilution and dispersion of treated effluent following discharge, with no accumulation of contaminants within the model domain and compliance with the relevant water quality thresholds considered in the assessment. The assessment concludes that potential effects on marine ecological values can be appropriately managed through the proposed treatment process, marine outfall design, diffuser configuration and monitoring framework.

The findings of the marine ecological assessment have informed the statutory assessment contained within this report and support the conclusion that the proposed wastewater servicing strategy represents an appropriate long-term solution for the Beachlands South development.

Assessment of Effects and Statutory Assessment

GWE has undertaken the assessment of environmental effects associated with the Stage 1 land-based discharge, addressing effects on surface water, groundwater, soils, amenity values, and public health. The Stage 2 marine discharge has been assessed by Tonkin & Taylor (T+T) through specialist marine ecological investigations and hydrodynamic modelling. GWE has prepared the statutory assessment for both Stage 1 and Stage 2, with the Stage 2 statutory assessment relying on and informed by T+T's findings on the marine receiving environment, effects, and proposed mitigation. Across both stages, any adverse effects on the receiving environment can be appropriately managed through the proposed design, monitoring, and conditions of consent, and are proportionate to the regional benefits of the project.

Key mitigation measures include:

- Tertiary treated effluent.
- Conservative loading rate.
- Suitable separation distances.
- Ongoing monitoring and management.

The detailed marine ecological assessment of the Stage 2 discharge is provided in the Tonkin & Taylor Marine Ecological Impact Assessment, the findings of which have informed the statutory assessment contained within this report.

Best Practicable Option (BPO)

A range of alternative wastewater servicing options were considered, including connection to the public network, decentralised systems, and alternative discharge pathways.

The staged approach comprising initial land-based discharge followed by a transition to marine discharge has been identified as the Best Practicable Option as it aligns infrastructure delivery with development staging, delays marine discharge until required, and provides a flexible long-term servicing solution.

Monitoring and Management

A comprehensive monitoring framework is proposed, including:

- Daily flow monitoring.
- Effluent quality monitoring.
- Soil monitoring within the disposal field.
- Surface water monitoring.
- Ongoing system performance assessment and reporting to Auckland Council.

Statutory Assessment

The proposed wastewater servicing strategy has been assessed against the Fast-Track Approvals Act 2024 (FTAA), the Resource Management Act 1991 (RMA), the Water Services (Wastewater Environmental Performance Standards) Regulations 2025 (WEPS), the National Policy Statement for Freshwater Management 2020 (NPS-FM), the Hauraki Gulf Marine Park Act 2000 (HGMPA), and the Auckland Unitary Plan – Operative in Part (AUP-OP).The staged approach is consistent with policy direction to avoid discharge to water where practicable, while providing a viable long-term solution.

Conclusion

The proposed wastewater treatment and disposal strategy provides a practical, robust, and environmentally responsible solution for the Beachlands South development.

Subject to detailed design and implementation of monitoring and management measures, the proposed approach is suitable for Fast-Track approval and consistent with sustainable management of natural and physical resources.

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1 INTRODUCTION

This report presents the wastewater concept design and assessment for the proposed Beachlands South development. It has been prepared by GWE Consulting Engineers (GWE) for Beachlands South Limited Partnership (BSLP) in support of the Substantive Fast-Track application.

This report defines the approach to wastewater collection, treatment and disposal, establishes the design basis, and assesses the environmental effects of the proposed discharges to land and the CMA. It also assesses the practicable wastewater servicing options to determine the Best Practicable Option (BPO).

1.1 Expert Witness Statement – Patrick O'Riordan

I confirm I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. I confirm that this report is within my area of expertise, except where I state that I rely upon the evidence or reports of other expert witnesses lodged forming part of the project's application material. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

I am a technical director at GWE Consulting Limited in the wastewater and environmental team. I am also a company director of GWE. I am a Chartered Professional Engineer in the area of water and environmental engineering, a Chartered Member of Engineering New Zealand, a member of Water New Zealand and a member of the Institute of Directors.

I hold a Bachelor of Engineering degree from Trinity College in Dublin, and a Post Graduate Diploma of Science from Dublin City University in the Management of Clean Technology.

1.2 Expert Witness Statement – Gareth Williams

I confirm I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. I confirm that this report is within my area of expertise, except where I state that I rely upon the evidence or reports of other expert witnesses lodged forming part of the project's application material. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

I have over twenty years' experience as a water/wastewater specialist specialising in water/wastewater infrastructure throughout the United Kingdom, Australia and New Zealand.

I am a Director and owner at GWE Consulting Engineers, having started the company in May 2011, initially specialising in on-site wastewater treatment and disposal and now providing geotechnical, stormwater and other engineering disciplines. Before that I was employed as Wastewater Manager at Andrew Stewart Ltd and Team Leader Wastewater at Beca. I oversee all water and wastewater projects within GWE.

I have a Bachelor of Science Degree in Environmental Technology from Middlesex University and a Research Masters in Water and Wastewater from Cranfield University. I am a member of Water New Zealand and previously the Chair of the WaterNZ subcommittee OWMS – On-site Wastewater Management Systems Interest Group.

1.3 Background and Context

This report has been prepared in support of a substantive application submitted by Beachlands South Limited Partnership ('BSLP') under the Fast-track Approvals Act ('FTAA'). The Project name is 'Beachlands South' and is included in Schedule 2 of the FTAA as a Listed Project with significant regional or national benefits. The Project location or Site is 110 Jack Lachlan Drive and 620, 712, 758 and 770 Whitford-Maraetai Road, Beachlands (the "Site" or the "project area").

In summary, the Project will provide for the development of live zoned land at Beachlands into a comprehensively planned and public transport focused community to achieve a well-functioning urban environment comprising residential dwellings, a hotel and conference venue, community and commercial activities, protected ecological restoration areas, walking and cycling networks, and community facilities, and enable the potential development of two schools, as well as all associated earthworks and all associated infrastructure including transport facilities, intersection upgrades and roading, telecommunications, power, and water supply, stormwater, and wastewater infrastructure (including any treatment or storage facilities, drainage, pipes, pump stations, outfalls and discharges). A portion of Future Urban zoned land will be used for wastewater management purposes.

Key elements of the Project include:

- Residential activities comprising approximately 2,000 dwellings in a variety of housing types, densities and vacant sites for future residential development.
- Establishment of a commercial local centre supported by employment opportunities within and around the periphery of the local centre and on the Whitford-Maraetai Road frontage comprising approximately 27,000 m^2 of commercial GFA and 30,000 m^2 of light industrial GFA.
- Education facilities comprising the development of both primary and secondary schools.
- Establishment of an Ecological Protected Area Network (EPAN) comprising approximately 75 hectares of land being replanted, restored, maintained and enhanced including preservation of streams and their margins.
- A series of open spaces including a suburban park, neighbourhood parks, the Fairway Reserve, golf course, esplanade reserve and riparian margins.
- Provision of public access to and along the coastal marine area and the creation of a quality coastal pathway.
- Public transport enhancements and integrations including expanded ferry passenger capacity.

- Staged road upgrades including the provision of pedestrian and cycling facilities along Jack Lachlan Drive, the upgrade of Whitford roundabout, a series of intersection upgrades.
- Establishment of infrastructure to service the project including wastewater, water supply, stormwater, telecommunications and power.

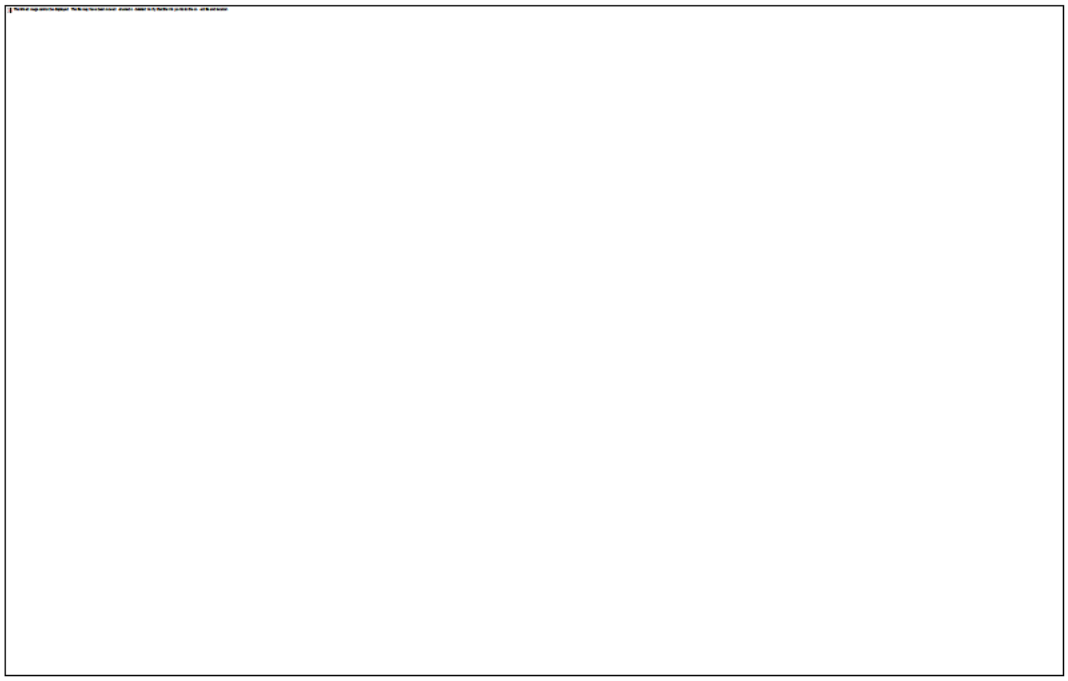

Figure 1: Site Location Plan

2 SITE DESCRIPTION

The subject site is legally described as Lot 2 DP 501271 and Lot 100 DP 504488, with recorded addresses of 110 Jack Lachlan Drive, Beachlands, Auckland, and 620, 712, 758 and 770 Whitford-Maraetai Road, Whitford, Auckland, respectively. The total site area is approximately 250 hectares consisting of the following properties listed in Table 1 below.

Table 1: Subject properties

PROPERTY ADDRESS	LEGAL DESCRIPTION
110 Jack Lachlan Drive Beachlands Auckland 2571 (Formosa Golf Resort) (170.4750 ha)	Lot 2 DP 501271
620 Whitford-Maraetai Road Whitford Auckland 2571 (79.9444 ha)	Lot 100 DP 504488
770 Whitford-Maraetai Road Whitford Auckland 2571 (6.8665 ha)	Lot 10 DP 54105
758 Whitford-Maraetai Road Whitford Auckland 2571 (6.1403ha)	Lot 9 DP 54105
746 Whitford-Maraetai Road Whitford Auckland 2571 (5.7997 ha)	Lot 8 DP 54105
740 Whitford-Maraetai Road Whitford Auckland 2571 (5.1448 ha)	Lot 7 DP 54105
732 Whitford-Maraetai Road Whitford Auckland 2571 (5.0940 ha)	Lot 6 DP 54105

PROPERTY ADDRESS	LEGAL DESCRIPTION
722 Whitford-Maraetai Road Whitford Auckland 2571 (4.9227 ha)	Lot 5 DP 54105
712 Whitford-Maraetai Road Whitford Auckland 2571 (4.7518 ha)	Lot 4 DP 54105
702 Whitford-Maraetai Road Whitford Auckland 2571 (2.1341 ha)	Lot 1 DP 208997
692 Whitford-Maraetai Road Whitford Auckland 2571 (1.7747 ha)	Lot 1 DP 197719
682 Whitford-Maraetai Road Whitford Auckland 2571 (1.2583 ha)	Lot 1 DP 187934
680 Whitford-Maraetai Road Whitford Auckland 2571 (12.8125 ha)	Lot 26 DP 504488

Topography at the site varies but generally slopes gently towards the coastal edge before dropping steeply to the Coastal Marine Area (CMA). The CMA and portions of the site are classified as Significant Ecological Areas (SEAs). There are several tributaries flowing from the site to the coast, with all surface water and overland flow paths (OLFPs) flowing to these tributaries or directly to the coastline. There are various 1% Annual Exceedance Probability (AEP) floodplains associated with these flow paths. The site hydrology is depicted in Figure 33, noting that a more in-depth assessment of overland flow pathways and other surface water features has been prepared by Harrison Grierson.

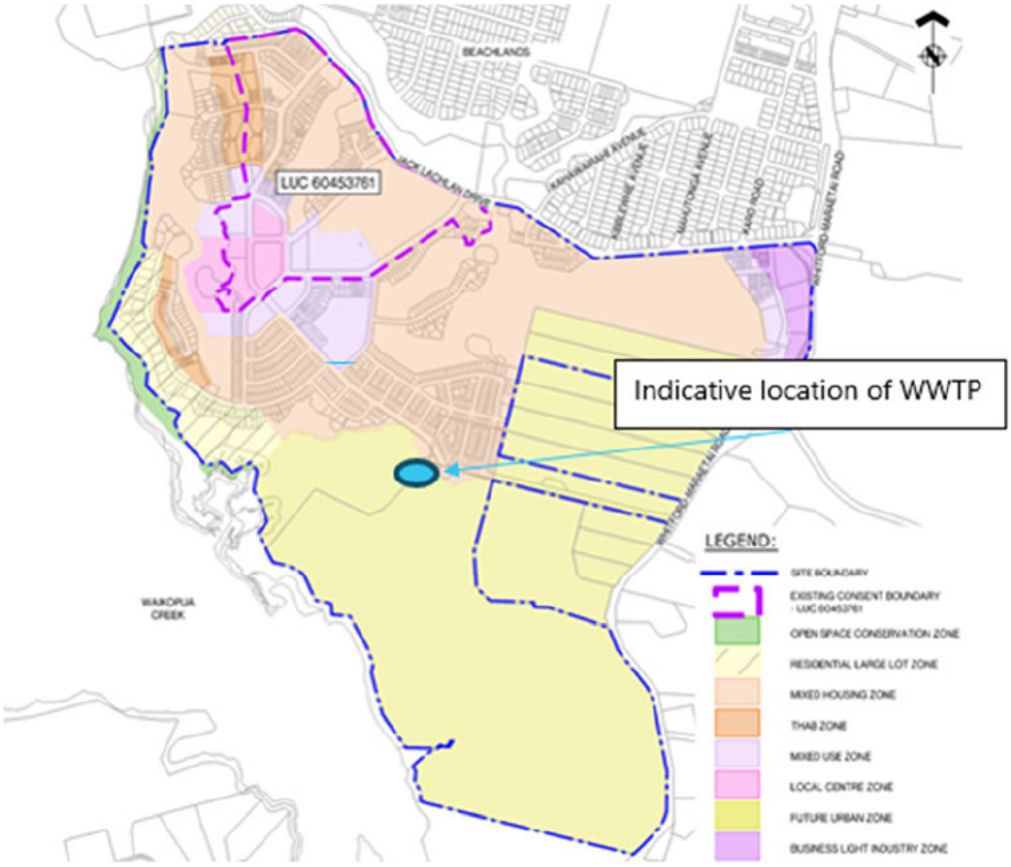

Figure 2: Site Location Plan with Indicative Location of WWTP

Source: Harrison Grierson

Figure 3: Site Hydrology Plan

Source: https://geomapspublic.aucklandcouncil.govt.nz/viewer/

2.1 Mapped Geology

The Geological Map of New Zealand 1:250,000 (GNS Science, 2012), indicates that the entirety of the site is underlain by East Coast Bays Formation of Warkworth Subgroup (Waitemata Group). The deposits are described as "*alternating sandstone and mudstone with variable volcanic content and interbedded volcaniclastic grits*".

2.2 Subsoil Investigation

GWE conducted a site walkover and subsoil investigation at Beachlands South on 23 April 2026 to assess the suitability of the site for a wastewater land application field. This involved eleven hand-augured boreholes to 1.2 m below ground level.

The borehole information is provided in Table 2. The bore logs are provided in Appendix A.

Table 2: Soil Profile Descriptions

HORIZON WW-1	DESCRIPTION	DRAINAGE	SOIL CATEGORY
0–0.2 m	TOPSOIL (silty).		
0.2–1.2 m	Silty CLAY; brownish orange; highly plastic; dry to moist; friable; tree organics. 0.5 m – becomes brownish orange, mottled light grey, orange, and brown. 0.8 m – becomes light grey and mottled orange.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		

HORIZON	DESCRIPTION	DRAINAGE	SOIL CATEGORY
WW-2			
0–0.1 m	TOPSOIL (some rootlets).		
0.1–1.2 m	Silty CLAY; light grey, orange, trace organic discolouration; highly plastic; moist. 0.9 m – becomes grey, occasional orange mottles.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-3			
0–0.2 m	TOPSOIL.		
0.2–0.4 m	Silty CLAY and TOPSOIL; organics; moderate plasticity; moist.	Moderate to Slow Drainage	5/6
0.4–1.2 m	Silty CLAY; light grey, mottled orange, slight discolouration in the light grey; highly plastic; moist.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-4			
0–0.2 m	TOPSOIL.		
0.2–1.2 m	Silty CLAY; brownish orange and brown; highly plastic; moist; minor organics. 0.7 m – becomes light grey and mottled orange.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-5			
0–0.15 m	TOPSOIL (silty).		
0.15–1.2 m	Clayey SILT; brownish orange; moderately plastic; moist; some organics. 0.6 m – becomes light grey and mottled brownish orange.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-6			
0–0.2 m	TOPSOIL (Clayey SILT).		
0.2–0.5 m	Silty CLAY; brownish orange and mottled brown; highly plastic; moist.	Moderate to Slow Drainage	5/6
0.5–0.7 m	Clayey SILT; brownish orange and light grey.	Moderate to Slow Drainage	5/6
0.7–1.2 m	SILT, trace Sand and Clay; light grey, mottled brown and red.	Slow Drainage	6
1.2 m	End of borehole; no groundwater encountered.		
WW-7			
0–0.25 m	TOPSOIL (Silty CLAY, black and moist).		
0.25–1.2 m	Clayey SILT; brown; very stiff; moist. 0.5 m – becomes light brown streaked orange/grey 0.9 m – becomes grey streaked light brown	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		

HORIZON	DESCRIPTION	DRAINAGE	SOIL CATEGORY
WW-8			
0–0.2 m	TOPSOIL (Silty CLAY, black and moist).		
0.2–1.0 m	Silty CLAY; light brown/ orange streaks; very stiff; moist.	Moderate to Slow Drainage	5/6
1.0–1.2 m	Clayey SILT; grey streaked light brown; very stiff; moist.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-9			
0–0.2 m	TOPSOIL (Silty CLAY, black and moist).		
0.2–1.2 m	Silty CLAY; brown; very stiff; moist. 0.7 m – becomes orange, brown streaking.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-10			
0–0.2 m	TOPSOIL (Silty CLAY, black and moist).		
0.2–1.2 m	Clayey SILT; dark brown, orange streaked; very stiff; moist. 1.0 m – becomes streaked brown	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		
WW-11			
0–0.2 m	TOPSOIL (Silty CLAY, black and moist).		
0.2–0.6 m	Silty CLAY; brown, orange streaked.	Moderate to Slow Drainage	5/6
0.6–1.2 m	Clayey SILT; light brown and pinkish grey.	Moderate to Slow Drainage	5/6
1.2 m	End of borehole; no groundwater encountered.		

The subsoil investigation is summarised as follows:

- Most of the boreholes have a small layer of topsoil containing a mixture of silt, clay, and variable organic matter.
- The soils are generally described as clayey silt or silty clay and are generally very stiff.
- The soils are Category 5/6 in accordance with TP58 Table 5.1.
- Groundwater was not encountered in any of the boreholes up to the exploratory depth of 1.2 m.

The outcomes of this investigation have been used to inform the concept design of the Stage 1 land disposal system and associated environmental assessment.

3 WASTEWATER SERVICING PHILOSOPHY

The proposed activity comprises the staged collection, treatment, and disposal of wastewater generated by the Beachlands South development using a communal, centralised wastewater servicing system.

3.1 Overview

Wastewater generated within the development will be collected via a reticulated gravity sewer network and conveyed through a series of pump stations to a centralised wastewater treatment plant (WWTP) located within the project area. The treatment plant will utilise a modular Combined Works (CW) process capable of delivering tertiary-level treatment.

The wastewater servicing strategy has been developed on a staged and adaptive basis, whereby treatment capacity and discharge pathways are progressively implemented in line with actual development uptake and measured wastewater generation. This approach ensures that infrastructure provision is aligned with demand, while maintaining a high level of environmental protection throughout the life of the development.

3.2 Development Scale and Serviced Catchment

The communal wastewater system is designed to ultimately service the Beachlands South urban development, which will comprise:

- Approximately 2,000 residential dwellings.
- Educational facilities, including two schools.
- A local commercial centre.
- Light industrial and employment-generating land uses.

Wastewater flows will increase over time as development progresses, with servicing infrastructure expanded accordingly.

3.3 Staging Strategy

The proposed wastewater servicing strategy comprises two primary stages:

Stage 1 – Land-Based Disposal

During the initial phase of development, wastewater will be:

- Collected via the reticulated sewer network.
- Treated at the centralised WWTP to a tertiary standard.
- Discharged to land via a communal pressure compensating dripper irrigation (PCDI) system.

The Stage 1 treatment plant will consist of an initial CW treatment module with a nominal capacity of approximately 450 m^3/day (average dry weather flow). This capacity is intended to service the early stages of development and provides operational flexibility to accommodate initial growth.

Land-based disposal has been selected as the initial discharge pathway as it:

- Avoids direct discharge to freshwater and marine environments.
- Utilises natural soil processes for further treatment and attenuation.
- Aligns with regional policy direction favouring land disposal where practicable.

Stage 2 – Marine Outfall

As wastewater flows increase and land disposal approaches its practical capacity, the discharge pathway will transition to a long sea outfall to the Coastal Marine Area (CMA).

Under Stage 2:

- Additional CW treatment modules will be installed to increase overall treatment capacity.
- The WWTP will continue to provide tertiary-level treatment.
- Treated effluent will be conveyed via a marine outfall to an offshore discharge location designed to achieve effective dilution and dispersion.

The timing of any transition from the land-based discharge (Stage 1) to a marine outfall discharge (Stage 2) will be determined by reaching defined, measurable thresholds. The following will be used, with the lowest threshold reached governing the transition:

- Development uptake - when cumulative occupied dwellings within the catchment exceed 500 HUEs or equivalent connected load, or;
- Hydraulic loading - when measured average dry weather flow (ADWF) at the treatment plant exceeds 85% of the consented Stage 1 capacity of 450 m^3/day over a rolling 6-month period;

Before the marine outfall is constructed, the feasibility of connecting the development into the Watercare reticulated network will be reassessed. If agreement can be reached with Watercare for connection into the public wastewater network, that option will be preferred over the marine outfall, consistent with the BPO assessment in Section 6.6. The marine outfall will only be progressed if connection into the Watercare network is confirmed as not practicable at the time the trigger thresholds are reached.

Trigger thresholds, monitoring requirements, reporting frequency, and the process for confirming whether transition to Stage 2 is required (including reassessment of the Watercare connection option) will be set out in the conditions of consent and the associated Wastewater Management Plan.

3.4 Integrated System Operation

The wastewater collection, treatment, and disposal components form a single integrated system, designed to operate cohesively across both stages of development. Key characteristics of the system include:

- Centralised treatment, enabling consistent performance and operational control.
- The system shall be equipped with remote monitoring capability.
- Modular expansion of treatment capacity in response to demand.
- Use of tertiary treatment processes to achieve high effluent quality.
- Progressive transition between discharge pathways without requiring a change in core treatment technology.

3.5 Nature of the Discharges

The activity gives rise to two principal types of discharge:

- Discharge to land (Stage 1): Treated wastewater applied to land via a PCDI system.
- Discharge to the Coastal Marine Area (Stage 2): Treated wastewater discharged via a long sea outfall.

The discharge to land represents the preferred initial discharge pathway, with discharge to the CMA forming the long-term solution necessary to accommodate full development of the catchment.

3.6 Purpose of the Activity

The wastewater servicing system is an essential component of the Beachlands South development and is required to:

- Enable the delivery of a large-scale, planned urban community.
- Protect public health through the safe collection and treatment of wastewater.
- Avoid, remedy, or mitigate adverse environmental effects associated with wastewater discharges.

The proposed staged servicing approach has been developed to provide a practical, scalable, and environmentally responsible solution that will enable a project with significant regional benefits, consistent with the objectives of the Resource Management Act 1991 and the Fast-track Approvals Act 2024.

4 BASIS OF DESIGN AND SOURCE DOCUMENTS

This report has been prepared based on the scope and reporting requirements for wastewater servicing associated with the Substantive Fast-Track application.

- The wastewater collection and reticulation system concept is based on input prepared by Harrison Grierson (HG).

- The wastewater treatment concept, plant configuration and staged treatment capacities are based on the concept layouts and input provided by Raath and Associates (Raath).
- The assessment of the land disposal pathway is based on work carried out by GWE.
- The assessment of the marine discharge pathway is based on input prepared by Tonkin & Taylor (T&T).
- Available hydrogeological and geotechnical information has been used to inform the preliminary feasibility assessment of treated wastewater disposal to land.

4.1 Design Standards and Guidelines

The following standards, guidelines, and planning assumptions have been adopted in the development of the wastewater concept design:

- Watercare Engineering Standards and Code of Practice for Land Development and Subdivision.
- Auckland Council Technical Publication TP58 (2004) – On-site Wastewater Systems: Design and Management Manual.
- Water Services (Wastewater Environmental Performance Standards) Regulations 2025 (WEPS).
- Relevant New Zealand Standards (including NZS 4404:2010).

These documents provide the regulatory and technical framework within which the wastewater servicing strategy has been developed.

4.2 Supporting Technical Reports

This report should be read in conjunction with the following supporting technical documents:

- Raath and Associates – Wastewater Treatment Concept Design Report (Appendix D).
- Tonkin & Taylor – Marine Ecological Effects Assessment and Outfall Design Report.
- Flow Reconciliation Note (Appendix C).
- Relevant geotechnical and environmental investigations appended to this application.

These reports support the proposed wastewater servicing approach and the assessment presented in this application. Each document addresses a specific component of the system, including treatment processes, marine discharge, and site conditions, and together they provide the technical basis for the overall servicing strategy.

The potential effects of the Stage 2 marine discharge have been assessed by Tonkin & Taylor through hydrodynamic and water quality modelling of the Whitford Embayment. This assessment forms a key input into the statutory and environmental evaluation of the marine outfall presented in this report.

Tonkin & Taylor Ltd (T+T) have undertaken a detailed Marine Ecological Impact Assessment (EcIA) and associated coastal water quality modelling to assess the potential effects associated with the proposed marine outfall discharge.

The assessment included:

- Characterisation of the marine receiving environment within the Whitford Embayment.
- Sediment quality and benthic infauna investigations.
- Water quality investigations.
- Assessment of ecological values associated with marine habitats, fish, coastal avifauna and marine mammals.
- Hydrodynamic modelling of treated wastewater dispersion and dilution.
- Assessment of potential ecological effects associated with construction and operation of the marine outfall.

The conclusions of the T+T assessment have been relied upon in the preparation of this report for matters relating to marine ecological effects and the receiving environment associated with the marine discharge option.

5 DESIGN FLOWS AND LOADING BASIS

The wastewater servicing strategy for Beachlands South has been developed using a staged infrastructure approach that aligns treatment capacity with the rate of development and measured wastewater generation.

Previous planning investigations assessed wastewater demand based on full development of the wider live-zoned catchment and identified ultimate flows of up to approximately 1,500 m^3/day. Those assessments were undertaken to understand long-term servicing requirements and potential network capacity constraints.

The current wastewater strategy adopts a staged framework. Rather than constructing infrastructure to service the ultimate catchment from the outset, the proposed Combined Works (CW) treatment system is intended to be delivered progressively through a series of modular treatment stages. This approach enables wastewater treatment capacity to be expanded in response to actual development uptake while maintaining consistent treatment performance and avoiding significant upfront over-investment in infrastructure.

Accordingly, the wastewater design basis considers three separate stages:

- Stage 1 - Land-Based Disposal – servicing approximately 400–500 dwellings, two proposed schools, and associated early-stage development through a 450 m^3/day treatment train.
- Stage 2 - Marine Outfall – expansion of treatment capacity through additional CW modules as utilisation thresholds are approached, and full development of the Beachlands South catchment, including all residential, educational, commercial and employment-generating land uses.

The design flows adopted for this assessment are based on Auckland Council and Watercare planning criteria together with the Watercare Code of Practice for commercial and industrial land uses. These flows provide the basis for assessment of treatment capacity, hydraulic loading, storage requirements and staging triggers.

Table 2 summarises the adopted design flows and treatment capacities used throughout this assessment. The relationship between the earlier live-zoned flow assumptions and the staged wastewater servicing strategy is discussed further in the Flow Reconciliation Note (Appendix C).

5.1 Initial Development Stage and Flow Allocation (Stage 1 and 2)

The proposed wastewater servicing strategy is based on a staged treatment approach that aligns infrastructure delivery with actual development uptake and measured wastewater generation.

The initial stage of development will be serviced by a Combined Works (CW) wastewater treatment plant with a design capacity of 450 m^3/day ADWF. This first treatment train is intended to service approximately 400–500 Household Unit Equivalents (HUEs) together with the proposed schools and associated early-stage commercial activities. The treatment plant forms the first component of the ultimate wastewater system and is not considered temporary infrastructure.

The Stage 1 treatment capacity has been deliberately sized to accommodate early development demand while providing sufficient operational flexibility and resilience. Upstream hydraulic buffering is provided through three pump stations, each incorporating approximately 24 hours of emergency storage, together with a 100 m^3 balancing/emergency storage tank located within the treatment process. This arrangement moderates inflow variability and allows the treatment plant to operate under controlled hydraulic loading conditions.

Based on the adopted wastewater generation rates of 540 L/HUE/day (3 persons per dwelling at 180 L/person/day), the residential component of the initial stage is expected to generate approximately 216–270 m^3/day. Allowing for the school demand of approximately 30 m^3/day, the initial development stage would generate approximately 246–300 m^3/day ADWF, representing approximately 55–67% utilisation of the Stage 1 treatment capacity.

This provides additional capacity within the first treatment train to accommodate subsequent residential development, neighbourhood commercial activities, and early employment-generating land uses before expansion of the treatment system is required.

Expansion beyond 450 m^3/day will occur through installation of additional CW treatment modules as part of Stage 2 development. The timing of expansion will be informed by measured inflows and plant utilisation, with Stage 2 implementation expected once inflows consistently reach approximately 70–80% of the Stage 1 treatment capacity, equivalent to approximately 315–360 m^3/day ADWF. This approach ensures infrastructure investment is aligned with actual demand while maintaining appropriate treatment performance and environmental outcomes.

Table 3: Stage 1 Design Flow and Loading Basis

SOURCE	DEVELOPMENT YIELD	FLOW ALLOWANCE	STAGE 1 FLOW (m^3/day)
Residential dwellings	400–500 HUE	3 persons/HUE @ 180 L/person/day	270
School	2 schools	Planning allowance	60
Commercial local centre	Early neighbourhood centre only	WSL CoP basis	50
Light industrial	Not expected in initial stage	WSL CoP basis	50
		Total ADWF	**246–300**
		Stage 1 Plant Capacity	**450**

5.2 Stage 2 Marine Outfall - Development Flows and Loads

The wastewater loading assessment has been developed based on the anticipated full build-out of the Beachlands South development area, including residential, educational, commercial and employment-generating land uses.

For planning purposes, the ultimate development scenario comprises:

- Approximately 2,000 residential dwellings.
- Two schools.
- Approximately 27,000 m^2 gross floor area (GFA) of commercial development within the proposed local centre and along the Whitford–Maraetai Road frontage.
- Approximately 30,000 m^2 GFA of light industrial and employment land.

Residential wastewater generation has been assessed using an average occupancy of three persons per dwelling and a wastewater generation rate of 180 litres per person per day, consistent with Auckland Council and Watercare planning assumptions. Commercial and industrial wastewater generation rates have been derived from the Watercare Code of Practice (CoP) for planning-level assessments.

Table 4 summarises the ultimate average dry weather flow (ADWF) assessment.

Table 4: Average Dry Weather Flow

SOURCE	DEVELOPMENT YIELD	DESIGN BASIS	ADWF (m^3/day)
Residential dwellings	2,000 dwellings	3 persons/dwelling @ 180 L/person/day	1,080
School	2 school	Planning allowance	60
Commercial local centre	27,000 m^2 GFA	Watercare CoP commercial demand	93
Light industrial	30,000 m^2 GFA	Watercare CoP light industrial demand	135
		Total Ultimate ADWF	**1,368**
		Peak WWF	**2,736**

The ultimate wastewater flow is therefore estimated to be approximately 1,368 m^3/day ADWF, equivalent to an average flow rate of approximately 15.6 L/s.

The commercial and industrial land uses contribute approximately 228 m^3/day, representing around 17% of the total wastewater load. While residential development remains the dominant contributor to wastewater generation, the proposed commercial centre and employment lands provide an important component of the overall wastewater demand and have been incorporated into the ultimate servicing assessment.

Hydraulic Loading

For planning and concept design purposes, a hydraulic peaking factor of 2.0 has been adopted, consistent with the assumptions used for the proposed treatment system.

On this basis, the ultimate design flows are estimated as follows:

- Average Dry Weather Flow (ADWF): 1,368 m^3/day
- Equivalent Average Flow: 15.6 L/s
- Peak Design Flow (PDF): 31.0 L/s

These estimates are intended to provide a planning-level assessment of ultimate wastewater demand and will be refined through subsequent detailed design and network modelling.

Treatment Plant Staging

The ultimate development flow of approximately 1,368 m^3/day ADWF exceeds both the proposed Stage 1 treatment capacity of 450 m^3/day ADWF and the two-train treatment capacity of 900 m^3/day ADWF.

The wastewater servicing strategy has therefore been structured as a staged and modular system that expands in response to actual development uptake and measured wastewater generation. The initial Combined Works (CW) treatment train will provide capacity for the early stages of development, with additional treatment modules installed as utilisation thresholds are approached.

Expansion beyond the initial 450 m^3/day treatment train will be triggered by measured inflows and operational performance. A second treatment train would increase total treatment capacity to approximately 900 m^3/day ADWF, with further expansion or augmentation required to accommodate full development of the catchment.

The modular nature of the CW treatment process enables treatment capacity to be increased incrementally while maintaining consistent treatment performance, operational stability, and environmental outcomes. This approach aligns capital investment with development demand and avoids the need for substantial upfront over-sizing of infrastructure.

5.3 Contaminant Loads

5.3.1 Influent Characteristics and Design Basis

The wastewater quality assessment has been undertaken using industry-standard wastewater characteristics and accepted design concentrations commonly adopted for municipal wastewater treatment plant design.

The proposed catchment is anticipated to comprise predominantly residential development, together with two schools, local commercial activities and light industrial land uses. The commercial and industrial activities proposed within the structure plan area are not expected to generate significant process wastewater or high-strength trade waste streams. Consequently, wastewater quality is anticipated to be broadly representative of typical domestic sewage.

For the purposes of concept design and assessment, the contaminant concentrations presented in Table 5 have been adopted as representative influent characteristics for the proposed treatment plant.

Table 5: Design Influent Wastewater Characteristics

PARAMETER	RAW WASTEWATER CONCENTRATION (MG/L)
$cBOD_5$	425
TSS	475
NH_4-N	39
TKN	67
TP	17
Fats, Oils and Grease	195
pH	6.5–8.0

Should future development include activities with the potential to generate elevated-strength wastewater, appropriate trade waste controls would be implemented to ensure influent quality remains within the design envelope adopted for the treatment plant. This shall be managed via a consent condition.

5.3.2 Estimated Contaminant Loads

Using the ultimate design flow of 1,368 m^3/day, the estimated contaminant mass loads entering the treatment plant have been calculated. These loads provide the basis for sizing and performance assessment of the treatment process.

Table 6: Estimated Ultimate Influent Contaminant Loads

PARAMETER	CONCENTRATION (mg/L)	LOAD (kg/day)
$cBOD_5$	425	570
TSS	475	640
NH_4-N	39	53
TKN	67	90
TP	17	25
Fats, Oils and Grease	195	265

These contaminant loads represent the anticipated maximum loading associated with full development of the catchment and provide the basis for assessing treatment capacity requirements and long-term plant expansion based on the proposed dwelling type and commercial development.

5.3.3 Treatment Design Implications

The CW treatment process has been selected due to its ability to achieve stable treatment performance across a wide range of hydraulic and contaminant loadings. The modular nature of the treatment system allows additional process capacity to be introduced progressively as wastewater flows and contaminant loads increase over time.

The treatment plant has been designed to achieve high levels of organic carbon removal, solids removal, nitrification, denitrification and phosphorus reduction while maintaining operational resilience under variable loading conditions. The staged treatment approach ensures that process capacity can be expanded in parallel with development growth while maintaining compliance with anticipated discharge consent requirements.

The contaminant loading assessment confirms that the proposed treatment process is suitable for the anticipated wastewater characteristics generated by the Beachlands South development and provides an appropriate basis for subsequent detailed design and consenting.

5.4 Target Effluent Quality

GWE have undertaken an assessment of the expected requirements for the proposed receiving environment – discharge to the land via pressure compensating dripper irrigation. Effluent quality limits are expected to be derived from the potential effects on several different elements, including overall water quality, ecology and cultural values.

Table 7 outlines the expected average effluent quality targets the WWTP would be expected to reliably achieve under a discharge consent and are in-line with current best practice. The proposed effluent quality limits are as shown.

Table 7: Anticipated Average Effluent Quality Requirements

PARAMETER	RAW COMBINED INFLUENT	TREATED EFFLUENT QUALITY
5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	425	15
Total Suspended Solids (TSS)	475	15
Total Kjeldahl Nitrogen (TKN)	67	15
Ammonia (NH_3)	39	5
Total Phosphorus (TP)	17	12
Faecal Coliforms (FC)	$>1x10^8$ CFU/100 mL	<200 CFU/100 mL

Note: *[1]All concentrations in mg/L unless otherwise stated.*

6 BEST PRACTICABLE OPTION ASSESSMENT

This section evaluates a range of alternative wastewater servicing strategies for the Beachlands South development. The options considered represent fundamentally different approaches to treatment location, discharge pathway, and infrastructure staging.

In accordance with Section 2(1) of the Resource Management Act 1991 (RMA), this assessment identifies the Best Practicable Option (BPO), being the option that best avoids or minimises adverse environmental effects, having regard to:

- The nature of the discharge.
- The sensitivity of the receiving environment.
- The applicants reasoning.
- Technical feasibility.
- Financial implications.

The BPO is identified in Section 6.6.

6.1 Immediate Connection to Public Wastewater Network

Connection to Watercare's public wastewater network was considered.

Based on available information, there is no existing public wastewater network with sufficient capacity in proximity to the site and the timeframe for the upgrades to the public network are understood to be inconsistent with the development timeframe. Connection would require significant off-site infrastructure upgrades, which are outside the control of the applicant and are not currently programmed.

Accordingly, this option is not considered practicable and is discounted from further consideration.

6.2 Lot-by-lot On-site Systems

Individual on-site wastewater systems were considered.

Given the scale (approximately 2,000 lots) and urban nature of the development, this approach would result in a large number of independent discharges. This would increase the risk of:

- Inconsistent performance.
- Poor maintenance and monitoring.
- Cumulative environmental effects.

This option is also inconsistent with the planned integration and future vesting of wastewater infrastructure.

For these reasons, lot-by-lot systems are not considered appropriate.

6.3 Decentralised Precinct Plants

The use of multiple decentralised precinct-scale wastewater treatment plants was considered as an alternative to a centralised plant.

While technically feasible, this approach would increase operational and maintenance complexity, create multiple discharge points, and require multiple consents. It would also reduce operational resilience and flexibility over time.

Although viable in principle, decentralised precinct plants are not preferred as the servicing option for the development.

6.4 Central Treatment – Land-Based Disposal Only

A centralised treatment plant with land-based disposal as the sole discharge pathway was considered.

This approach is considered practicable for early stages of development. However, as flows increase, land disposal capacity would become a constraint due to:

- Increasing land area requirements.
- Practical limitations on expansion of the disposal field.

This would reduce long-term flexibility and may result in the need for additional land or reconfiguration.

Accordingly, while suitable for initial stages, this option does not provide a viable full-development solution.

6.5 Central Treatment – Immediate Long Sea Outfall

A centralised treatment plant with immediate discharge to the Coastal Marine Area (CMA) via a long sea outfall was considered.

While technically feasible, this option:

- Requires significant upfront capital investment.
- Introduces marine discharge earlier than necessary.
- Does not utilise an available and appropriate land-based disposal pathway.

This approach is inconsistent with the policy direction to avoid discharge to water where practicable.

Accordingly, this option does not represent the best balance of environmental outcomes, staging, and cost.

6.6 Staged Central Treatment – Land-Based Disposal First, Followed by Long Sea Outfall

This option involves a centralised treatment plant with:

Stage 1: Disposal of tertiary treated wastewater to land; and

Stage 2: Transition to discharge to the CMA via long sea outfall.

This approach:

- Aligns infrastructure provision with staged development.
- Enables treatment capacity to be expanded based on measured wastewater flows.
- Defers marine discharge until it is required.
- Optimises capital investment over time.
- Maintains operational flexibility and resilience.

Importantly, this approach:

- Utilises land-based disposal where practicable, consistent with policy direction.
- Provides a scalable long-term solution for the ultimate development.

Overall, this option best balances environmental effects, technical feasibility, and cost.

This staged approach is therefore considered to represent the Best Practicable Option (BPO) for the Beachlands South development.

CRITERION	PUBLIC NETWORK CONNECTION	LOT-BY-LOT ON-SITE	DECENTRALISED PRECINCT PLANTS	CENTRAL TREATMENT – LAND ONLY	CENTRAL TREATMENT – IMMEDIATE OUTFALL	STAGED CENTRAL – LAND THEN OUTFALL (PREFERRED)
Technical Feasibility	No proximate network with capacity	Feasible but high risk at scale	Feasible	Feasible for initial stages only	Feasible	Fully feasible and scalable
Environmental Effects	N/A	Multiple uncontrolled discharges; inconsistent maintenance	Multiple discharge points	Land disposal only; no marine effects	Immediate marine discharge	Minimises early marine discharge; staged approach
Capital Cost Profile	Extensive off-site upgrades beyond applicant control	Moderate per-lot but cumulative high	Multiple plants increase cost	Moderate	High upfront (outfall construction)	Capital staged with demand
Operational Complexity	Low (Watercare managed)	High – many independent systems	High – multiple plants, multiple consents	Low – single plant	Low – single plant	Low – single plant, staged expansion

CRITERION	PUBLIC NETWORK CONNECTION	LOT-BY-LOT ON-SITE	DECENTRALISED PRECINCT PLANTS	CENTRAL TREATMENT – LAND ONLY	CENTRAL TREATMENT – IMMEDIATE OUTFALL	STAGED CENTRAL – LAND THEN OUTFALL (PREFERRED)
Regulatory Alignment	N/A	Inconsistent with urban-scale development intent	Multiple consents required	Aligned with preference for land disposal	Does not avoid marine discharge where practicable	Avoids marine discharge where practicable; aligned with AUP E1 Policy 17
Scalability / Flexibility	Dependent on third-party upgrades	Not scalable	Limited modularity	Land-constrained at higher flows	Scalable	Fully scalable; modular CW trains
Mana Whenua Values	N/A	Risk of multiple unmanaged discharges to land/water	Multiple discharge locations	Land disposal protects Mauri	Early marine discharge	Delays marine discharge; land-based disposal protects Mauri
Future Vesting Potential	Already public	Not vestable	Complex vesting	Suitable for vesting	Suitable for vesting	Suitable for vesting subject to WSL approval
Overall Assessment	Not viable	Not appropriate	Not preferred	Viable short-term only	Viable but not optimal	Best Practicable Option
Criterion	Public Network Connection	Lot-by-Lot On-site	Decentralised Precinct Plants	Central Treatment – Land Only	Central Treatment – Immediate Outfall	Staged Central – Land then Outfall (Preferred)
Technical Feasibility	No proximate network with capacity	Feasible but high risk at scale	Feasible	Feasible for initial stages only	Feasible	Fully feasible and scalable

7 WASTEWATER COLLECTION SYSTEM

Wastewater generated by the Beachlands South development will be collected via a communal gravity sewer network with associated pump stations, designed by Harrison Grierson (HG) in accordance with Watercare's Code of Practice for Land Development and Subdivision (Wastewater).

The collection system is designed with the intent that wastewater assets are suitable for future vesting to Watercare Services Limited, ensuring long-term operational management by the regional water services provider.

Stage 1 Configuration

At Stage 1, the collection system will comprise:

- A gravity sewer network servicing the initial ~750 dwellings, 2 schools, and commercial area.
- Three pump stations, each providing a minimum of 24-hour emergency storage capacity.
- Rising mains conveying wastewater from the pump stations to the centralised treatment plant.

Ultimate Configuration

At full development (~2,000 lots), the collection system will expand to include up to nine pump stations, with associated gravity sewers and rising mains extended progressively as each stage of the development is constructed.

Design Standards

The collection system will be designed in accordance with:

- Watercare's Code of Practice for Land Development and Subdivision (Wastewater).
- NZS 4404:2010 Land Development and Subdivision Infrastructure.
- Relevant Auckland Council engineering standards.

Pipe sizing, gradient, and materials will be confirmed through detailed design. Inflow and infiltration (I&I) management will be addressed through appropriate pipe materials, jointing, and testing to minimise wet-weather inflows to the treatment plant.

8 WASTEWATER TREATMENT CONCEPT

Raath and Associates have developed a two-stage Combined Works (CW) wastewater treatment solution comprising two parallel CW treatment trains, each with a nominal capacity of 450 m^3/day (average dry weather flow (ADWF)). The two trains together provide an ultimate combined treatment capacity of 900 m^3/day. The system is designed to accommodate a peaking factor of 2, with flows managed through a combination of upstream storage, emergency storage and inlet buffering.

A detailed wastewater treatment concept design report prepared by Raath and Associates, which outlines the treatment process, plant configuration, and design basis, is provided in Appendix D.

The proposed site-specific treatment facility layout provided by Raath and Associates identifies the key treatment plant components, including the following:

- A 100 m^3 balancing tank for inlet buffering.
- Two CW treatment plants comprising four biological treatment modules each.
- A centralised arrangement to allow for parallel operation.
- Two phosphate reactors, each with a nominal capacity of 50 m^3, for tertiary phosphorus removal.
- Provision for a sludge handling facility (centrifuge building).

The CW system forms part of a single integrated treatment solution, allowing modular expansion over time without requiring changes to treatment technology or creating redundant infrastructure.

8.1 Description of Treatment Train

The proposed wastewater treatment plant utilises a Combined Works (CW) process, which integrates primary, secondary and tertiary treatment within a single enclosed system. The treatment process is summarised below.

8.1.1 Inlet Screening

Raw wastewater enters the treatment plant via the inlet works, where it passes through a 6 mm mechanical screen to remove rags, plastics, and coarse solids. This protects downstream treatment components and ensures reliable operation. Screenings are collected and managed for off-site disposal.

8.1.2 Grit Removal

Following screening, wastewater passes through a grit removal stage, where sand and heavier inorganic material are separated to a screw sand separator. This process allows for some removal of fats, oils, and grease (FOG), prior to being directed to the mixing chamber.

8.1.3 Aeration and Biological Treatment

Wastewater then flows into the aeration zone, where oxygen is supplied through fine-bubble diffusion to promote biological activity. In this zone organic matter is oxidised and ammoniacal nitrogen is converted to nitrate through nitrification.

The aeration system operates efficiently using atmospheric air and internal recirculation, without the need for surface aerators or high-pressure compressors.

8.1.4 Integrated Clarification

Mixed liquor passes into an integrated clarification zone where solids are separated from treated effluent. Settled biomass is returned internally to the aeration zone, maintaining biological balance without the need for external sludge return systems.

8.1.5 Fixed-Film Biofilter Treatment

Partially clarified effluent flows through a fixed film biofilter containing structured media. Biofilms attached to the media provide aerobic zones and anoxic micro-environments, enabling further nitrification and biological denitrification within the same reactor, without the need for a chemical carbon addition.

8.1.6 Denitrification

A dedicated anoxic denitrification reactor downstream of the biofilter/aeration zone promotes further conversion of nitrate to nitrogen gas, reducing total nitrogen concentrations in the final effluent.

8.1.7 Phosphorus Removal

Effluent passes through a dedicated phosphorus removal stage, where phosphorus is reduced through a combination of biological uptake and adsorption within the reactor media.

8.1.8 Sludge Stabilisation

Excess sludge generated during the treatment process is directed to a stabilisation zone, where it undergoes further biological breakdown under low-oxygen conditions. This reduces sludge volume and frequency of removal, with residual solids removed periodically by licensed contractors.

8.1.9 Final Clarification and Disinfection

Final polishing removes any remaining fine solids prior to ultraviolet (UV) disinfection. The UV system inactivates pathogens, enabling the treated effluent to meet tertiary treatment standards and achieve low faecal indicator levels.

8.2 Hydraulic Buffering and Storage

The wastewater system provides multiple levels of hydraulic buffering and storage to manage inflows and ensure reliable operation. This includes:

- Upstream storage: Pump stations (three at Stage 1 and up to nine at full development), each providing 24-hour storage capacity; and
- On-site storage – 100,000 L emergency storage tank located between the inlet works and mixing chamber.

8.3 Miscellaneous

8.3.1 Noise

Some noise will be generated during the operation of the treatment plant from equipment such as pumps, aeration components, and mixers. However, the CW system utilises efficient internal aeration processes and does not rely on multiple large blowers or surface aerators typically associated with conventional wastewater treatment systems, resulting in lower overall noise emissions which will be contained within the building.

In addition, the entire treatment plant is housed within a purpose-built building, which provides effective acoustic containment. As a result, any operational noise is expected to be minimal and will not give rise to adverse effects or nuisance beyond the site boundary.

An acoustic assessment has been prepared by Hegley Acoustic Consultants Ltd.

8.3.2 Odour

Under normal operating conditions odour is not anticipated at the treatment plant. The CW system is enclosed and maintains predominantly aerobic conditions throughout the treatment process, limiting the generation of foul odours. Odour management equipment will be specified during the detailed design phase of the project.

Regular service and maintenance of the treatment plant will further ensure that any potential odour effects are effectively managed.

A detailed odour assessment has been undertaken by Air Matters Ltd. to support this application.

8.4 Resilience and Contingency

The wastewater treatment and disposal system incorporates several layers of resilience and contingency to manage operational risks, equipment failures, and adverse weather events. These provisions are intended to ensure that the system can continue to operate safely and within consented parameters during abnormal conditions.

It should be noted that a detailed Hazard and Operability (HAZOP) and Safety-in-Design (SiD) will also be undertaken during the preliminary and detailed design stages of the treatment plant to further stress test the design.

8.4.1.1 Emergency Storage

The system includes 100,000 L of emergency storage between the inlet works and mixing chamber. In addition, the upstream pump stations (three at Stage 1, up to nine at full development) each provide 24-hour storage capacity. Combined, these provisions offer sufficient buffering to manage short-duration plant outages or maintenance shutdowns without uncontrolled discharge.

8.4.2 Standby Power

A standby generator will be installed to provide power in the event of power outage at the plant.

Provision for standby power generation is recommended to maintain essential treatment processes and pump station operation during power outages. Critical systems to be maintained under backup power include inlet pumping, aeration, and UV disinfection.

8.4.3 Monitoring, Alarms, and Telemetry

The treatment plant and pump stations will be equipped with a SCADA (Supervisory Control and Data Acquisition) system or equivalent telemetry and alarm system to provide:

- Continuous flow monitoring at the inlet works and discharge point.
- High-level and overflow alarms at pump stations and storage tanks.
- Treatment process performance monitoring (e.g., dissolved oxygen, turbidity).
- Remote notification of alarm conditions to the operations and maintenance contractor.
- Data logging for compliance reporting purposes.

8.4.4 Contingency Procedures

In the event of plant upset, equipment failure, or emergency conditions, the following contingency procedures are proposed:

SCENARIO	RESPONSE	RESPONSIBLE PARTY
Power failure	Automatic transfer to standby generator (if installed); upstream pump station storage activated	O&M Contractor
Treatment process upset	Divert flow to emergency storage; investigate and rectify cause; notify Council if discharge quality is at risk of non-compliance	O&M Contractor/GWE/Raath
Pump station failure	Activate 24-hour emergency storage; deploy mobile pump if required	O&M Contractor
Disposal field overloading/ponding	Redirect flow to alternative disposal zones; reduce loading rate; investigate cause	O&M Contractor
Major equipment failure	Isolate affected unit; operate on remaining capacity (modular design allows partial operation); arrange emergency repair	O&M Contractor/Raath
Spill or uncontrolled discharge	Contain and clean up; notify Auckland Council within 24 hours; investigate cause and implement corrective actions	O&M Contractor/Consent Holder

8.4.5 Spill Containment

The treatment plant site will incorporate secondary containment measures, including bunding around chemical storage areas and process tanks, to prevent uncontrolled release of wastewater or treatment chemicals to the environment.

9 STAGING PHILOSOPHY

During Stage 1 (land-based disposal), the first 450 m^3/day wastewater treatment train will be constructed and operated, with treated wastewater disposed of to land via a communal, land disposal system. The proposed land disposal system is detailed in Section 10.

Expansion to Stage 2 (marine outfall disposal) and construction of the second 450 m^3/day treatment train is proposed to be triggered by measured wastewater inflows reaching approximately 85% of Stage 1 treatment capacity, rather than by land sales. This approach ensures the increase in treatment capacity aligns with actual wastewater generation.

Once land-based disposal reaches its practical capacity, the treated wastewater discharge pathway is proposed to transition to a long sea outfall discharge to the CMA. This discharge method is explained in Section 11. The land-based disposal will then be decommissioned once the marine outfall is constructed.

The land-based and marine discharge stages form integrated parts of the overall wastewater strategy, and their resulting environmental effects are assessed separately in Section 12 of this report.

10 STAGE 1 – LAND-BASED DISPOSAL

During Stage 1 of the Beachlands South development, treated wastewater will be discharged to land via a communal pressure compensating dripper irrigation (PCDI) system.

Wastewater will first be treated to a tertiary standard at the centralised wastewater treatment plant, before being conveyed to a designated disposal field and applied to land in a controlled and distributed manner.

Land-based disposal has been adopted as the initial discharge pathway because it:

- Avoids direct discharge to freshwater and the Coastal Marine Area.
- Utilises natural soil and vegetation processes to provide additional treatment and attenuation.
- Is consistent with regional policy direction to discharge to land where this is practicable.

At a concept level, the assessment undertaken demonstrates that the site is capable of accommodating the proposed discharge during Stage 1, subject to confirmation through detailed design and further investigation.

10.1 Loading Rates and Disposal Method

Based on site-specific subsoil investigations undertaken by GWE (refer Section 2.2), soils across the site are classified as category 5/6 under TP58 Table 5.1. On this basis, a loading rate of 3 mm/day is appropriate based on TP58 Section 9.2.3.

Applying this loading rate to the Stage 1 design flow of 450 m^3/day, this indicates a required disposal area of approximately 150,000 m^2. In addition, a reserve disposal area equivalent to 50% of the primary disposal area has been assumed in accordance with TP58 Table 5.3.

The system will be divided into multiple dosing zones to allow rotation and resting of disposal areas, promoting soil recovery and maintaining infiltration performance over time.

These loading rates and disposal areas are indicative only and are intended to support a concept-level assessment of land-based disposal feasibility. Final loading rates, disposal method, and required disposal area will be confirmed through further detailed site investigations and detailed design refinement.

10.2 Preparation of the Disposal Field

Prior to installation of the treated wastewater disposal system, the proposed disposal areas will be prepared to ensure suitability for use. This is expected to include removal of debris and any hardstand associated with existing land uses, including the Formosa Golf Resort and farmland.

Where localised soil compaction is identified, remediation such as soil loosening may be required to restore infiltration capacity. The suitability of each disposal zone will be confirmed by site inspection prior to installation, undertaken by a suitably experienced wastewater land-disposal practitioner.

10.3 System Components

Treated wastewater will be conveyed to the disposal field via a rising main network, with effluent delivered to the field using a zoned drip irrigation system. The disposal field will be divided into multiple zones controlled by sequencing valves to ensure even distribution across the different zones of the disposal field. This also ensures that the effluent is not overloaded to specific zones within the disposal field, as each zone has a period of "rest" once it has been dosed.

The disposal field will be planted with suitable vegetation to enhance nutrient uptake, promote evapotranspiration, improve soil structure, and provide long-term stability of the land application area. Species selection will be guided by the recommendations of TP58 and will favour locally appropriate native species capable of tolerating periodic wastewater irrigation and elevated nutrient conditions. The establishment of a well-managed vegetative cover will assist in assimilating residual nutrients within the treated effluent, reducing the potential for runoff and erosion, and improving the overall environmental performance of the land disposal system. Vegetation health will be monitored as part of the ongoing operation and maintenance programme to ensure continued effectiveness of the disposal field.

Effluent will be applied using pressure compensating dripline to provide even distribution of effluent across the disposal field. Dosing will be controlled by a timed pump system, applying small, regular doses of treated wastewater over an extended period to allow for assimilation into the ground.

The land disposal system is summarised in Table 8. The parameters shown are indicative only and are intended to support concept-level assessment. Final system configuration, and component specifications will be confirmed through detailed design following site-specific investigations.

Table 8: Land Disposal System

PARAMETER	INDICATIVE VALUE	NOTES
DISPOSAL METHOD	Surface-laid pressure compensating drip lines at 1 m centres	Measured centre-to-centre between adjacent drip lines in the disposal field.
EMITTER SPACING	0.6 m centres	Measured along each drip line; typically, standard for many PCDI systems.
EMITTER FLOW RATE	Approximately 2 L/hr per emitter (common value).	Actual flow rate depends on manufacturer; often 1.6–3.6 L/hr. Pressure compensating ensures consistent output across the system.
FILTRATION REQUIREMENT	120–150 micron	A disk or screen filter is usually installed before distribution to prevent emitter blockage.
SOIL CATEGORY	5/6	From subsoil investigations.
FLOW RATE	450 m^3/day (450,000 L/day)	Concept design basis.
LOADING RATE	3 mm/day	TP58 indicative.
PRIMARY DISPOSAL AREA	150,000 m^2	Indicative only.
RESERVE DISPOSAL AREA	75,000 m^2	Indicative only.
INSTALLATION ACCESS	Ensure supply and flushing manifolds are accessible.	Valves and cleanouts must remain reachable for inspection, flushing, and maintenance.
FLUSH VALVES / AIR VENTS	Flush valves at line ends. Air vents at high points.	Facilitates maintenance by removing sediment and preventing vacuum conditions that might draw debris into emitters.

10.4 Management and Maintenance

The land application area will be managed by a third-party contractor as part of the management of the treatment plant. Management and maintenance activities will include the following:

- Regular inspections of the disposal field, and associated distribution network, fittings and valves.
- Flushing of the disposal field.
- Vegetation maintenance and removal of invasive weeds.

11 STAGE 2 – MARINE OUTFALL

11.1 Receiving Environment

Stage 2 provides for the discharge of tertiary-treated effluent to the Coastal Marine Area (CMA) via a long sea outfall. The receiving environment is the Whitford Embayment, which discharges to the Tāmaki Strait within the wider Hauraki Gulf/Tīkapa Moana which is a body of water recognised as being of national significance under the Hauraki Gulf Marine Park Act 2000 (HGMPA).

The Whitford Embayment is a drowned valley estuary of approximately 11.1 km^2, with a mean tidal range of 2.4 m and a catchment area of 61 km^2, fed by three regionally and nationally significant tidal creeks - Waikōpua, Tūranga, and Mangemangeroa. The embayment contains four Significant Ecological Areas – Marine (SEA-M) recognised by the Auckland Unitary Plan, reflecting its values for estuarine habitats, intertidal mud/sand/shell flats, shellbanks, mangrove and saltmarsh communities, and as feeding and roosting habitat for international migratory and New Zealand endemic wading birds. The subtidal benthic habitat at the proposed outfall location has been characterised through site-specific sampling and has been assessed as having moderate ecological value, while seagrass beds within the wider embayment, fish, coastal avifauna, and marine mammals have been assessed as having high to very high ecological value.

The Hauraki Gulf is a significant ecological, cultural, recreational, and economic resource. The assessment of the Stage 2 discharge has been undertaken having regard to sections 7 and 8 of the HGMPA and the relevant provisions of the New Zealand Coastal Policy Statement 2010, and is informed by the marine ecological impact assessment prepared by Tonkin & Taylor.

11.2 Outfall Design

The long sea outfall will comprise a marine pipeline extending offshore from the Beachlands South site to a discharge location within the Tāmaki Strait, selected to achieve a high level of initial dilution and effective dispersion within the receiving environment.

Key design parameters include:

PARAMETER	INDICATIVE VALUE	NOTES
Outfall pipeline length	1.5km of submerged pipeline	
Discharge depth	Below Mean Sea Level Depth	Selected to maximise dilution.
Diffuser arrangement	Submerged multi-port diffuser	Designed to maximise initial dilution and promote rapid mixing.
Initial dilution	~800-fold	Per preliminary modelling by Tonkin & Taylor.
Discharge flow (ultimate)	Up to 900 m^3/day ADWF	Two CW treatment trains operating in parallel.

11.3 Treatment and Effluent Quality

Under Stage 2, the treatment plant will continue to provide tertiary-level treatment using the CW process. The treatment standard will be maintained at the same level as Stage 1, with the primary difference being the discharge pathway (marine outfall rather than land disposal). Once flow is diverted to the marine outfall, the land disposal system will be decommissioned.

The CW treatment process is designed to maintain consistent effluent quality under variable loading conditions, providing confidence in the reliability of discharge quality to the marine environment over time.

PARAMETER	UNIT	STAGE 2 TARGET EFFLUENT QUALITY
BOD_5	mg/L	≤ 5
Total Suspended Solids (TSS)	mg/L	≤ 10
Total Nitrogen (TN)	mg/L	≤ 8
Total Phosphorus (TP)	mg/L	≤ 5
Faecal Coliforms	CFU/100 mL	≤ 200 (90th percentile)
Dissolved Oxygen (DO)	mg/L	≥ 1.5

11.4 Environmental Effects (Stage 2)

Stage 2 of the proposed wastewater treatment system involves the discharge of highly treated effluent via a marine outfall, and the environmental effects have been assessed in detail by Tonkin & Taylor. On the basis of that assessment, and adopting a conservative modelling approach, the adverse effects of the discharge are appropriately managed and confined, such that:

- High levels of dilution are achieved within a short distance of the outfall (approximately 850-fold at 100 m under conservative conditions).
- Incremental changes in water quality at the mixing zone boundary are negligible and below laboratory detection limits.
- Dissolved oxygen levels remain within acceptable ranges, with no material effect on aquatic ecosystem function.
- Tidal flushing prevents any accumulation of contaminants within the receiving environment.

Accordingly, consistent with the findings of the T+T report, any adverse environmental effects associated with the Stage 2 marine discharge are localised to a confined mixing zone and are sufficiently managed such that the wider receiving environment continues to be governed by background water quality conditions.

11.5 Alternative Discharge Pathways Considered

Alternative discharge pathways for the full development scale were considered as part of the BPO assessment (refer Section 6), including:

- Extended land-based disposal (constrained by available land area and soil capacity at higher flow volumes).
- Discharge to surface water (not preferred due to limited dilution capacity and sensitivity of freshwater receiving environments).
- Connection to public wastewater network (not practicable due to absence of proximate infrastructure with capacity).

Marine outfall has been identified as the preferred long-term discharge pathway at full development scale due to its capacity to reliably manage increasing discharge volumes while achieving appropriate dilution and dispersion consistent with the WEPS and the HGMPA.

12 ASSESSMENT OF ENVIRONMENTAL EFFECTS

This Assessment of Environmental Effects is confined to the Stage 1 treated wastewater discharge to land. The Stage 1 discharge represents the initial discharge pathway and is assessed at a concept level only.

The potential environmental effects of Stage 2 discharge to the CMA via long sea outfall are addressed separately within the Marine Ecological Effects Assessment prepared by T&T.

The proposed tertiary treatment system and surface-laid PCDI disposal system are anticipated to perform to a high environmental standard, with any adverse effects on the environment able to be appropriately avoided, remedied, or mitigated through the proposed design and conditions of consent.

12.1 Impact on Surface Water

Auckland Council GIS mapping indicates the presence of several overland flow paths (OLFPs) and tributaries traversing the site that ultimately discharge to the CMA.

As a general guideline, TP58 identifies a minimum separation distance of 5–10 m for tertiary treated wastewater. For the purposes of this assessment, disposal areas have been conceptually located to achieve these minimum setback distances. Final layout will be confirmed at detailed design stage.

The use of surface-laid PCDI and timer dosing of effluent represents accepted best practice for land disposal systems and minimises the potential for runoff. Vegetation/grass in the disposal areas will assist with the retention, breakdown and uptake of effluent at the site and further reduce the potential for surface runoff and subsequent discharge to surface water.

Overall, any adverse effects on surface water are anticipated to be appropriately avoided and mitigated through the proposed setbacks, treatment standard, and disposal design.

12.2 Impact on Groundwater

Site-specific subsoil investigations undertaken by GWE (refer Section 2.2) did not encounter groundwater to a depth of 1.2 m. Groundwater levels are therefore expected to remain below the TP58 minimum separation requirement of 0.6 m under typical conditions, subject to seasonal variation. The high level (tertiary) of treatment proposed will ensure protection of groundwater.

Overall, any adverse effects on groundwater are anticipated to be appropriately avoided and mitigated through the proposed treatment standard and vertical separation from groundwater.

12.3 Impact on Soils

The site has been subject to a mix of land uses including a golf resort and farmland. Treated wastewater disposal is expected to contribute additional moisture and nutrients to the soil profile, which can support vegetation establishment when appropriately managed.

Revegetation of disposal areas with suitable native species is proposed, with species selection informed by TP58 Appendix G. Vegetation will assist with evapotranspiration, nutrient uptake, and maintenance of soil structure.

12.3.1 Hydraulic Loading

The underlying soils in the irrigation areas are expected to be categorised as 5/6 under TP58 Table 5.1, with moderate to slow drainage characteristics and recommended loading rates of up to 3 mm/day. Category 5/6 soils have relatively high clay content and relatively low infiltration capacity. At this indicative loading rate, risk of ponding, runoff, or saturation of the soils which might compromise the availability of the oxygen within the soils is considered low. As noted above, vegetation in the disposal areas will provide evapotranspiration assistance.

12.3.2 Nutrient Effects

Residual nutrients in the treated effluent, primarily nitrogen and phosphorus, are expected to be present at moderated concentrations from the tertiary treatment. Soil processes, microbial activity, and plant uptake will contribute to nutrient assimilation.

The risk of nutrient accumulation or migration will be managed through conservative loading rates and monitoring, with final nutrient management approaches confirmed at detailed design stage.

12.3.3 Nitrogen

Nitrogen in the effluent is expected to be primarily in the form of nitrate with some residual ammonium. While nitrate is mobile, the low permeability of the soils will reduce the mobility through the soils to groundwater, the uptake of nitrogen will be further supplemented by the vegetation within the disposal field.

12.3.4 Phosphorus

Phosphorus typically exhibits strong sorption to clay-rich soils, so the primary risk of phosphorus leaching is likely to be via hydraulic overloading of the soils causing runoff. This risk is mitigated by the low loading rate of phosphorus to ground provided by the high level of treatment at the treatment plant and the low loading rate proposed for the effluent. Monitoring of phosphorus is recommended as part of the soils sampling regime for the disposal field.

12.3.5 Other Nutrients

Other nutrients present in treated effluent may contribute to soil fertility. Sodium accumulation will be managed through monitoring and, if required, soil amendment measures such as gypsum application.

12.3.6 Soil pH

Soil pH is expected to remain within a range suitable for plant growth, with effluent application potentially assisting in moderating acidity over time.

12.3.7 Soil Summary

The application of treated wastewater to land is not anticipated to result in any adverse effects on soils. The highly treated effluent will provide additional nutrients to the soils which will aid the establishment of native plants within the disposal field. As the native vegetation develops, improved soil structure and stability, in addition to a return of organic matter in the form of leaf litter.

12.3.8 Nutrient Mass Balance – Stage 1 Land Disposal

The following indicative nutrient mass balance has been prepared for the Stage 1 land-based disposal system to assess the annual nutrient loading to the disposal field.

Assumptions:

- Stage 1 design flow: 450 m^3/day.
- Treated effluent TKN: 15 mg/L (target).
- Treated effluent TP: 12 mg/L (target).
- Primary disposal area: 150,000 m^2 (15 ha).
- Operating days: 365 days/year

PARAMETER	EFFLUENT CONCENTRATION (mg/L)	DAILY MASS LOAD (kg/day)	ANNUAL MASS LOAD (kg/year)	LOADING RATE (kg/ha/year)	GUIDELINE RANGE (kg/ha/year)
Total Nitrogen	15	6.75	2,464	164	150–300 (pasture/vegetation)
Total Phosphorus	12	5.40	1,971	131	30–60 (clay soils — **elevated; requires monitoring**)

Note: If the more conservative effluent targets from the FPL are adopted (TN <5 mg/L, TP <2 mg/L), the nutrient loadings reduce significantly:

PARAMETER	EFFLUENT CONCENTRATION (mg/L)	DAILY MASS LOAD (kg/day)	ANNUAL MASS LOAD (kg/year)	LOADING RATE (kg/ha/year)
Total Nitrogen	5	2.25	821	55
Total Phosphorus	2	0.90	329	22

The lower effluent quality targets significantly reduce nutrient loading to the disposal field and provide greater confidence that nutrient accumulation will remain within acceptable limits. The nitrogen loading at the lower target (55 kg/ha/yr) is well below typical sustainable application rates for vegetated land. Phosphorus loading at 22 kg/ha/yr is within the range for clay-rich soils, noting that phosphorus sorption capacity of the Category 5/6 soils will provide additional buffering.

12.4 Impact on Amenity Values

Given the tertiary level of treatment and the nature of land disposal, odours are not anticipated at the treatment plant or the disposal field. The volume of treated effluent produced is dispersed over a large disposal area. As outlined in Section 0, discernible noise and odour are not anticipated from the treatment plant.

The treatment plant will be located a minimum of 3.0 m from all buildings and a minimum of 3.0 m from the lot boundaries. Any visual effects associated with the treatment plant and disposal fields will be mitigated through location, planting, and screening.

12.5 Impact on Public Health

The proposed wastewater system has been designed to provide a high level of protection for public health through a multi-barrier approach that combines centralised tertiary treatment, controlled subsurface dosing, restricted public access, and ongoing operational oversight.

A communal treatment and disposal system has been adopted in preference to individual on-site systems. This approach removes reliance on lot-by-lot performance, enables consistent treatment to a tertiary standard, and significantly reduces the cumulative public health risk profile across the catchment.

Treated effluent will achieve a tertiary standard, with UV disinfection providing pathogen inactivation prior to discharge. Disposal will be via timer-dosed, surface-laid pressure-compensating drip irrigation (PCDI), which delivers small, evenly distributed doses of effluent into the upper soil profile where natural soil processes - including filtration, adsorption, microbial breakdown, and plant uptake - provide further pathogen attenuation. The combination of high-quality treatment and controlled subsurface application substantially limits the potential for direct human contact, aerosol generation, or surface runoff.

Public access to the disposal fields will be prevented through secure fencing and signage, and the disposal areas will be located within designated reserve land that is not intended for public use. Setback distances to dwellings, property boundaries, surface water features, and groundwater bores will be maintained in accordance with TP58 and the conditions of consent.

The system will be subject to ongoing operational monitoring, maintenance, and reporting by the appointed operator, with performance verified against the consented effluent quality standards. Alarm and remote monitoring systems will provide early warning of any operational issue, enabling prompt response and preventing uncontrolled discharges.

Overall, the combination of tertiary treatment, UV disinfection, controlled subsurface disposal, restricted public access, setback distances, and ongoing operational oversight provides robust protection of public health mean any residual adverse effects on public health are anticipated to be negligible.

The potential environmental effects of the Stage 2 marine discharge have been assessed by Tonkin & Taylor in the Marine Ecological Impact Assessment and associated water-quality modelling. That assessment identifies the principal potential marine ecological effects as nutrient enrichment, changes to benthic sediment quality and benthic communities, potential effects on intertidal and subtidal seagrass, potential food-chain effects for fish and avifauna, and uncertainty associated with emerging organic contaminants.

The modelling indicates a high level of dilution and dispersion in Whitford Embayment, with no modelled accumulation of discharge in the model domain. Under typical conditions, the modelled 1st percentile dilution is 470-fold at 100 m from the discharge location, and modelled pollutant concentrations, when added to background conditions, remain within the relevant guideline concentrations considered by Tonkin & Taylor.

On that basis, and subject to finalisation of the EcIA, the Stage 2 marine discharge is expected to be manageable through the proposed tertiary treatment, diffuser design, outfall location, and monitoring/adaptive management framework. The statutory assessment in this report relies on Tonkin & Taylor's specialist assessment for marine ecological effects.

12.6 Stage 1 Summary

The proposed Stage 1 land disposal system has been assessed at a concept level and assessed to be in accordance with relevant guidelines, and consistent with the Resource Management Act, Auckland Regional Policy Statement, and the Auckland Unitary Plan – Operative in Part. Furthermore, there are several specific design features that will mitigate against adverse environmental effects, including:

- Tertiary-level treatment.
- A conservative loading rate.
- Separation distances in accordance with relevant requirements.
- Monitoring conditions (Refer to Section 13.7).

Subject to confirmation through further detailed design and supporting investigations, for the reasons outlined above, the Stage 1 land disposal system is anticipated to have no more than minor adverse environmental effects that can be contained within the boundaries of the site. Surface water, groundwater, soils, and public health are expected to be adequately protected.

On-going maintenance and management of the proposed treatment system in accordance with the supplier's specifications will be required and stipulated as a condition of consent.

12.7 Stage 2 Summary

The assessment of the marine discharge has been informed by hydrodynamic and water quality modelling undertaken by Tonkin & Taylor for the Whitford Embayment.

The modelling demonstrates that the discharge achieves a high level of dilution within the receiving environment. Under representative worst-case conditions (dry weather, neap tide, low-water slack), dilution at the edge of a 100 m mixing zone is approximately 850-fold, with higher dilution occurring under typical conditions.

At this level of dilution, the incremental increase in contaminant concentrations at the edge of the mixing zone is very small and, in most cases, falls below laboratory detection limits when compared to background concentrations.

The modelling therefore indicates that background water quality within the receiving environment remains the primary control on overall water quality, rather than the proposed discharge.

13 STATUTORY ASSESSMENT

This section assesses the proposed wastewater servicing strategy against the relevant statutory framework (for both Stage 1 land based disposal and Stage 2 marine outfall). The assessment addresses the Fast-Track Approvals Act 2024 (FTAA), the Resource Management Act 1991 (RMA), the Water Services (Wastewater Environmental Performance Standards) Regulations 2025 (WEPS), the National Policy Statement for Freshwater Management 2020 (NPS-FM), the Hauraki Gulf Marine Park Act 2000 (HGMPA), and the Auckland Unitary Plan – Operative in Part (AUP-OP).

13.1 Fast Track Approvals Act

The Beachlands South development is the subject of a Substantive Fast-Track application under the FTAA. The purpose of the FTAA is to provide a streamlined decision-making process to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

Section 10 of the FTAA establishes procedural principles emphasising consistent, timely, efficient and cost-effective decision-making.

The proposed wastewater servicing strategy is a key enabling component of a regionally significant housing development, providing approximately 2,000 residential lots within Auckland's growth area to help address the city's acute housing supply shortage. The wastewater infrastructure is necessary to unlock this development potential and cannot be separated from the broader housing and community outcomes the project delivers.

The FTAA requires the expert panel to consider whether the adverse effects of the activity are sufficiently significant to be out of proportion to the regional benefits and the purpose of the FTAA. In respect of the wastewater servicing strategy:

- The Stage 1 land-based discharge has been assessed as resulting in adverse environmental effects that can be appropriately avoided, remedied, or mitigated through the proposed design and conditions of consent (refer Section 12).
- The staged approach delays marine discharge until required, minimising early-stage effects on the Coastal Marine Area.
- The system is designed to comply with all relevant regulatory standards, including the recently enacted WEPS 2025.
- Comprehensive monitoring and adaptive management conditions are proposed to ensure ongoing environmental protection.
- The wastewater infrastructure directly enables a regionally significant housing development and associated community facilities, including a school and commercial services.

On this basis, the proposed wastewater servicing strategy for Stage 1 and Stage 2 is consistent with the purpose of the FTAA, and the environmental effects are not of a scale or nature that would outweigh the significant regional benefits delivered by the development.

13.2 Water Services (Wastewater Environmental Performance Standards) Regulations 2025

The Water Services (Wastewater Environmental Performance Standards) Regulations 2025 (WEPS) came into force on 19 December 2025 and apply to all new consents for wastewater infrastructure.

The WEPS regulate four categories of wastewater activity:

- Discharge of biosolids to land (Part 1).
- Overflows from wastewater networks and bypasses of wastewater treatment plants (Part 2 – effective 19 December 2028).
- Discharge from wastewater treatment plants into water (Part 3).
- Discharge from wastewater treatment plants to land (Part 4).

Applicability to Stage 1 – Discharge to Land (Part 4)

The Stage 1 land-based discharge is subject to Part 4 of the WEPS. Resource consent applications for discharge to land must include a site assessment that assigns a land class based on environmental and public health risk factors and the drainage capacity of the site. Applicable discharge concentration limits vary based on the assigned land class and whether the site is classified as a slow or rapid-infiltration discharge site.

Based on the site-specific subsoil investigation (refer Section 2.2), the site is characterised by Category 5/6 soils with moderate to slow drainage. The site is expected to be classified as a slow-infiltration discharge site under the WEPS framework.

The proposed tertiary treatment system is designed to achieve effluent quality standards consistent with, or exceeding, the discharge concentration limits applicable to the assigned land class under the WEPS. The proposed monitoring conditions (refer Section 13.3) are consistent with the mandatory conditions framework established by the WEPS.

Applicability to Stage 2 – Discharge to the CMA (Part 3)

Stage 2 involves discharge of treated wastewater to the Coastal Marine Area via a long sea outfall. Part 3 of the WEPS applies different treatment requirements and discharge concentration limits based on the level of dilution in the receiving water body. For coastal marine areas, the level of dilution available at the discharge point determines the applicable standards.

Preliminary modelling by Tonkin & Taylor indicates approximately 850-fold dilution of treated effluent following discharge, which, if confirmed, would classify the receiving environment as having a high level of dilution. The treatment plant will continue to provide tertiary-level treatment under Stage 2, and the proposed effluent quality is expected to comply with the applicable WEPS discharge concentration limits.

Biosolids (Part 1)

Sludge generated by the treatment process will be managed in accordance with Part 1 of the WEPS. It is estimated that approximately 15 to 20m^3 per day of waste sludge will be produced at peak flow. The sludge will be processed further by thickening/dewatering to significantly reduce its volume prior to disposal off site.

13.3 National Policy Statement for Freshwater Management 2020

The NPS-FM 2020 establishes a national framework for freshwater management and is underpinned by the fundamental concept of Te Mana o te Wai.

Te Mana o te Wai imposes a hierarchy of obligations that prioritises:

1. The health and well-being of water bodies and freshwater ecosystems.
2. The health needs of people (such as drinking water).
3. The ability of people and communities to provide for their social, economic, and cultural well-being.

The proposed wastewater servicing strategy is consistent with Te Mana o te Wai and the NPS-FM hierarchy for the following reasons:

Priority 1 – Health of Water Bodies

Stage 1 avoids any direct discharge to freshwater. The land-based disposal system relies on soil treatment processes, evapotranspiration, and plant uptake to assimilate treated effluent. Conservative loading rates and separation distances are adopted to protect freshwater bodies. Baseline and ongoing stream monitoring is proposed to verify that the discharge does not result in adverse effects on surface water quality.

Priority 2 – Health Needs of People:

The tertiary treatment process, including UV disinfection, significantly reduces pathogen levels. Separation distances from any known water supply bores will be maintained.

Priority 3 – Social, Economic, and Cultural Well-being

The wastewater infrastructure enables the delivery of approximately 2,000 residential lots, a school, and commercial facilities, directly contributing to the social and economic well-being of the Beachlands community and the wider Auckland region.

The NPS-FM also requires avoidance of further loss or degradation of natural inland wetlands. The proposed disposal field and associated infrastructure have been located to avoid any identified natural inland wetlands.

13.3 National Policy Statement for Freshwater Management 2020

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Te Mana o te Wai imposes a hierarchy of obligations that prioritises:

1. The health and well-being of water bodies and freshwater ecosystems;
2. The health needs of people (such as drinking water); and
3. The ability of people and communities to provide for their social, economic, and cultural well-being.

The proposed wastewater servicing strategy is consistent with Te Mana o te Wai and the NPS-FM hierarchy for the following reasons:

Priority 1 – Health of Water Bodies

Stage 1 avoids any direct discharge to freshwater. The land-based disposal system relies on soil treatment processes, evapotranspiration, and plant uptake to assimilate treated effluent. Conservative loading rates and separation distances are adopted to protect freshwater bodies. Baseline and ongoing stream monitoring is proposed to verify that the discharge does not result in adverse effects on surface water quality.

Priority 2 – Health Needs of People

The tertiary treatment process, including UV disinfection, significantly reduces pathogen levels. Separation distances from any known water supply bores will be maintained.

Priority 3 – Social, Economic, and Cultural Well-being

The wastewater infrastructure enables the delivery of approximately 2,000 residential lots, two schools, and commercial facilities, directly contributing to the social and economic well-being of the Beachlands community and the wider Auckland region.

The NPS-FM also requires avoidance of further loss or degradation of natural inland wetlands. The proposed disposal field and associated infrastructure have been located to avoid any identified natural inland wetlands.

13.4 Hauraki Gulf Marine Park Act 2000

The Hauraki Gulf Marine Park Act 2000 (HGMPA) recognises the national significance of the Hauraki Gulf and establishes management objectives for the Gulf, its islands, and catchments.

Section 7 of the HGMPA provides that the interrelationship between the Hauraki Gulf, its islands, and catchments and the ability of that interrelationship to sustain the life-supporting capacity of the environment of the Hauraki Gulf and its islands are matters of national significance.

Section 8 establishes management objectives including:

- The protection and enhancement of the life-supporting capacity of the environment of the Hauraki Gulf.
- The protection and enhancement of the natural, historic, and physical resources of the Gulf, including those with which tangata whenua have a historic, traditional, cultural, and spiritual relationship.
- The maintenance and enhancement of the contribution of the Gulf's resources to the social and economic well-being of people and communities.
- The protection of cultural and historic associations of people and communities with the Gulf's resources.

Section 13 of the HGMPA requires that all persons exercising powers under the RMA for the Hauraki Gulf must have particular regard to sections 7 and 8. Sections 7 and 8 are treated as a national policy statement and a New Zealand coastal policy statement for the purposes of the RMA.

The proposed wastewater servicing strategy has been assessed against sections 7 and 8 of the HGMPA as follows:

Stage 1 (land-based disposal): Avoids any discharge to the Hauraki Gulf or its tributaries. The conservative design, tertiary treatment, and monitoring framework ensure that the Stage 1 discharge does not adversely affect the life-supporting capacity of the Gulf's catchment.

Stage 2 (long sea outfall): The transition to marine discharge within the Tāmaki Strait of the Hauraki Gulf / Tīkapa Moana requires careful consideration under the HGMPA. The proposed tertiary treatment, long sea outfall design, and high initial dilution (~1,000-fold per T&T modelling) are specifically designed to ensure that the discharge does not compromise the life-supporting capacity of the marine environment. The detailed marine ecological effects assessment prepared by Tonkin & Taylor addresses the potential effects of the Stage 2 discharge on the marine environment of the Hauraki Gulf.

The staged approach, prioritising land-based disposal and delaying marine discharge until required, is itself consistent with the protective intent of the HGMPA by minimising the duration and scale of marine discharge.

13.5 Resource Management Act

The RMA sets out a statutory framework for consideration of resource consent applications which includes National Environmental Standards, National Policy Statements, Regional Policy Statements and Regional and District Plans. An assessment of the proposed activity against the RMA is given below.

The RMA overarches statutory regulation in New Zealand. Part 2 of the RMA promotes the sustainable management of natural and physical resources. Sustainable management is defined as:

> *Managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while:*
>
> *a. sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations.*
>
> *a. safeguarding the life-supporting capacity of air, water, soil, and ecosystems.*
>
> *b. avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

The proposal is the disposal of tertiary treated wastewater associated with the Beachlands South development with ongoing monitoring, by way of consent conditions. The tertiary treatment of wastewater at the development is consistent with best practice and therefore remedies and mitigates adverse effects on the environment, as per the requirements under Section 17 of the RMA.

The proposal has also been assessed regarding sections 6(e) and 7(a) of the RMA. The Stage 1 land-based wastewater discharge avoids direct discharge to water, supports the protection of Mauri, and is consistent with kaitiakitanga by relying on land-based treatment processes and staged infrastructure provision. The Stage 2 discharge to the CMA via the long sea outfall is supported by Ngai Ti Tamaki and maintains a high level of treatment and significant dilution.

13.5.1 Part 2 – Purpose and Principles

Section 5 – Purpose

The purpose of the RMA is to promote the sustainable management of natural and physical resources. The proposed wastewater servicing strategy enables the Beachlands South community to provide for its social, economic, and cultural well-being while:

- Sustaining the potential of natural resources to meet the reasonably foreseeable needs of future generations through a staged, scalable infrastructure approach.
- Safeguarding the life-supporting capacity of water, soil, and ecosystems through tertiary treatment, conservative loading rates, and comprehensive monitoring.
- Avoiding, remedying, or mitigating adverse effects through the design measures and conditions set out in this report.

Section 6 – Matters of National Importance

The following matters of national importance under section 6 are relevant:

Table 9: Summary of Matters of National Importance

SECTION	MATTER	ASSESSMENT
6(a)	Preservation of the natural character of the coastal environment, wetlands, and rivers	Stage 1 avoids discharge to the coastal environment and freshwater. Stage 2 marine discharge is designed to achieve high dilution and rapid mixing, minimising effects on natural character.
6(c)	Protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna	The disposal field and infrastructure have been located to avoid identified Significant Ecological Areas (SEAs). This is addressed within the T&T report
6(e)	Relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga	The Stage 1 land-based discharge avoids direct discharge to water, consistent with the protection of Mauri. Engagement with Ngāi Tai ki Tāmaki and Ngāti Pāoa has been undertaken.

Section 7 – Other Matters

Table 10: Other Matters

SECTION	MATTER	ASSESSMENT
7(a)	Kaitiakitanga	The staged approach, prioritising land-based disposal, is consistent with kaitiakitanga by relying on natural soil treatment processes and avoiding early marine discharge.
7(b)	Efficient use and development of natural and physical resources	The staged, modular treatment system aligns infrastructure investment with actual demand, avoiding over-investment or redundant infrastructure.

SECTION	MATTER	ASSESSMENT
7(c)	Maintenance and enhancement of amenity values	The enclosed treatment plant, low-noise equipment, and controlled land application system maintain amenity values for surrounding land uses. Stage 2 effects are addressed within the T&T report.
7(f)	Maintenance and enhancement of the quality of the environment	The tertiary treatment and comprehensive monitoring framework ensure that environmental quality is maintained.

13.5.2 Section 104

Section 104(1) of the RMA requires a consent authority, when considering an application for a resource consent, to have regard to:

- Any actual and potential effects on the environment of allowing the activity (Section 104 (1)(a)).
- Any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity (Section 104(1)(ab)).
- Relevant national environmental standards, national and regional policy statements, planning and policy documents and other regulations (Section 104(1)(b)).
- Any other relevant matter (Section 104 (1)(c)).

The actual and potential effects on the environment of the proposal pursuant to Section 104(1)(a) of the Act are set out in Section 12 of this report. Wastewater is treated to a tertiary level under TP58 standards, in accordance with best practice. Several monitoring conditions are proposed to ensure the activity is carried out responsibly (refer to Section 13.7).

In addition to the matters above, the expert panel is required under the FTAA to consider the purpose of the Act (section 3), the procedural principles (section 10), and the obligation relating to Treaty settlements (section 7) when making its decision. These matters are addressed in Sections 13.1 and 13.5.1 above.

Section 104 (2D) does not apply in this case as the Wastewater Environmental Performance Standards are only relevant for Council owned wastewater infrastructure.

13.5.3 Section 105

Section 105 of the RMA requires that where a discharge permit is required, the consent authority must have regard to:

- The nature of the discharge and the sensitivity of the receiving environment to adverse effects.
- The applicant's reasons for the proposed choice.

- Any possible alternative methods of discharge, including discharge into any other receiving environment.

This proposal includes an assessment of environmental effects of discharge to land and to the CMA, which concluded that the discharge is expected to have *less than minor adverse effects on the receiving environment*.

Alternative methods of wastewater management have been identified and discussed in Section 0 of this report, including on-site management on a lot-by-lot basis. Overall, a strategy involving staged treatment and discharge first to land, followed by discharge to the CMA via long sea outfall was determined to be the best practical option (BPO).

13.5.4 Section 107

Section 107 of the RMA restricts the grant of a discharge permit where the discharge of a contaminant into water would, after reasonable mixing, give rise to any of the following effects in the receiving waters:

- The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials.
- Any conspicuous change in the colour or visual clarity.
- Any emission of objectionable odour.
- The rendering of fresh water unsuitable for consumption by farm animals.
- Any significant adverse effects on aquatic life.

The Stage 1 discharge is to land, therefore s107 does not directly apply.

The Stage 2 discharge to the CMA within the Tāmaki Strait of the Hauraki Gulf/Tīkapa Moana has been assessed against each of the s107 matters by Tonkin & Taylor, with the following conclusions

- No conspicuous oil or grease films, scums, foams, or floatable or suspended materials are anticipated, having regard to tertiary treatment, solids removal, screening, and the discharge depth and dispersion characteristics of the diffuser.
- No conspicuous change in colour or visual clarity is anticipated, having regard to the high initial dilution at the diffuser and the quality of the treated effluent.
- No objectionable odour is anticipated, having regard to the offshore discharge location, water depth, and treated effluent quality.
- The s107(1)(d) matter relating to stock water supply is not applicable, as the receiving environment is marine.
- No significant adverse effects on aquatic life are anticipated, having regard to dilution modelling, water quality guideline assessment, and the proposed effluent quality limits.

Subject to the proposed treatment standard, discharge configuration, and conditions of consent, the Stage 1 land-based discharge is not anticipated to give rise to any of the effects listed in s107(1) of the RMA in the receiving surface water environment, and the Stage 2 marine discharge is not anticipated to give rise to any of those effects after

reasonable mixing. The restrictions in s107 are therefore not considered to preclude the grant of a discharge permit for either stage.

13.6 Auckland Unitary Plan

The AUP-OP is the primary regional and district planning instrument for the Auckland region. The WEPS 2025, which came into force on 19 December 2025, prevail over AUP-OP rules, where inconsistent. Accordingly, the assessment below addresses both the AUP-OP provisions and the WEPS where relevant.

In accordance with Table E6.4.1 of the AUP-OP, the proposal to discharge wastewater from the proposed development via a land disposal system is a **Discretionary Activity** (A6).

An assessment of effects of the activity was carried out on Section 12 of this report, where it was concluded that the effects will be less than minor.

13.6.1 Section E1 – Water Quality and Integrated Management

Section E1 of the AUP-OP identifies the following policies in relation to on-site wastewater treatment and disposal and discharge to the CMA:

(17) Avoid the discharge of wastewater to the coastal marine area and to freshwater, unless:

(a) alternative methods, sites and routes for the discharge have been considered and are not the best practicable option;

(b) Mana Whenua have been consulted in accordance with tikanga Māori and due weight has been given to section 6, section 7 and section 8 of the Resource Management Act 1991;

(c) the affected community has been consulted regarding the suitability of the treatment and disposal system to address any environmental effects;

(d) the extent to which adverse effects have been avoided, remedied or mitigated on areas of:

(i) high recreational use, or that are used for fishing or shellfish gathering;

(ii) areas of maintenance dredging;

(iii) commercial or residential waterfront development;

(iv) high ecological value; and

(v) marine farms.

(23) Enable on-site domestic-type wastewater treatment and disposal where:

(a) there is no wastewater network available, or it is not practicable to connect into one of the network, or any existing network does not have capacity and it is not practicable to upgrade it; and

(b) *the on-site wastewater treatment results in a discharge that is of a quality and volume that avoids significant adverse effects on groundwater, surface and coastal water quality, public health and amenity.*

(24) *Require proposals for on-site wastewater treatment and disposal to land or water to demonstrate all of the following:*

(a) *there is no practicable alternative land based disposal option;*

(b) *significant adverse effects on public and environmental health, water quality and amenity values are avoided and other adverse effects are remedied or mitigated;*

(c) *an assessment of the site conditions has been undertaken and the proposed system and its design are appropriate for these conditions;*

(d) *the design of the on-site wastewater system and the proposed volume of discharge will minimise the level of contaminants to the greatest extent practicable;*

(e) *that adverse effects on Mana Whenua values will be avoided; and*

(f) *that operations, management and response procedures are in place to ensure the on-going performance of the system and where systems service more than one site, responsibilities for these functions are clearly identified.*

(25) *Only allow the discharge of treated wastewater to water where all the following are addressed:*

(a) *there is no practicable alternative land-based disposal option;*

(b) *the effects on Mana Whenua values;*

(c) *the discharge quality is of a standard appropriate for discharge to a waterbody and does not affect all of the following:*

(i) *the use of that waterbody for other purposes;*

(ii) *public health and amenity; and*

(iii) *ecosystem health and functioning.*

Overall, the proposed activity is considered consistent with the relevant policies of Section E1 due to the following:

- It is not practical to connect to Watercare's reticulation system.
- As noted in Section 12, less than minor effects are expected on surface water, soils, and groundwater. By discharging to a land disposal system, any potential effects on surface water are greatly reduced.
- The use of tertiary treatment is in accordance with best practice and will minimise the discharge of contaminants. The WWTP will also be serviced regularly, in accordance with the supplier's recommendations and warranty requirements.
- Monitoring of the discharge is proposed to ensure the performance of the system is maintained and verified.

- Establishment of baseline values prior to the discharge commencing, and ongoing monitoring of these parameters is recommended as conditions of this consent.
- Disposing of wastewater to land and relying on natural processes, including evapotranspiration and further treatment within the soil matrix, will avoid adverse effects on Mana Whenua values.
- The Stage 2 marine discharge to the CMA has been assessed by Tonkin & Taylor and confirmed to result in adverse effects on water quality, ecosystem health, and Mana Whenua values that can be appropriately avoided, remedied, or mitigated through the proposed treatment standard, outfall configuration, and conditions of consent.

13.7 Proposed Management and Monitoring Conditions

Trade Waste Management

The Consent Holder shall ensure, via regular communication, that the occupiers of premises connected to the wastewater reticulation systems servicing the Beachlands South development are aware of and comply with their responsibilities for discharging wastewater into the network in accordance with the conditions of this consent.

In particular, each property occupier shall:

a. comply with the connection agreement(s) and associated covenants, including restrictions on the discharge of toxic substances, responsibilities for immediate repair of leaks, and the identification and removal of cross-connections or damaged sewer pipework; and

b. not discharge any Trade Waste into the wastewater reticulation system unless the discharge has been approved in writing by the Consent Holder as being equivalent in quality to typical domestic wastewater, or as otherwise meeting the limits of this consent.

Establishment of Baseline Data

Given the scale of the proposed discharge and the long-term use of land application, monitoring of the receiving environment is appropriate.

The monitoring framework has been developed having regard to the confirmed site conditions (Category 5/6 soils), the conservative loading rate proposed, and the staged nature of the wastewater system. Monitoring is intended to provide baseline data and allow for the identification of any trends in soil condition or receiving environment response, enabling appropriate management actions to be implemented if required.

Note – all recommended conditions below are given in "*italic quotes*".

Soil Monitoring – Baseline

Prior to the commencement of wastewater discharge, baseline soil conditions should be established across the disposal field.

"Prior to wastewater discharge occurring, the consent holder shall engage a suitably qualified individual to undertake soil sampling across the disposal field. A minimum of six samples shall be collected at evenly spaced distances across the disposal field, at a depth of 0 to 150 mm below ground level.

The samples shall be tested for the following parameters:

PARAMETER	UNITS
pH	Standard units
Electrical Conductivity	dS/m
Total Nitrogen	mg/kg
Nitrate Nitrogen	mg/kg
Ammoniacal Nitrogen	mg/kg
Total Phosphorus	mg/kg
Olsen Phosphorus	g/m^3
Sodium	me/100 g

Sample locations shall be recorded to enable repeat monitoring at comparable locations.

Soil Monitoring – Ongoing

Ongoing soil monitoring is proposed to identify any trends in nutrient accumulation, salinity, or changes in soil condition over time.

"Every two years following wastewater discharge at the site, the consent holder shall engage a suitably qualified individual to undertake soil sampling across the disposal field. Sampling shall be undertaken at approximately the same locations identified during baseline monitoring, at a depth of 0 to 150 mm below ground level

The samples shall be analysed for the following parameters:

PARAMETER	UNITS
pH	Standard units
Electrical Conductivity	dS/m
Total Nitrogen	mg/kg
Nitrate Nitrogen	mg/kg
Ammoniacal Nitrogen	mg/kg
Total Phosphorus	mg/kg
Olsen Phosphorus	g/m^3
Sodium	me/100 g

Soil Monitoring – Response and Adaptive Management

This condition shall be further strengthened by a review condition to determine any trends in the findings of the baseline monitoring as follows:

Within 10 years of the commencement of the discharge authorised by this consent, the Consent Holder shall submit to the Council a Performance Review Report prepared by a suitably qualified and experienced person. The report shall analyse and summarise all monitoring data collected over the preceding ten-year period, assess compliance with the conditions of this consent and the effects of the discharge on the receiving environment, and recommend any operational, maintenance, or management actions required to maintain compliance and address any identified environmental effects. The Consent Holder shall implement the recommendations of the report within the timeframes specified therein.

A response framework is proposed to ensure that any emerging issues are identified early and appropriately managed.

"Where monitoring results indicate:

(a) a sustained increase in nutrient concentrations beyond expected trends; or

(b) evidence of declining soil performance, including reduced infiltration capacity; or

(c) evidence of ponding, runoff, or localised saturation,

the consent holder shall engage a suitably qualified wastewater or land treatment practitioner to:

(i) investigate the cause of the change; and

(ii) recommend appropriate management responses.

Management responses may include adjustment to loading rates, redistribution of irrigation areas, modification of dosing regimes, or expansion of the disposal field area."

Stream Sampling – Baseline

Given the absence of a direct hydrological connection between the disposal field and nearby overland flow paths, effects on surface water are expected to be minimal. However, to give effect to relevant AUP objectives and policies, together with those of the NPS-FM, baseline monitoring is proposed to provide a reference against which any future changes can be assessed.

"Prior to discharge taking place, water samples shall be taken from two representative sample points within receiving environments downstream of the site monthly for a period of 12 months.

For each sampling event, weather conditions and observed flow conditions shall be recorded.

The samples shall be tested for the following parameters:

PARAMETER	UNITS
pH	-
Temperature	*degrees Celsius*
5 day Biochemical Oxygen Demand (BOD_5)	*mg/L*
Total Suspended Solids (TSS)	*mg/L*
Escherichia Coli (E. Coli)	*cfu/100mL*
Total Nitrogen (TN)	*mg/L*
Total Kjeldahl Nitrogen (TKN)	*mg/L*
Ammoniacal Nitrogen (NH_3-N)	*mg/L*
Nitrate Nitrogen (NO_3-N)	*mg/L*
Nitrite Nitrogen (NO_2-N)	*mg/L*
Total Phosphorus (TP)	*mg/L*

Stream Sampling – Ongoing

"Water samples shall be taken from the established baseline sample points at six monthly intervals (July and January each year).

The samples shall be tested for the following parameters:

PARAMETER	UNITS
pH	-
Temperature	*degrees Celsius*
5 day Biochemical Oxygen Demand (BOD_5)	*mg/L*
Total Suspended Solids (TSS)	*mg/L*
Escherichia Coli (E. Coli)	*cfu/100mL*
Total Nitrogen (TN)	*mg/L*
Total Kjeldahl Nitrogen (TKN)	*mg/L*
Ammoniacal Nitrogen (NH_3-N)	*mg/L*
Nitrate Nitrogen (NO_3-N)	*mg/L*
Nitrite Nitrogen (NO_2-N)	*mg/L*
Total Phosphorus (TP)	*mg/L*
Dissolved Reactive Phosphorus (DRP)	*mg/L*

Monitoring results shall be compared against baseline data to identify any trends in receiving environment condition."

Effluent Sampling

"Samples of treated wastewater shall be collected and analysed every three months for the following parameters.

PARAMETER	UNITS
5-day Biochemical Oxygen Demand (BOD_5)	mg/L
Total suspended solids (TSS)	mg/L
Escherichia coli (E. coli)	cfu/100ml
Total Nitrogen (TN)	mg/L
Total Kjeldahl Nitrogen (TKN)	mg/L
Nitrate Nitrogen (NO_3-N)	mg/L
Nitrite Nitrogen (NO_2-N)	mg/L
Ammoniacal nitrogen (NH_3)	mg/L
Total phosphorus (TP)	mg/L
Dissolved Reactive Phosphorus (DRP)	mg/L

Staged Upgrades to Wastewater Treatment Plant and Disposal Field

Flow Monitoring and Capacity Thresholds

a. *The consent holder shall continuously monitor the daily volume of wastewater received at the wastewater treatment plant.*

b. *When the average daily flow over any three-month period reaches or exceeds 80% of the design capacity (as certified in the accepted engineering plans), the consent holder shall, within three months, submit to the Council's Compliance Manager (or equivalent) a detailed upgrade plan.*

c. *The upgrade plan shall describe how the wastewater treatment plant and/or disposal field will be expanded or upgraded to accommodate projected increases in flow and shall include an implementation timetable to be agreed with Council.*

Effluent Quality and Performance Limits

a. *The consent holder shall test the treated effluent for compliance with all parameters and limits specified in Condition [reference to relevant condition: e.g., "Effluent Quality Standards"].*

b. *Should monitoring results over three consecutive sampling periods show non-compliance with any parameter by more than 20% of its specified limit (e.g., BOD_5, suspended solids, or microbiological parameters), the consent holder shall, within three months, submit to the Council's Compliance Manager a report prepared by a suitably qualified wastewater engineer.*

c. *The report shall:*

   i. *Identify the likely causes of the non-compliance,*

   ii. *Recommend treatment plant or operational upgrades (including improvements to the disposal field if necessary),*

   iii. *Include an implementation schedule for any recommended upgrades.*

Disposal Field Capacity and Loading Criteria

a. The consent holder shall ensure the disposal field loading rate does not exceed the design infiltration or hydraulic loading rates specified in the approved design plans.

b. Where field monitoring indicates the loading rate is trending towards 80% or more of the design limit over a three-month period, the consent holder shall commence planning for the disposal field expansion in conjunction with any necessary treatment upgrades.

c. Construction and commissioning of any required disposal field expansion shall be completed within 12 months of the date on which the Council's Compliance Manager receives written notification from the consent holder that the threshold has been (or is about to be) exceeded.

Upgrade Implementation and Certification

a. Within one month of completing any upgrade, the consent holder shall provide the Council's Compliance Manager with:

iv. As-built drawings certified by a suitably qualified engineer,

v. A commissioning report confirming the treatment plant and/or disposal field meets or exceeds the specified performance standards.

Review Provision

a. Pursuant to sections 128 and 129 of the Resource Management Act 1991, the Council may, at any time, review the conditions of this consent if monitoring data indicate ongoing or significant non-compliance with consented discharge quality limits, or if the volume of wastewater exceeds design thresholds in a way not anticipated by the original consent application.

Sampling Protocols

"All samples shall be collected and analysed in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater", a joint publication of the American Public Health Association, Water Environment Federation and the American Water Works Association; or an alternative method that has been approved in writing by the Auckland Council.'"

Inflow and Infiltration Monitoring

"The consent holder shall record daily rainfall depth from the nearest National Institute for Water and Atmosphere (NIWA) weather station and report this data together with daily discharge flow information in the annual report. Should the discharge flow data exceed the consented daily volume, and the incidence of peak daily flows corresponds with days where there is rainfall, the consent holder shall engage a suitable qualified expert to provide advice and recommendations on addressing these exceedances."

5 yearly Audits of the Wastewater System

"An audit of the condition, operation, and performance of the wastewater treatment and land disposal system shall be undertaken by a suitably qualified wastewater professional every 5 years. The audit shall include:

- *An assessment of the condition of the wastewater treatment and land disposal system.*
- *An assessment of the adequacy of the system to treat and dispose the consented wastewater volume.*
- *An up-to-date list of the components of the wastewater treatment and land disposal system.*
- *Recommendations including timeframes for any changes, upgrades or remedial works to the treatment and land disposal system or process.*

A copy of the assessment report shall be provided to the Auckland Council by no later than 30 September of the year in which the assessment is undertaken"

Vegetation Monitoring

"The consent holder shall undertake a visual inspection at least once per year to assess the health of the vegetation on the disposal field area."

14 CONCLUSIONS AND RECOMMENDATIONS

Based on the detailed assessment of site conditions, wastewater flows, and regulatory requirements presented in this report, the following conclusions are drawn.

14.1 Wastewater Treatment and Disposal Feasibility

The proposed Beachlands South development can be effectively serviced by a staged, centralised wastewater treatment and disposal system. The CW treatment process, as developed by Raath and Associates, can achieve a consistent tertiary level of treatment suitable for both land-based disposal and marine discharge.

The staged approach, involving initial land-based disposal followed by transition to a long sea outfall discharge, provides a practical and scalable solution that aligns with the projected growth of the development.

14.2 Environmental Effects

With tertiary treatment, timer dosing, and drip irrigation across a sufficiently large disposal field, the Stage 1 discharge of treated wastewater to land via a communal PCDI system is assessed as resulting in adverse effects on surface water, groundwater, soils, and public health that can be appropriately avoided, remedied, or mitigated through the proposed design and conditions of consent, provided that the system is appropriately managed and monitored.

For Stage 2, discharge to the CMA within the Tāmaki Strait of the Hauraki Gulf/Tīkapa Moana is supported by preliminary dilution modelling and assessment by Tonkin & Taylor, which indicates that effects can be appropriately mitigated through tertiary treatment and high initial dilution.

14.3 Regulatory Consistency:

The proposed wastewater servicing strategy is consistent with the purpose and principles of the FTAA, the RMA, the WEPS, the NPS-FM, the HGMPA, and the AUP-OP. The discharge to land is aligned with Section E1 – Water quality and integrated management, as well as relevant wastewater disposal policies and provisions of the Unitary Plan.

The staged approach, which prioritises land-based disposal prior to marine discharge, is aligned with policy direction to avoid discharge to water where practicable, while still providing a viable long-term servicing solution for the full development scale.

14.4 System Design and Monitoring

14.4.1 Design

The proposed modular CW-based treatment plant, combined with staged expansion and integrated disposal pathways, provides a robust and flexible system capable of accommodating increasing wastewater flows over time while maintaining tertiary treatment standards.

14.4.2 Monitoring

The proposed monitoring framework, including effluent, soil, and surface water monitoring, provides an appropriate mechanism to verify system performance and ensure environmental effects remain within acceptable limits.

14.4.3 Maintenance

Ongoing maintenance and operation by suitably qualified personnel will be required to ensure the continued performance and reliability of both the treatment plant and disposal systems.

14.5 Recommendations

14.5.1 Implementation

Proceed with the staged implementation of the CW wastewater treatment plant and associated land disposal system, with treatment capacity upgrades triggered by measured wastewater inflows in accordance with the proposed staging philosophy.

14.5.2 Consent Conditions

Adopt the monitoring and performance-based conditions outlined in Section 13.7 to ensure environmental effects are appropriately managed and system upgrades are implemented in a timely manner.

14.5.3 System Operation

Ensure that system operation, monitoring, and reporting are carried out by suitably qualified personnel in accordance with best practice and supplier recommendations.

14.5.4 Adaptive Management

Apply an adaptive management approach, whereby monitoring results are used to inform operational adjustments, system optimisation, and future upgrades as required.

14.6 Conclusion

Overall, the proposed staged wastewater treatment and disposal solution is assessed as the Best Practicable Option for the Beachlands South development. This system provides a sustainable and robust long-term solution that safeguards public health and environmental values.

15 LIMITATIONS

This report has been prepared for the sole benefit of **Beachlands South Limited Partnership** as our Client, and their appointed representatives, according to their instructions, for the specific objectives described herein.

It is acknowledged that this report has been prepared to support a substantive application under the FTAA, and that the report may be relied upon by the FTAA Expert Panel for the purposes of considering the application, assessing the proposed wastewater servicing strategy, and confirming how adverse environmental effects will be appropriately avoided, remedied, mitigated, or otherwise managed through the proposed design and conditions of consent.

This report is qualified in its entirety and should be considered in the light of our Terms of Engagement with the Client and the following:

b. Data or opinions contained within the report may not be used in other contexts or for any other purpose without our prior review and written agreement. Any reliance will be at the parties' sole risk.

c. No responsibility is assumed for inaccuracies in reporting by the information providers. In no event, regardless of whether GWE 's consent has been provided, does GWE accept any liability, whether directly or indirectly, for any liability or loss suffered or incurred by any third party to whom this report is disclosed placing any reliance on this report, in part or in full.

d. GWE has relied on information provided by the Client and by third parties to produce this document and arrive at its conclusions. GWE has not verified information provided (unless specifically noted otherwise) and we assume no responsibility and make no representations with respect to the adequacy, accuracy, or completeness of such information.

APPENDIX A
BORE LOGS

CLIENT:	
PROJECT:	
LOCATION:	Beachlands
Surface Conditions:	gentle to mod. grassed slope

Borehole/Test Pit: MS WW 1

Sheet 1 of

Lithologic Key: FILL; TOP SOIL; SAND; SILT SANDY; SILT; SILT CLAYEY; CLAY; ORGANIC SOILS

Topsoil (silty)

silty CLAY: brn; hp; m; friable, trace organics

brn, mottled lt gr, or. br.

lt gr, mottled orange

E.O.H @ 1.2m; no GW.

WW2

Topsoil; some rootlets

silty CLAY: lt gr, orange, ~~some~~ trace organic discolor; hp; m

bec gr, occ orange mottling

E.O.H @ 1.2m; No GW.

WW3 MS

TOPSOIL

SILTY CLAY and topsoil organics; m; hp

silty CLAY: lt gr, mottled orange (slight discoloration in lt gr); m; hp.

E.O.H @ 1.2m; No GW.

Drill Method	HA
Date Drilled	23/04/26
Drilled By	MJ
Shear Vane No.	—

Observations

GWE CONSULTING ENGINEERS
Ground Floor, Oceanbridge House, 25 Anzac Street, Takapuna, Auckland 0622
09 445 8338
www.gwe.co.nz

CLIENT:		Borehole/Test Pit	MS HW 4
PROJECT:			
LOCATION:	Beachlands		
Surface Conditions:		Sheet 1 of	

Lithologic Key: FILL | TOP SOIL | SAND | SILT SANDY | SILT | SILT CLAYEY | CLAY | ORGANIC SOILS

HW 4

Topsoil: silty clay

Silty clay: lbr or a lbr (min organics) m; hp

Lt gr, mottled orange

EOH @ 1.2m: No GW.

HW NS 5 NS

Topsoil / silty clayey SILT, brn, & brn (some organics): m: mp

Lt gr & or & br (mottled)

EOH @ 1.2m: No GW

HW 8 MS

Topsoil: clayey SLT

silty clay, min organics: br or, mottled br. m: hp

clayey SLT: br or, Lt gr

SILT, tr sand & clay: Lt gr, moth brn, red.

EOH @ 1.2m No GW.

Drill Method	HA
Date Drilled	23/04/26
Drilled By	MS
Shear Vane No.	—

Observations

GWE CONSULTING ENGINEERS
Ground Floor, Oceanbridge House, 25 Anzac Street, Takapuna
Auckland 0622
09 445 8338
www.gwe.co.nz

CLIENT:		Borehole/Test Pit
PROJECT:		
LOCATION:	Fairview / Beach Travels	
Surface Conditions:		Sheet 1 of

Lithologic Key: FILL | TOP SOIL | SAND | SILT SANDY | SILT | SILT CLAYEY | CLAY | ORGANIC SOILS

Geological Unit | Depth (metres) | Groundwater | Shear Vane | Scala Penetrometer (Start Depth (m))

BH1

Topsoil (Silty Clay, Black, moist)

Natural: SILT, Clayey, VSt, M, Brown

BC LBrown streaked orange/Grey

BC Grey Strk LBr

No GWE: EOB @ 1.2m

BH2

TS: Cl/Si/Black

0.2: Nat Cl, silty LBr strk or, VSt M

1.0: BC Z, clayey Grey strk LBr VSt, M,

EOB @ 1.2 no GW

BH3

0.0 TS: As above

0.2 Nat: BC Clay, Silty, Brown, VSt, M

BC Or/Brown Streaky

No GW: EOB @ 1.2m

BH4

0.0: TS as per

0.2: SILT, Clayey, Dbrn Strk or, VSt, M

1.0: BC Strk Blue

No GW

BH5

0.0 TS as per

0.2 Natural: ~~SILT, Clay~~ Clayey, Silty / Brown Strk Orang

SILT, Clayey, BC LBr strk Grey Pinkish

Drill Method	HA
Date Drilled	23/4
Drilled By	AL
Shear Vane No.	—

Observations

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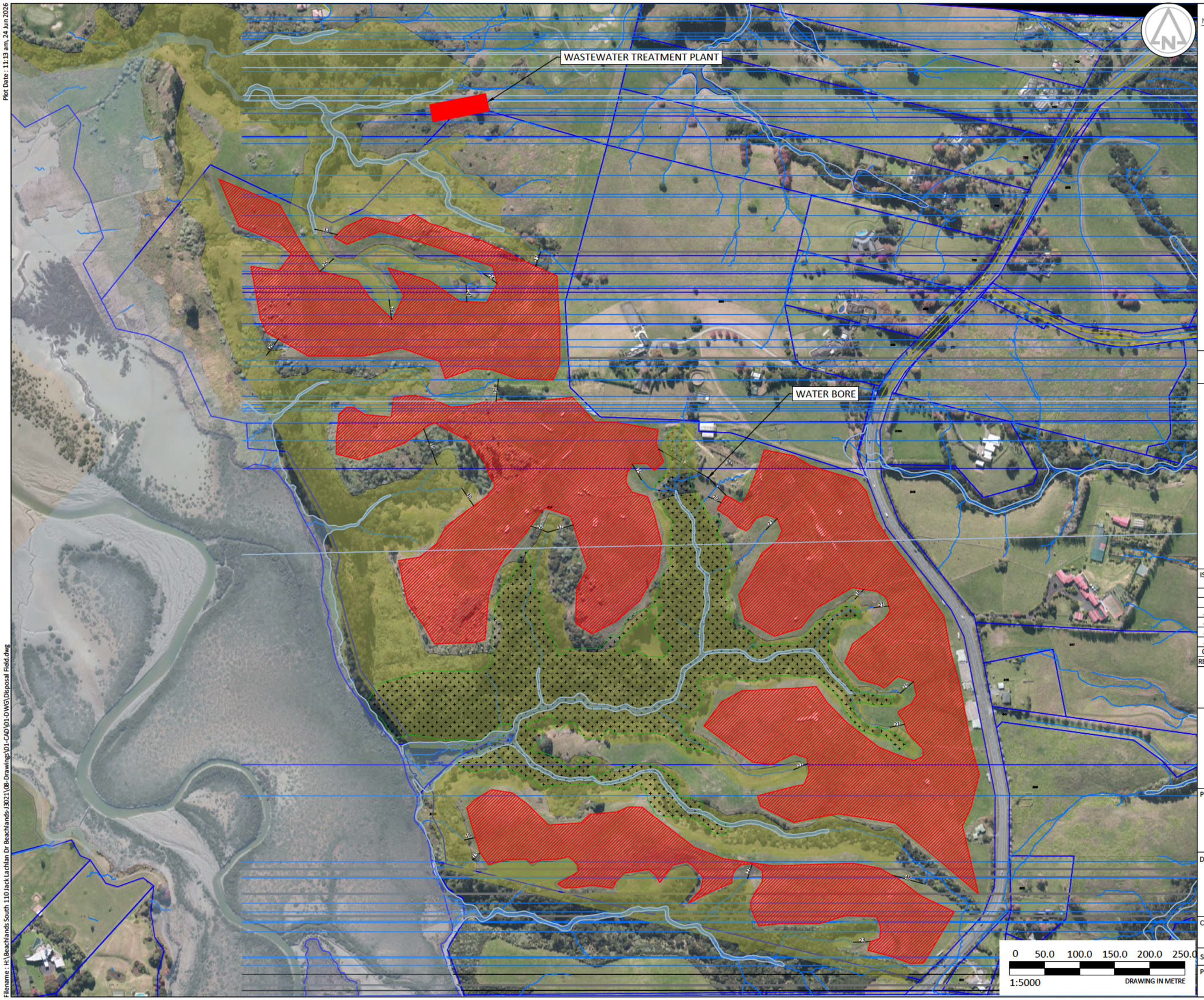
APPENDIX B
SITE PLAN

Plot Date : 11:13 am, 24 Jun 2026



NOTES

1. DRAWING IS BASED ON AUCKLAND COUNCIL GEOMAPS, AERIAL IMAGERY AND AVAILABLE SURVEY INFORMATION.
2. DISPOSAL FIELD LOCATION AND EXTENTS SHALL BE CONFIRMED ON-SITE PRIOR TO CONSTRUCTION.
3. WASTEWATER TREATMENT SYSTEM SHALL BE INSTALLED AND OPERATED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
4. SOIL CATEGORY ADOPTED FOR DESIGN: CATEGORY 5/6
5. DESIGN LOADING RATE: 3 MM/DAY
6. AVERAGE DRY WEATHER FLOW: X L/day
7. PEAK DAILY FLOW: 450 M^3/DAY
8. DESIGN FLOW ADOPTED FOR DISPOSAL FIELD SIZING: 450 M^3/DAY
9. LEVEL OF TREATMENT = TERTIARY
10. DISPOSAL SYSTEM TYPE: SUBSURFACE IRRIGATION OR SURFACE LAID PRESSURE COMPENSATING DRIPPER IRRIGATION.
11. PRIMARY DISPOSAL AREA: 150,000 M^2
12. RESERVE DISPOSAL AREA: 75,000 M^2
13. RESERVE AREA SHALL REMAIN AVAILABLE FOR FUTURE WASTEWATER DISPOSAL PURPOSES AND SHALL NOT BE BUILT UPON.
14. NO EARTHWORKS, STRUCTURES, DRIVEWAYS, STOCKPILES OR VEHICLE MOVEMENT SHALL OCCUR WITHIN THE DISPOSAL AREAS UNLESS SPECIFICALLY APROVED BY THE DESIGNER.
15. DISPOSAL FIELD PIPEWORK DEPTHS, SPACING AND ZONING SHALL BE CONFIRMED DURING DETAILED DESIGN.
16. IRRIGATION ZONES SHOWN AREA INDICATIVE ONLY AND SUBJECT TO DETAILED HYDRAULIC DESIGN.
17. SURFACE WATER SHALL BE DIVERTED AWAY FROM THE DISPOSAL FIELD.
18. DISPOSAL FIELD SHALL MAINTAIN REQUIRED SETBACKS FROM WATERWAYS, DRAINS, BUILDINGS, BOUNDARIES, BORES AND OTHER SERVICES.
19. ANY CHANGES TO SITE LEVELS WITHIN THE DISPOSAL AREA SHALL BE APPROVED BY THE DESIGN ENGINEER.
20. DO NOT SCALE FROM THIS DRAWING.
21. IRRIGATION SHALL OPERATE ON A ROTATIONAL BASIS BETWEEN DESIGNATED ZONES.

LEGEND

- OVERLAND FLOW PATH
- PROP. PRIMARY DISPOSAL AREA
- PROP. RESERVE DISPOSAL AREA
- FLOOD PRONE AREA
- SENSITIVE ECOLOGICAL AREA
- ECOLOGICAL PROTECTED AREA NETWORK

ISSUE STATUS:

REV	AMENDMENT	CAD	ENG	APPD	DATE
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PROJECT ADDRESS:

BEACHLANDS SOUTH, AUCKLAND

DRAWING TITLE:

WASTEWATER SITE PLAN

CLIENT NAME:
BEACHLANDS SOUTH LIMITED PARTNERSHIP

SCALE: 1:5000		A3
PROJECT No: J3021-2	DRAWING No: 500	REV 0

Filename : H:\Beachlands South 110 Jack Lachlan Dr Beachlands-J3021\08-Drawings\01-CAD\01-DWG\Disposal Field.dwg

APPENDIX C

FLOW RECONCILIATION NOTE

FLOW RECONCILIATION NOTE

1. PURPOSE

This Flow Reconciliation Note has been prepared to explain the relationship between earlier wastewater flow assumptions developed for the Beachlands South live-zoned land area and the staged wastewater treatment capacities adopted in the current wastewater concept design. The purpose of this note is to provide clarity for review and does not represent detailed hydraulic sizing or final ultimate capacity design.

2. EARLIER LIVE-ZONED FLOW ASSUMPTIONS

Earlier wastewater assessments prepared in support of rezoning and live-zoning of the Beachlands South land area assumed an overall development yield of approximately 2,900 household equivalent units (HEUs). On this basis, wastewater flows of up to approximately 1,500 m^3/day were identified for a fully developed scenario.

These earlier flow estimates reflected an ultimate development basis and were not linked to staged infrastructure delivery, interim disposal constraints, or measured wastewater generation.

3. CURRENT STAGED FLOW BASIS

The current wastewater concept design adopts a staged communal servicing approach aligned with incremental development delivery. Wastewater treatment capacity has therefore been defined to service early and intermediate development stages, rather than the full ultimate development yield.

The staged treatment capacities are as follows:

- **Stage 1 treatment capacity:**

  450 kL/day (average dry weather flow), provided by a single Combined Works (CW) treatment train.

  This capacity is intended to service the initial development stage comprising approximately 750 dwellings, together with a school and a limited area of local commercial development.

- **Stage 2 treatment capacity:**

  900 kL/day (average dry weather flow), achieved through installation of a second parallel CW treatment train as wastewater flows increase.

  The treatment system is designed to accommodate a hydraulic peaking factor of 2, with peak and wet-weather flows managed through a combination of wastewater network storage, pump station storage, and inlet buffering at the treatment plant.

4. RECONCILIATION OF FLOW ASSUMPTIONS

The staged treatment capacities of 450 kL/day and 900 kL/day are not directly comparable to the earlier 1,500 m^3/day live-zoned flow estimate, as they represent different development horizons and servicing intents.

The earlier flow estimate reflects a theoretical ultimate development scenario, whereas the current staged capacities are intentionally aligned with:

- incremental development staging;
- interim land-based disposal constraints;
- measured wastewater inflows; and
- progressive delivery of treatment infrastructure.

The staged treatment framework does not preclude the provision of additional treatment and discharge capacity in the future should development staging, disposal capacity, or receiving environment assessments require it.

5. CONCLUSION

The staged wastewater flow basis adopted for the Beachlands South development provides a clear and defensible framework for concept-level assessment. It supports servicing of the initial and intermediate stages of development while maintaining flexibility for future expansion. The relationship between the earlier live-zoned flow assumptions and the current staged treatment capacities is therefore considered logical and consistent with a staged communal wastewater servicing strategy.

APPENDIX D

RAATH AND ASSOCIATES REPORTS

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Beachlands South Development
Integrated Wastewater Servicing Strategy and Discharge Assessment Report

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Authorisation

	Person / Function	Date	Signature
Prepared	M Raath	24 April 2026	
Checked	P O' Riordan	24 April 2026	
Approved	M Raath *Managing Director*	12 May 2026	

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1. EXECUTIVE SUMMARY

This report presents a staged wastewater servicing strategy for the Beachlands South development, designed to support both immediate infrastructure requirements and long-term growth through a single, integrated and scalable solution.

The proposed approach is based on a modular onsite wastewater treatment system utilising Combined Works (CW) technology. This enables progressive expansion of treatment capacity while maintaining consistent treatment performance, operational stability, and alignment with regulatory requirements across all stages of development.

Interim Wastewater Solution (Phase 1)
An initial treatment plant with a capacity of 450 m³/day is proposed to service early stages of the development, including residential dwellings and a school. Wastewater flows have been assessed in accordance with Auckland Council design criteria, providing a conservative and compliant basis for reporting.

The interim solution is supported by upstream network infrastructure comprising three pump stations, each designed with 24-hour storage capacity. This approach provides effective hydraulic buffering, enabling the treatment plant to operate under controlled and stable flow conditions.

In addition, a 100,000-litre emergency storage tank is incorporated within the treatment process, located between the inlet works and the mixing chamber. This provides operational resilience during abnormal events and enhances overall system robustness.

Treated effluent from the interim plant will be discharged to land via controlled irrigation systems within the forest area and the 620 site. This discharge pathway has been selected as the preferred interim solution due to:

- Reduced ecological risk relative to direct stream discharge
- Alignment with anticipated consenting requirements
- Ability to demonstrate environmental performance through monitoring

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The detailed design and assessment of the land disposal system will be undertaken separately by **GWE**, with findings to support the discharge consent application.

Staged Development and System Expansion (Phase 2)

As development progresses, the wastewater system will be expanded in a staged and controlled manner. The treatment plant will be augmented through the addition of further CW modules, increasing overall capacity while maintaining consistent treatment performance.

The upstream network will expand to include a total of six pump stations, each incorporating 24-hour storage capacity, ensuring continued hydraulic buffering and operational stability under increased loading conditions.

The design and configuration of the pump stations and associated network infrastructure will be undertaken by **Harrison Grierson**, with integration into the overall system architecture.

Ultimate Wastewater Solution

At full build-out, the wastewater treatment system will accommodate the ultimate development demand. The long-term discharge strategy transitions from land-based disposal to a marine outfall system, providing a permanent and sustainable discharge solution.

Under this final configuration:

- The expanded CW treatment plant will continue to provide high-quality effluent
- Land-based discharge will be progressively reduced and ultimately replaced
- Treated effluent will be conveyed via a marine outfall to the receiving environment

Integrated Infrastructure Strategy

A key strength of the proposed approach is the continuity between interim and ultimate solutions. The treatment plant is not a temporary installation, but rather the initial stage of a fully integrated long-term system.

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This methodology enables:

- No stranded or redundant infrastructure
- No change in treatment technology or process philosophy
- Efficient capital deployment aligned with development staging
- Operational resilience through integrated storage and buffering systems

The combination of upstream pump station storage and on-site emergency storage allows the treatment plant to operate at a controlled hydraulic loading regime, supporting both performance and compliance.

Conclusion

The proposed staged wastewater servicing strategy provides a practical, robust, and environmentally responsible solution for the Beachlands South development.

By integrating treatment, storage, and discharge infrastructure into a single integrated framework, the approach supports immediate development needs while establishing a clear and defensible pathway to the ultimate long-term solution.

2. BACKGROUND AND NEED FOR WASTEWATER SERVICING

2.1 Development Overview

The Beachlands South development is a large-scale, masterplanned urban expansion located within Future Urban Zoned (FUZ) land at Beachlands, Auckland.

The development comprises a mix of residential, educational, and supporting commercial land uses, with an ultimate yield of approximately 2,100 dwellings, together with a primary and secondary school and associated community infrastructure.

Stage 1 of the development is currently underway, with earthworks commenced and infrastructure planning progressing in parallel with the fast-track consenting process.

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Given the scale and staged nature of the development, a wastewater servicing strategy is required that can support both immediate servicing needs and long-term system expansion.

The overall site layout and development staging are illustrated in **Appendix A.**

2.2 Need for a Staged Wastewater Solution

At present, there is no confirmed available capacity within the existing Watercare wastewater network and treatment infrastructure to service the initial stages of the

Beachlands South development within the required programme timeframes.
While long-term regional infrastructure upgrades are being considered, these are subject to:

- Funding allocation
- Design development
- Consenting and procurement processes
- Programme uncertainties

Reliance on external infrastructure therefore introduces a level of uncertainty that is not compatible with the current development programme.

Accordingly, an onsite interim wastewater servicing solution is required to enable development to proceed in a timely and controlled manner, while maintaining flexibility for future integration with long-term infrastructure.

2.3 Project Objectives

The key objectives of the wastewater servicing strategy are to:

- Enable immediate development progression without reliance on external infrastructure availability
- Provide a compliant and environmentally responsible discharge solution for early stages of development
- Ensure alignment with Auckland Council design criteria and consenting requirements
- Establish a clear and defensible pathway from interim servicing to the ultimate long-term solution

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- Avoid the creation of temporary or redundant infrastructure
- Provide a system that is robust under variable loading conditions

2.4 Integrated Staging Approach

The wastewater servicing strategy has been developed as a single integrated system, incorporating both interim and ultimate servicing requirements within a unified framework. The modular expansion strategy is illustrated in **Appendix B.**

Rather than implementing a temporary solution requiring future replacement, the approach adopts a staged infrastructure model, whereby:

- The initial treatment plant forms the first stage of the ultimate system
- Treatment capacity is increased progressively through modular expansion
- The discharge strategy transitions from land-based disposal during early stages to a permanent marine outfall solution at full build-out

This approach ensures continuity in system design, operation, and performance across all stages of development.

2.5 Interim Wastewater Servicing Strategy

The interim servicing strategy is based on the implementation of an onsite wastewater treatment plant with a design capacity of 450 m³/day, servicing the initial development stages, including residential dwellings and a school.

Wastewater flows are derived using Auckland Council design criteria, providing a conservative and appropriate basis for both design and consent assessment.

Treated effluent will be discharged to land via irrigation systems located within the forest area and the 620 site.

This discharge approach has been selected as the preferred interim solution, as it:

- Minimises potential adverse effects on receiving water bodies
- Provides a practical and achievable pathway for consent approval
- Enables monitoring and adaptive management of environmental performance

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The detailed design and assessment of the land discharge system will be undertaken by **GWE**, with supporting documentation forming part of the consent application.

2.6 Ultimate Wastewater Servicing Strategy

As development progresses, the wastewater system will be expanded to accommodate increasing flows through the addition of further treatment modules.

At full development, the discharge strategy will transition from land-based disposal to a marine outfall system, providing a permanent and sustainable solution for treated effluent disposal.

Under this ultimate configuration:

- The treatment system will operate at full capacity in line with development demand
- Land-based discharge will be progressively reduced and decommissioned
- Treated effluent will be conveyed to the coastal receiving environment

2.7 Supporting Technical Inputs

The wastewater servicing strategy is supported by a number of parallel technical workstreams, including:

- Land discharge assessment and design (GWE)
- Pump station and network design (Harrison Grierson)
- Ecological and receiving environment assessments
- Geotechnical investigations

These inputs will be incorporated into the overall consenting framework to ensure a coordinated and comprehensive assessment.

2.8 Summary

The Beachlands South development requires a wastewater servicing solution that is both immediately implementable and capable of supporting long-term growth.

The proposed approach provides a practical and scalable framework, enabling development to proceed while establishing a clear transition to the ultimate discharge strategy.

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3. WASTEWATER FLOW AND LOADING ASSESSMENT

3.1 Overall Treatment Configuration

The proposed wastewater treatment facility has been specifically configured to align with the staged infrastructure and financial modelling framework developed for the Beachlands South project.

The treatment facility will comprise a permanent enclosed municipal treatment structure designed to accommodate six (6) independent Combined Works (CW) treatment modules.

Each module has a nominal treatment capacity of:

- **225 m³/day**

Providing a total ultimate installed treatment capacity of:

- **1,374 m³/day**

This capacity aligns directly with the projected ultimate development demand and the financial modelling assumptions used to define infrastructure staging, capital deployment, and long-term utility revenue recovery.

Table 3.1. shows the CW modular treatment system will be progressively commissioned in accordance with the following staged capacity expansion profile:

Table 3.1.

Stage	Installed Capacity (m^3/day)	Equivalent Modules
Phase 1	225	1 Module
Phase 2	450	2 Modules
Phase 3	681	3 Modules
Phase 4	912	4 Modules
Phase 5	1,143	5 Modules
Phase 6	1,374	6 Modules

This staged modular configuration has been intentionally aligned with:

- projected subdivision growth;
- wastewater generation profiles;
- infrastructure funding requirements; and

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- progressive utility revenue generation.

The modular treatment philosophy therefore enables infrastructure capacity to be deployed incrementally in direct correlation with development uptake, ensuring that treatment infrastructure remains appropriately loaded and financially optimised throughout the development lifecycle.

3.2 Design Population and Development Staging

The Beachlands South development comprises an ultimate yield of approximately:

- 2,100 residential dwellings
- A primary and secondary school
- Associated commercial and community facilities

The wastewater servicing strategy is based on staged development, with the **initial phase (Phase 1)** representing a portion of the ultimate development.

For the purposes of this report, the interim wastewater treatment plant has been sized to accommodate:

- Residential development within early stages
- School wastewater flows
- Allowance for variability and operational contingency

3.3 Residential Wastewater Generation

Residential wastewater flows have been estimated using Auckland Council standard design criteria, based on:

- **Population per dwelling:** 3 persons/dwelling
- **Wastewater generation rate:** 180 L/person/day

This results in a typical residential wastewater generation rate of:
540 L/dwelling/day.

This value has been adopted for reporting purposes to ensure alignment with Council expectations and to provide a conservative design basis.

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3.4 School Wastewater Contribution

Wastewater flows associated with the school have been incorporated as a fixed allowance of:
30 m³/day

This value represents a conservative estimate of combined student and staff contributions and is considered appropriate for the purposes of interim plant sizing and consent assessment.

The staged infrastructure deployment strategy has been specifically developed to align with the financial modelling framework presented in this proposal. Each modular expansion phase corresponds directly to a defined increase in installed treatment capacity and associated capital investment, allowing infrastructure expenditure to closely track subdivision growth and revenue generation.

This direct alignment between treatment capacity expansion and financial staging ensures that:

- capital deployment is optimised over time;
- peak debt exposure is minimised;
- infrastructure utilisation remains efficient during early-stage development; and
- utility revenue generation can progressively support ongoing infrastructure expansion.

Accordingly, the CW modular treatment configuration forms an integral part of the overall financial and commercial strategy, rather than functioning as an isolated engineering solution.

3.5 Average Daily Flow (ADF)

The interim wastewater treatment plant has been designed for an Average Daily Flow (ADF) of: 450 m³/day

This capacity includes:

- Residential wastewater contributions
- School flows
- Allowance for variability and system balancing

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The selected ADF provides sufficient capacity to service the initial stages of development while maintaining operational flexibility.

3.6 Peaking Factor and Hydraulic Loading

A peaking factor of 2 has been adopted for the wastewater treatment plant and discharge consent assessment.

This approach reflects a controlled hydraulic loading regime enabled by the upstream network configuration, specifically:

- Pump stations designed with 24-hour storage capacity
- Operational buffering of inflows prior to treatment
- Reduction of short-term hydraulic surges

It is noted that the upstream gravity network and pump stations will be designed in accordance with Watercare standards, including higher peaking factors for network design purposes. However, the treatment plant is not directly exposed to these peak flows due to the buffering effect of the system.

This approach provides:

- Improved treatment stability
- Reduced risk of hydraulic overloading
- More consistent effluent quality

3.7 Hydraulic Buffering and Storage

The wastewater system incorporates multiple levels of storage to manage flow variability and ensure stable plant operation:

Upstream Storage:

- Three pump stations (Phase 1)
- Each providing 24-hour storage capacity

On-site Storage:

- 100,000-litre emergency storage tank
- Located between inlet works and the mixing chamber

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These storage components function collectively to:

- Equalise inflows to the treatment plant
- Provide contingency during peak events or operational disruptions
- Maintain controlled hydraulic loading conditions

3.8 Ultimate Flow Considerations

At full development, the wastewater system will be expanded to accommodate flows associated with the ultimate development yield.

While detailed ultimate flow calculations will be refined as part of future design stages, the long-term system is expected to operate at a significantly higher capacity, consistent with:

- Full residential build-out
- School and commercial contributions
- Progressive system expansion

The modular nature of the proposed treatment system allows for incremental increases in capacity without fundamental changes to the treatment process or system configuration.

3.9 Summary

The wastewater flow assessment confirms that an interim treatment capacity of 450 m³/day provides an appropriate and conservative basis for servicing the initial stages of the Beachlands South development.

The adoption of Auckland Council design criteria, combined with system buffering through pump station and on-site storage, ensures that the treatment plant will operate under controlled and stable hydraulic conditions.

This approach supports both treatment performance and consent compliance, while providing a clear pathway for future system expansion.

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3.10 Influent Wastewater Characteristics

The design of the Combined Works (CW) treatment system is based on typical domestic wastewater characteristics, aligned with Auckland Council design guidelines and verified international operating data.

For the purposes of process design and performance assessment, the following representative influent wastewater concentrations have been adopted.

Table 3.2 – Typical Influent Wastewater Characteristics (Design Basis)

Parameter	Unit	Design Value
BOD_5	mg/L	500
Total Suspended Solids (TSS)	mg/L	250–350
Ammonium-N	mg/L	20–25
Total Nitrogen (TN)	mg/L	35–45
Total Phosphorus (TP)	mg/L	4–8
pH	-	6.5 – 7.5

These values are consistent with:

- Measured influent characteristics from operational CW plants (refer Appendix D)
- International domestic wastewater benchmarks
- Conservative assumptions for consent and design purposes

As shown in the verified laboratory data (Appendix D), influent BOD_5 concentrations in the order of 150–500 mg/L and suspended solids up to approximately 284 mg/L have been observed, confirming that the adopted design values represent a robust and conservative basis for treatment system sizing.

The CW process is specifically designed to accommodate variability in influent quality through:

- Integrated hydraulic buffering
- Combined suspended-growth and fixed-film biological processes
- Internal sludge stabilisation and recirculation

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This ensures stable treatment performance across a range of influent loading conditions.

4. WASTEWATER TREATMENT SYSTEM (COMBINED WORKS TECHNOLOGY)

4.1 General Description of the CW Process

The Combined Works (CW) process is an integrated biological wastewater treatment system that consolidates all major treatment functions within a single enclosed structure. Unlike conventional treatment trains that rely on multiple separate tanks and external recirculation systems, CW combines suspended-growth and attached-growth biological processes into one coordinated unit.

The system is designed to achieve secondary and tertiary treatment outcomes simultaneously, including:

- Removal of organic matter (BOD);
- Reduction of suspended solids (TSS);
- Nitrification and denitrification for nitrogen removal;
- Phosphorus reduction;
- Sludge stabilisation.

A defining feature of the CW process is its ability to achieve tertiary-level effluent quality **without reliance on membrane filtration or continuous chemical dosing**.

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This is achieved through controlled biological processes and internal hydraulic integration rather than add-on treatment stages.

The CW configuration is modular and fully enclosed, allowing treatment capacity to be increased incrementally as development proceeds. The enclosed design also limits odour generation, reduces visual effects, and improves operational resilience in sensitive environments.

4.2 Detailed Process Description

The CW process integrates a sequence of treatment zones that operate hydraulically and biologically as a single system. Each zone contributes to overall treatment performance while maintaining internal stability and low energy demand.

(1) Inlet Screening

Incoming wastewater first passes through a fine mechanical screen (6 mm), which removes rags, plastics, and coarse solids. Screenings are automatically washed, compacted, and collected in sealed containers for off-site disposal.

This stage protects downstream biological processes and mechanical equipment while minimising maintenance requirements. Odour control can be provided at the inlet works through enclosure and ventilation where required.

(2) Aeration and Contact Zone – Carbon Oxidation and Nitrification

Screened wastewater flows into the aeration zone, where oxygen is supplied through fine-bubble diffusion. In this zone:

- Carbonaceous organic matter is biologically oxidised;
- Ammonium nitrogen is converted to nitrate via nitrification;
- Mixed liquor suspended solids are maintained at stable concentrations.

The aeration system is designed to operate at lower energy input than conventional extended aeration systems due to internal recirculation and efficient oxygen transfer. No surface aerators or high-pressure compressors are required.

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(3) Integrated Clarification

Following aeration, mixed liquor passes into an integrated lamella clarification zone. Inclined settling surfaces provide effective solids separation within a compact footprint.

Settled biomass is returned by gravity to the aeration zone, maintaining internal solids balance without external sludge return pumps. This integration improves process stability and reduces mechanical complexity.

(4) Fixed-Film Biofilter Zone – Nitrogen Transformation

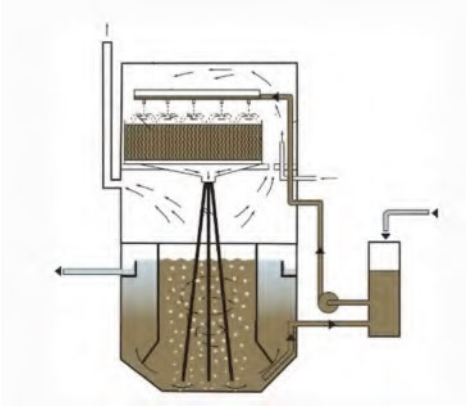

Figure 4.1: Cross-section of CW Reactor (Aeration, Lamella, Biofilter, Stabilisation Zones)

Clarified effluent flows upward through a fixed-film biofilter containing structured media with a high specific surface area. Biofilms attached to the media provide:

- Aerobic zones for continued nitrification;
- Anoxic microzones for biological denitrification.

This configuration allows simultaneous nitrification and denitrification to occur within the same reactor volume, using residual organic carbon as the electron donor. The process is self-regulating and does not require chemical carbon addition under normal operating conditions.

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(5) Dedicated Denitrification Reactor (Where Required)

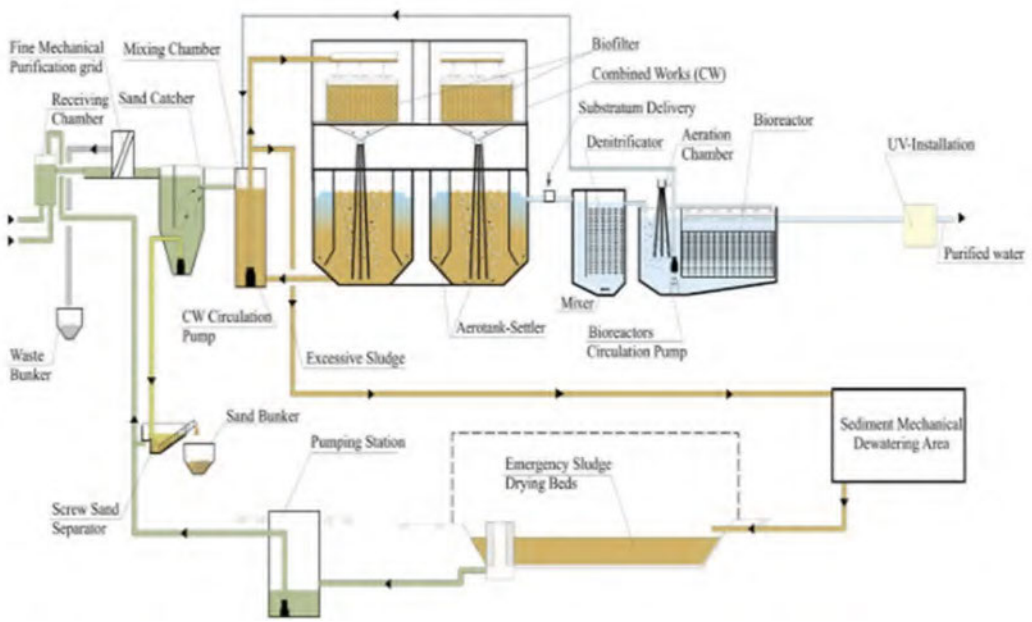

Figure 4.2: Dedicated Denitrification Reactor – Process Schematic and Flow Path

Where enhanced nitrogen removal is required, a dedicated anoxic denitrification reactor is incorporated downstream of the biofilter zone. This reactor:

- Maintains low dissolved oxygen conditions;
- Promotes complete conversion of nitrate and nitrite to nitrogen gas;
- Operates using residual organic carbon from upstream processes.

This configuration enables Total Nitrogen concentrations of **≤ 5 mg/L** to be consistently achieved without chemical dosing.

(6) Phosphorus Removal Reactor – Biological and Adsorptive Mechanisms

The CW system includes a phosphorus reactor downstream of the main treatment process. This zone contains granular inert media where phosphorus is removed via:

- Biological uptake by polyphosphate-accumulating organisms (PAOs).
- Adsorption and precipitation with ferric and calcium ions naturally present.
- Total phosphorus levels of 2–3 mg/L are achieved without external chemical dosing.

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(7) Sludge Stabilisation

Excess biological solids are directed to a sludge stabilisation zone operating under low-oxygen conditions. Through endogenous respiration, microorganisms consume internal energy reserves, reducing sludge volume and odour potential.

This internal stabilisation significantly reduces sludge production compared with conventional activated sludge systems, allowing sludge to be removed infrequently by licensed contractors.

(8) Final Polishing and Disinfection

Final clarification removes any remaining fine solids prior to disinfection. Ultraviolet (UV) disinfection is used to inactivate pathogenic organisms and achieve low faecal indicator levels.

Where required, optional ozone polishing can be applied to provide additional disinfection assurance and odour control. The CW system does not rely on downstream wetlands or land treatment areas to achieve compliance with effluent quality limits.

4.3 Treatment Performance Targets and Achieved Effluent Quality

Table 4.1 summarises the treatment performance targets adopted for the CW system and the effluent quality typically achieved under normal operating conditions.

The target values are based on Auckland Council TP58 guidance, Auckland Unitary Plan objectives, and industry-recognised tertiary treatment benchmarks. These targets represent conservative compliance thresholds rather than maximum achievable performance.

The CW system is designed to reliably achieve these performance targets under normal operating conditions.

Table 4.1 – CW Treatment Performance Summary

Parameter	Target Value	Typical CW Performance (90th Percentile)	Basis
BOD_5	≤ 5 mg/L	3–8 mg/L	Biological oxidation

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Parameter	Target Value	Typical CW Performance (90th Percentile)	Basis
TSS	≤ 10 mg/L	3–5 mg/L	Integrated lamella clarification
Total Nitrogen	≤ 5 mg/L	3–5 mg/L	Biofilter + denitrification
Total Phosphorus	≤ 3 mg/L	2–3 mg/L	Biological uptake and adsorption
Faecal Coliforms	≤ 5 cfu/100 mL	< 2 cfu/100 mL	UV disinfection

The CW system, incorporating integrated lamella clarification, is capable of achieving consistently low suspended solids concentrations, typically in the range of 2–5 mg/L under stable operating conditions, providing a high level of confidence for both land-based and marine discharge applications.

These performance outcomes demonstrate that the CW system is capable of achieving tertiary effluent quality suitable for discharge in environmentally sensitive receiving environments. Importantly, this level of treatment is achieved through biological process control and hydraulic integration rather than reliance on membrane filtration or continuous chemical dosing.

Translated and verified effluent results over a six-month period for the plant operating in Volsk, Eastern Europe, are provided in **Appendix D.**

Summary

In summary, the Combined Works system provides an integrated, compact, and biologically robust wastewater treatment solution capable of achieving tertiary effluent quality within a single enclosed facility. The process combines proven biological mechanisms with low mechanical complexity, making it suitable for decentralised residential developments such as Beachlands South.

5. DISCHARGE STRATEGY (INTERIM AND ULTIMATE)

5.1 Overview

The wastewater discharge strategy for the Beachlands South development has been developed as a staged approach, aligned with the overall infrastructure programme and environmental considerations.

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The strategy provides:

- An interim land-based discharge solution to support early stages of development
- A transition to a permanent marine outfall discharge at full build-out

This approach enables development to proceed while ensuring that discharge effects are appropriately managed at each stage.

5.2 Interim Discharge Strategy (Land-Based Disposal)

5.2.1 Approach

For the initial phase of development, treated effluent from the wastewater treatment plant will be discharged to land via controlled irrigation systems.

The primary discharge areas identified include:

- Forest areas within the development site
- The 620 site, providing additional contingency and capacity

This land-based discharge approach has been selected as the preferred interim solution, based on both environmental and consenting considerations.

5.2.2 Rationale for Land Discharge

Land-based disposal offers several advantages for the interim phase:

- Reduced direct impact on surface water bodies, particularly streams and estuarine environments
- Opportunity for soil-based attenuation of nutrients and contaminants
- Greater alignment with regulatory preferences for early-stage developments
- Ability to monitor and adapt discharge performance over time

Given the sensitivity of local receiving environments, particularly in relation to nutrient loading and ecological values, land discharge provides a conservative and appropriate pathway for the interim phase.

5.2.3 Design and Assessment

The detailed design and assessment of the land discharge system will be undertaken by **GWE**, including:

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- Soil and infiltration assessments
- Irrigation system design and layout
- Nutrient loading and application rate calculations
- Assessment of potential environmental effects

These assessments will form part of the discharge consent application and will ensure that land application is undertaken within sustainable limits.

5.2.4 Monitoring and Adaptive Management

The interim discharge strategy will be supported by a monitoring and adaptive management framework, including:

- Baseline environmental monitoring
- Ongoing monitoring of discharge volumes and quality
- Periodic assessment of soil and receiving environment conditions

This approach enables:

- Verification of system performance
- Early identification of any emerging issues
- Adjustment of operational parameters where required

5.3 Consideration of Surface Water Discharge

Surface water (stream) discharge has been considered as part of the overall strategy; however, it is not proposed as the primary discharge pathway for the interim phase.

This is due to:

- Potential risks associated with nutrient enrichment of receiving water bodies
- Sensitivity of local stream and estuarine environments
- Increased complexity in demonstrating acceptable environmental effects

Further assessment of stream discharge capacity and effects is being undertaken as part of broader environmental investigations. Any future consideration of this option would be subject to detailed modelling and ecological assessment.

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5.4 Ultimate Discharge Strategy (Marine Outfall)

5.4.1 Approach

At full development, the discharge strategy transitions from land-based disposal to a marine outfall system, providing a permanent and sustainable solution for treated effluent.

Under this approach:

- Treated effluent will be conveyed via a dedicated pipeline to a coastal discharge location
- Discharge will occur through a designed outfall system, incorporating appropriate hydraulic and environmental considerations

5.4.2 Rationale for Marine Discharge

The transition to marine discharge at full build-out is driven by:

- Limitations of available land area for long-term disposal at full development scale
- The need for a reliable and permanent discharge solution
- Ability to achieve appropriate dilution and dispersion within the marine environment
- Alignment with long-term infrastructure planning

5.4.3 Integration with Treatment System

The marine outfall strategy is fully compatible with the proposed CW treatment system. As treatment capacity is expanded through additional modules:

- Effluent quality will remain consistent with design expectations
- Discharge volumes will increase progressively
- Land-based discharge will be reduced and ultimately decommissioned

This ensures a smooth transition between interim and ultimate discharge configurations.

5.4.4 Future Design Development

Detailed design of the marine outfall system will be undertaken as part of the subsequent design and consenting phase, and will include:

- Hydraulic design of the pipeline and outfall structure

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- Assessment of tidal and coastal processes
- Mixing and dispersion modelling
- Evaluation of environmental effects on the receiving marine environment

5.5 Transition Between Interim and Ultimate Discharge

A key component of the proposed strategy is the managed transition between land-based and marine discharge.

This transition will occur progressively as:

- Development staging increases wastewater flows
- Treatment plant capacity is expanded
- Marine discharge infrastructure is implemented

During this transition:

- Land discharge volumes will be gradually reduced
- Monitoring data will inform operational adjustments
- The system will continue to operate within consent conditions

This staged transition ensures:

- Continuity of service
- Controlled environmental effects
- Flexibility in responding to regulatory requirements

5.6 Summary

The proposed discharge strategy provides a balanced and staged approach, aligning with both environmental considerations and development requirements.

The adoption of land-based discharge for the interim phase provides a low-risk and consent-aligned solution, while the transition to a marine outfall at full build-out ensures a sustainable long-term discharge pathway.

This integrated approach supports both immediate development needs and long-term environmental management objectives.

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6. INFRASTRUCTURE INTEGRATION AND HYDRAULIC CONTROL

6.1 Overview

The wastewater servicing strategy for Beachlands South has been developed as an integrated system, combining collection, storage, and treatment infrastructure to achieve controlled hydraulic loading and stable treatment performance.

A key objective of the design is to ensure that the wastewater treatment plant operates under managed and predictable flow conditions, despite variability in upstream generation.

This is achieved through a combination of:

- Distributed storage within the pump station network
- On-site emergency storage within the treatment facility
- Controlled transfer of flows to the treatment process

6.2 Integrated System Configuration

The overall wastewater system comprises:

- Gravity reticulation conveying flows to local pump stations
- Pump stations with significant storage capacity
- Rising mains conveying wastewater to a centralised treatment plant
- An onsite CW treatment system with integrated process control

The system is configured to decouple peak network flows from treatment plant inflows, allowing each component to be optimised for its specific function.

6.3 Pump Station Storage and Flow Buffering

Phase 1 (Interim)

- Three pump stations
- Each designed with 24-hour storage capacity

Phase 2 (Ultimate)

- Expansion to six pump stations
- Each maintaining 24-hour storage capacity

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The provision of 24-hour storage at each pump station serves several critical functions:

- Attenuation of peak inflows from the gravity network
- Equalisation of diurnal flow variations
- Operational flexibility during maintenance or upset conditions
- Reduced reliance on instantaneous pumping to match inflows

Rather than transmitting peak flows directly to the treatment plant, the pump stations operate in a controlled discharge mode, releasing flows in a managed manner.

6.4 On-Site Emergency Storage

In addition to upstream storage, the treatment facility incorporates a:
100,000-litre emergency storage tank

located between the inlet works and the mixing chamber.

This storage provides:

- Short-term buffering of inflows during abnormal events
- Protection of downstream biological processes from hydraulic shock loading
- Operational contingency in the event of equipment or power interruptions

The inclusion of this storage further enhances the overall resilience of the system.

6.5 Hydraulic Control Philosophy

The combined effect of upstream and on-site storage enables the implementation of a controlled hydraulic loading regime at the treatment plant.

Under this approach:

- Inflows to the treatment plant are regulated rather than instantaneous
- Peak wet weather flows are attenuated within the network
- The treatment plant receives a more uniform and predictable flow profile

This configuration allows the treatment system to operate under conditions that are more representative of average and moderated flows, rather than extreme short-duration peaks.

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6.6 Peaking Factor Application

A peaking factor of 2 has been adopted for:

- Wastewater treatment plant design
- Discharge consent assessment

This reflects the moderated inflow conditions resulting from:

- Pump station storage and controlled discharge
- On-site emergency buffering
- Operational management of flow transfer

It is noted that:

- The gravity network and pump stations will be designed in accordance with Watercare standards, including higher peaking factors
- These peak flows are not directly transmitted to the treatment plant, due to the buffering effect of the system

Accordingly, the adopted peaking factor for the treatment plant is considered appropriate and representative of actual operating conditions.

6.7 Benefits of the Integrated Approach

The integrated hydraulic design provides several key advantages:

- Improved treatment performance through stable hydraulic loading
- Reduced risk of process upset due to peak flow events
- Optimised infrastructure sizing, avoiding unnecessary overdesign of treatment capacity
- Enhanced operational flexibility and resilience
- Alignment with staged development requirements

This approach also supports more consistent effluent quality, which is critical for both land-based and marine discharge strategies.

6.8 Interface with Supporting Infrastructure Design

The detailed design of the pump stations and associated network infrastructure will be undertaken by **Harrison Grierson**, including:

- Pump sizing and configuration

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- Storage volume design
- Control systems and operational philosophy

These designs will be coordinated with the treatment plant to ensure full integration of hydraulic and process control systems.

6.9 Summary

The wastewater servicing system for Beachlands South has been designed as an integrated hydraulic and treatment system, with multiple levels of storage and control to manage flow variability.

The combination of pump station storage, on-site emergency storage, and controlled inflow to the treatment plant enables operation under a moderated hydraulic regime, supporting both process stability and treatment performance.

The adoption of a peaking factor of 2 for the treatment plant is consistent with this approach and reflects the actual operating conditions expected within the system.

7. ENVIRONMENTAL CONSIDERATIONS AND MONITORING APPROACH

7.1 Overview

The wastewater servicing strategy for the Beachlands South development has been developed with careful consideration of the receiving environment, including land, surface water, and coastal systems. Independent technical review of the CW process is provided in **Appendix C.**

The proposed staged discharge approach is supported by a framework of:

- Conservative design assumptions
- Selection of lower-risk interim discharge pathways
- Ongoing environmental monitoring
- Adaptive management

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This framework ensures that potential environmental effects are appropriately managed and progressively refined as the development proceeds.

7.2 Receiving Environment Considerations

The Beachlands South site and surrounding areas include:

- Land-based environments suitable for controlled irrigation
- Surface water systems, including streams and downstream estuarine environments
- A coastal receiving environment associated with the proposed long-term marine discharge

These environments are sensitive to:

- Nutrient enrichment (nitrogen and phosphorus)
- Organic loading
- Microbial contamination
- Changes in hydrological regimes

Accordingly, the discharge strategy has been developed to minimise potential adverse effects, particularly during the early stages of development.

7.3 Interim Environmental Management (Land Discharge)

The interim land-based discharge approach provides a controlled and conservative pathway for managing treated effluent.

Environmental benefits of this approach include:

- Soil-based attenuation of nutrients and contaminants
- Reduced direct discharge to surface water bodies
- Opportunity for gradual assimilation of treated effluent within the receiving environment

The performance of the land discharge system will depend on:

- Soil characteristics and infiltration capacity
- Application rates and loading management
- Seasonal and climatic variations

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These factors will be addressed through the detailed land disposal design being undertaken by **GWE**.

7.4 Surface Water and Stream Considerations

Direct discharge to surface water bodies has been considered but is not proposed as the primary discharge pathway for the interim phase.

This reflects:

- The sensitivity of local streams and downstream environments
- The potential for cumulative nutrient effects
- The need for a higher level of assessment and modelling to demonstrate acceptable effects

Baseline water quality data and discharge modelling are being undertaken as part of the broader environmental assessment process. These investigations will inform any future consideration of surface water discharge options.

7.5 Marine Environment Considerations (Ultimate Phase)

The long-term discharge strategy involves a transition to a marine outfall system.

The marine receiving environment offers:

- Greater dilution and dispersion capacity
- Reduced reliance on land availability for disposal
- A sustainable pathway for long-term discharge

However, marine discharge requires careful design and assessment, including:

- Consideration of coastal processes and tidal conditions
- Mixing and dispersion characteristics
- Potential ecological effects

These aspects will be addressed in detail during the future design and consenting phase for the marine outfall.

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7.6 Effluent Quality and Environmental Protection

The proposed CW treatment system is designed to produce high-quality treated effluent, with conservative performance targets adopted for the purposes of this application.

Maintaining consistent effluent quality is critical to:

- Protecting receiving environments
- Supporting land-based discharge performance
- Ensuring compatibility with future marine discharge

The integration of hydraulic buffering and stable biological treatment processes supports the reliability of effluent quality over time.

7.7 Monitoring Framework

A comprehensive monitoring programme will be implemented to support both consent compliance and environmental management.

The monitoring framework will include:

Baseline Monitoring

- Existing surface water quality
- Soil and groundwater conditions (where applicable)
- Background environmental parameters

Operational Monitoring

- Wastewater treatment plant performance
- Effluent quality (BOD, TSS, nutrients, microbiological indicators)
- Discharge volumes

Receiving Environment Monitoring

- Soil condition and nutrient accumulation
- Surface water quality (where relevant)
- Indicators of environmental response

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7.8 Adaptive Management Approach

The wastewater servicing strategy adopts an adaptive management approach, allowing for refinement of system operation based on monitoring outcomes.

This approach enables:

- Adjustment of application rates for land discharge
- Optimisation of treatment performance
- Early identification and mitigation of potential environmental effects

Adaptive management provides a practical mechanism for managing uncertainty and ensuring that environmental outcomes remain within acceptable limits.

7.9 Integration with Supporting Assessments

Environmental considerations are supported by a number of specialist inputs, including:

- Land discharge assessment and design (GWE)
- Ecological assessment and mitigation planning
- Hydrological and water quality modelling
- Geotechnical investigations

These assessments will be integrated into the overall consent application to provide a comprehensive evaluation of environmental effects.

7.10 Summary

The environmental management approach for the Beachlands South wastewater system is based on a conservative, staged, and monitored strategy.

The use of land-based discharge during the interim phase, combined with a structured monitoring and adaptive management framework, provides a low-risk pathway for managing environmental effects.

The transition to a marine discharge at full build-out will be supported by detailed assessment and design, ensuring that long-term environmental outcomes are appropriately addressed.

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8. OPERATIONAL MANAGEMENT, MONITORING AND ENVIRONMENTAL CONTROLS

8.1 Overview

The wastewater treatment and discharge system will be operated and maintained in accordance with established industry practices, with appropriate monitoring and management controls to ensure compliance with consent conditions and environmental performance requirements.

Detailed operational procedures will be developed during the detailed design and commissioning phases and will form part of the final operational management plan.

8.2 Operations and Maintenance

The CW treatment system is designed to operate as a robust biological process with relatively low operational complexity.

Routine operational activities will include:

- Inspection of inlet works and screening equipment
- Monitoring of process performance and flows
- Periodic sludge removal and management
- Inspection of pumps, valves, and mechanical equipment
- General housekeeping and site maintenance

Maintenance requirements are expected to be predictable and manageable, supported by standard mechanical and electrical systems.

A detailed Operations and Maintenance (O&M) Plan will be prepared prior to commissioning.

8.3 Monitoring Programme

A monitoring programme will be implemented to verify system performance and ensure compliance with consent conditions.

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Monitoring will include:

Treatment Plant Monitoring

- Influent and effluent quality
- Key parameters (BOD, TSS, nutrients, microbiological indicators)
- Flow volumes

Discharge Monitoring

- Land application volumes and loading rates
- Soil and environmental indicators (as required)

Receiving Environment Monitoring

- Surface water quality (where applicable)
- Environmental response indicators

Monitoring frequency and parameters will be defined as part of the consent conditions and supporting technical assessments.

8.4 Odour Management

The proposed wastewater treatment system is designed as a fully enclosed biological process, which inherently limits the generation and release of odours compared to conventional open treatment systems.

Odour generation is primarily associated with the inlet works and preliminary treatment stages. The design philosophy for odour control is therefore focused on these areas.

Inlet Works Design Approach

The inlet works will comprise integrated screening and grit removal systems, with:

- Fine screening (6 mm) for removal of gross solids
- Silt and grit separation within a contained chamber
- Collection of screenings and grit in sealed skip bins

Screenings and grit will be removed regularly by licensed contractors, minimising retention time and associated odour potential.

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Primary Odour Control Measures

The following measures are incorporated as standard:

- Enclosed inlet works and process areas
- Rapid removal of screenings and grit
- Maintenance of aerobic conditions within downstream treatment processes
- Good operational and housekeeping practices

Enhanced Odour Control (If Required)

Where required to meet site-specific or consent conditions, additional odour control systems can be implemented, including:

Option 1 – Ozone-Based Odour Control (Preferred)

- Ozone dosing at the inlet works to oxidise odorous compounds
- Reduction of hydrogen sulphide (H_2S) and volatile organic compounds (VOCs)
- Improved air quality within the inlet works and surrounding area

Option 2 – Mechanical Ventilation and Negative Pressure System

- Enclosure of inlet works within a ventilated structure
- Extraction of air under negative pressure
- Treatment via carbon filters or biofilters prior to discharge

The selection of odour control approach will be confirmed during detailed design in consultation with Council and based on proximity to sensitive receptors.

Conclusion

Due to the enclosed nature of the CW system, short solids retention times at the inlet works, and the availability of targeted odour control measures, odour effects are expected to be minor, localised, and manageable within standard operational controls.

8.5 Sludge Management

Sludge generated within the treatment process will be:

- Stored in dedicated sludge storage facilities
- Removed periodically by approved contractors
- Transported and disposed of at appropriately consented facilities

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The extended biological treatment process reduces sludge production and stabilises sludge characteristics prior to removal.

8.6 Contingency and Emergency Management

The wastewater system incorporates multiple layers of resilience, including:

- 24-hour storage at pump stations
- 100,000 L emergency storage at the treatment plant

These provisions enable the system to manage:

- Short-term power outages
- Equipment failures
- Peak flow events

In the event of abnormal operation:

- Flows can be temporarily retained within the system
- Operational responses can be implemented before discharge is affected

A detailed Emergency Response Plan will be developed as part of the operational documentation.

8.7 Adaptive Management

The system will be operated under an adaptive management framework, allowing adjustments to be made based on monitoring results and operational experience.

This includes:

- Adjustment of land application rates
- Optimisation of treatment performance
- Response to seasonal or environmental changes

8.8 Summary

The proposed wastewater system incorporates appropriate operational controls, monitoring, and contingency measures to ensure reliable performance and compliance with consent requirements.

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Detailed operational documentation will be developed during the detailed design phase and will form part of the final commissioning and handover process.

9. COMBINED WORKS TECHNOLOGY – EXPERIENCE AND PROVEN TRACK RECORD

9.1 Proven Application of Combined Works Technology

The Combined Works (CW) wastewater treatment process has been applied internationally across a wide range of scales and operating environments and has been independently reviewed and verified. A list of operational CW plants is provided in **Appendix E**.

CW technology has been implemented in both municipal and private-sector applications, including:

- Small decentralised treatment systems
- Medium-scale developments
- Large municipal wastewater treatment facilities

International installations have demonstrated:

- Stable biological performance under variable hydraulic and organic loading
- Consistent achievement of secondary and tertiary effluent quality
- Reduced energy demand relative to conventional activated sludge systems
- Lower sludge production due to integrated biological stabilisation

CW systems have been successfully deployed across a range of regions, including Eastern Europe, Central Asia, and Southern Africa, with plant capacities ranging from less than 50 m³/day to facilities exceeding 20,000 m³/day.

This operating history provides confidence that the underlying process is:

- Technically robust
- Scalable across a wide capacity range
- Adaptable to different regulatory and environmental conditions

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This experience forms the technical foundation for the application of CW technology to the Beachlands South development.

9.2 Application within New Zealand

Raath & Associates Ltd is responsible for the application and implementation of Combined Works technology within New Zealand.

The role of Raath & Associates includes:

- Process selection and treatment system configuration
- Integration of hydraulic, mechanical, and biological design components
- Adaptation of CW technology to New Zealand regulatory requirements
- Preparation of consent documentation and technical reports
- Support during commissioning and performance verification
- Development of monitoring and operational frameworks

At the time of this report, CW technology is being applied across multiple projects within New Zealand at varying stages of development, including:

- Concept and feasibility design
- Detailed design and consenting
- Construction and implementation planning

The current number of fully operational CW plants in New Zealand remains limited.

This reflects the emerging adoption of decentralised and modular wastewater treatment systems, rather than any limitation in the underlying technology.

The approach adopted has been to apply a proven international treatment process within a conservative New Zealand regulatory framework, supported by:

- Staged implementation
- Conservative design assumptions
- Monitoring and adaptive management

Where required, independent technical input has been obtained to confirm that the CW process is compatible with local wastewater characteristics and regulatory expectations.

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9.3 Summary

The Combined Works treatment process is supported by a substantial international operating history and has demonstrated consistent performance across a range of applications and environmental conditions.

Raath & Associates provides the technical interface between this established international technology and its application within New Zealand, ensuring that system design and operation align with:

- Local regulatory requirements
- Environmental protection objectives
- Operational reliability expectations

For the Beachlands South development, the CW system has been applied conservatively, with appropriate allowances for staged implementation, environmental sensitivity, and performance monitoring.

This combination of proven international performance and locally adapted design provides a sound and defensible basis for the proposed wastewater treatment solution.

9.4 Recommendation

Based on the technical assessment presented in this report, it is recommended that:

1. The staged wastewater servicing strategy be adopted, incorporating:
    - An initial 450 m³/day onsite treatment plant
    - Land-based discharge to the forest and 620 site during the interim phase
2. The treatment system be implemented using Combined Works (CW) technology, due to its:
    - Suitability for staged development
    - Ability to operate under variable loading conditions
    - Consistent treatment performance
3. The wastewater system be developed as a single integrated solution, allowing:
    - Progressive expansion of treatment capacity

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- Integration with upstream pump station storage
- Transition to the ultimate discharge configuration

4. The discharge strategy proceed as a staged approach, comprising:
    - Interim land-based discharge supported by monitoring and adaptive management
    - Transition to a marine outfall discharge at full development
5. Supporting technical workstreams, including:
    - Land discharge assessment (GWE)
    - Pump station and network design (Harrison Grierson)
    - Environmental and ecological assessments

be incorporated into the consenting process to provide a comprehensive and coordinated framework.

9.5 Conclusion

The proposed wastewater servicing strategy provides a practical, integrated, and scalable solution for the Beachlands South development.

The use of Combined Works technology, supported by staged infrastructure delivery and a structured discharge strategy, enables:

- Immediate servicing of early development stages
- Controlled management of environmental effects
- A clear transition to a sustainable long-term solution

The approach is considered technically sound, operationally robust, and appropriate for consent approval, subject to detailed design and supporting assessments.

10. REFERENCES

- Auckland Council (2017). *TP58 – On-Site Wastewater Systems: Design and Management Manual* (2nd Edition).
- Auckland Council (2016). *Auckland Unitary Plan – Operative in Part.*
- Kolesnikov V., Vilson E. (2017). *Modern Development of Operation Processes of Sewage Purification at Combined Installations.* Institute of Environmental Technologies, Rostov-on-Don.

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- Watercare Services Ltd (2015). *Water and Wastewater Code of Practice.*
- *Harrison Grierson Pumpstation and Network Infrastructure Report*
- *GWE Effluent Disposal Report and Plan*

11. APPENDIX - SUMMARY TABLE

Appendix	Description	Prepared by	Purpose
A	Site Layout and Development Plan	Harrison Grierson	Context map and infrastructure layout
B	Modular Expansion Plan	Raath & Associates Ltd	Demonstrates scalability (450 + 900 = 1350 m^3/d)
C	Independent Technology Review	DR CPJ Laubscher	Demonstrates Process Compatibility and Effectiveness
D	Verified Effluent Results	Prof Vladimir Kolesnikov	Demonstrates compliance with effluent discharge standards
E	List of Operational Plants	Raath and Associates	Reputable and Proven Functionality

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APPENDIX A - SITE LAYOUT AND DEVELOPMENT PLAN

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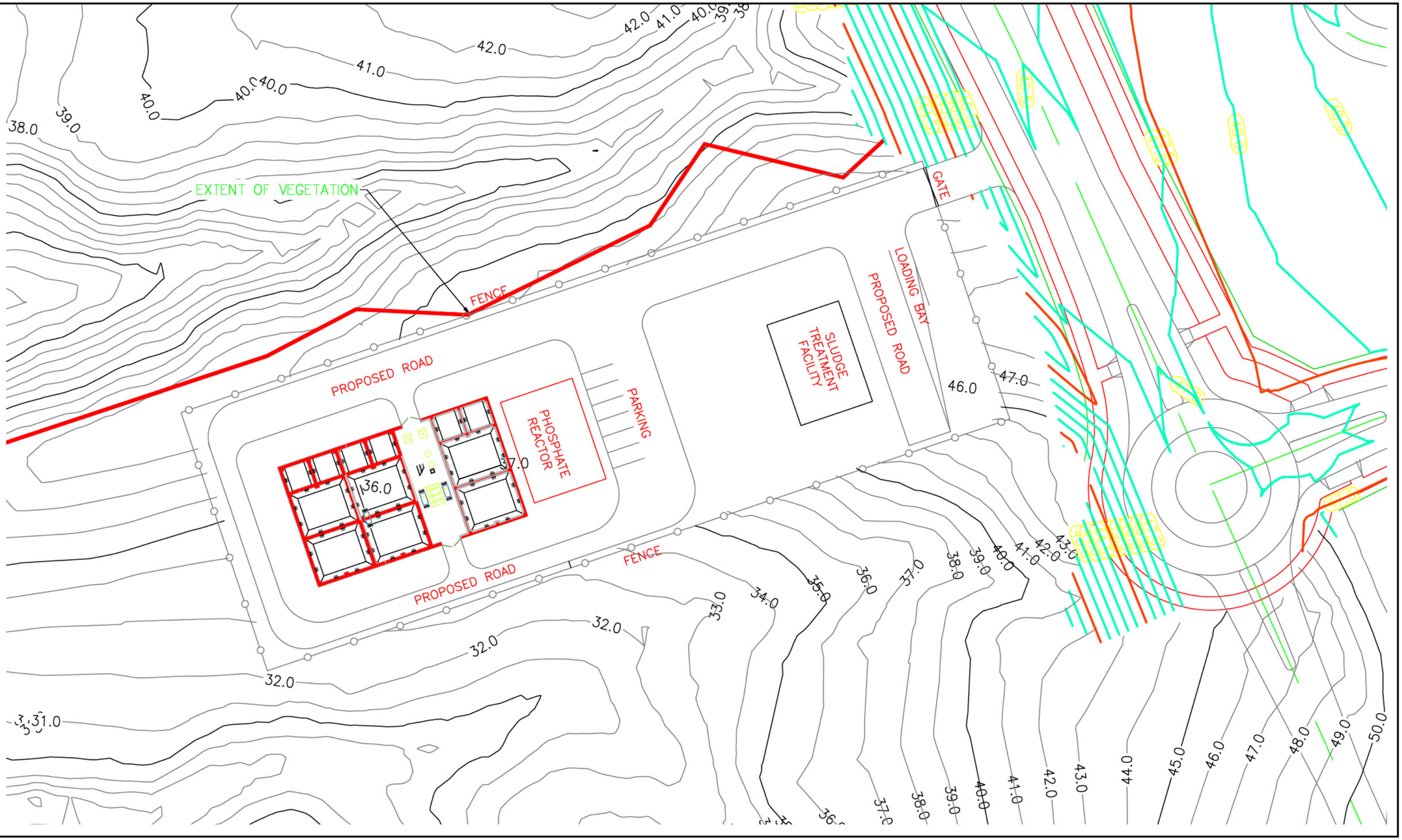

RAATH AND ASSOCIATES
source to consumption

CLIENT NAME	Beachlands South Limited Partnership
CLIENT ADDRESS	12 - 16 Tapora Street, Auckland
PROJECT NAME	1.35 ML/day Staged Wastewater Treatment

DRAWING TITLE	Site Layout and Development Plan		
DESIGNED	V Kolesnikov	09/10/2024	SCALE: NTS
DRAWN	M Raath	09/10/2024	
CHECKED	M Raath	09/10/2024	DRAWING NUMBER: RAA25053 2 of 3
APPROVED	M Raath	09/10/2024	REVISION: 0

PROJECT NUMBER: RAA25053
SIZE: A 3

REV	DATE	REVISIONS	BY / CHK
1	---	---	
2	---	---	
3	---	---	
4	---	---	
5	---	---	

EXTENT OF VEGETATION REMOVAL
PROPOSED ROAD
PROPOSED ROAD
PROPOSED ROAD

APPENDIX B - MODULAR EXPANSION PLAN

The site layout drawing illustrates the proposed arrangement of the wastewater treatment facility, including:

- Modular CW treatment units
- Phosphorus reactor
- Sludge handling facility
- Internal access roads and operational areas

The configuration shown represents a staged build-out approach, aligned with development growth.

Stage 1 (Initial Deployment)

- Installation of initial CW modules to achieve 450 m³/day capacity
- Commissioning of inlet works, screening, and sludge handling systems
-
- Integration with upstream pump station buffering

Stage 2 (Expansion)

- Addition of further CW modules within the allocated footprint
- Expansion to approximately 900 m³/day
- Continued use of shared inlet works and support infrastructure

Ultimate Configuration

- Full utilisation of allocated treatment footprint
- Integration with marine outfall system
- Decommissioning or reduction of land discharge

The modular layout ensures:

- No stranded infrastructure
- Efficient use of site footprint
- Alignment with staged capital deployment strategy

The drawing demonstrates that the treatment plant is not a temporary solution, but the **first stage of a permanent and scalable infrastructure system**.

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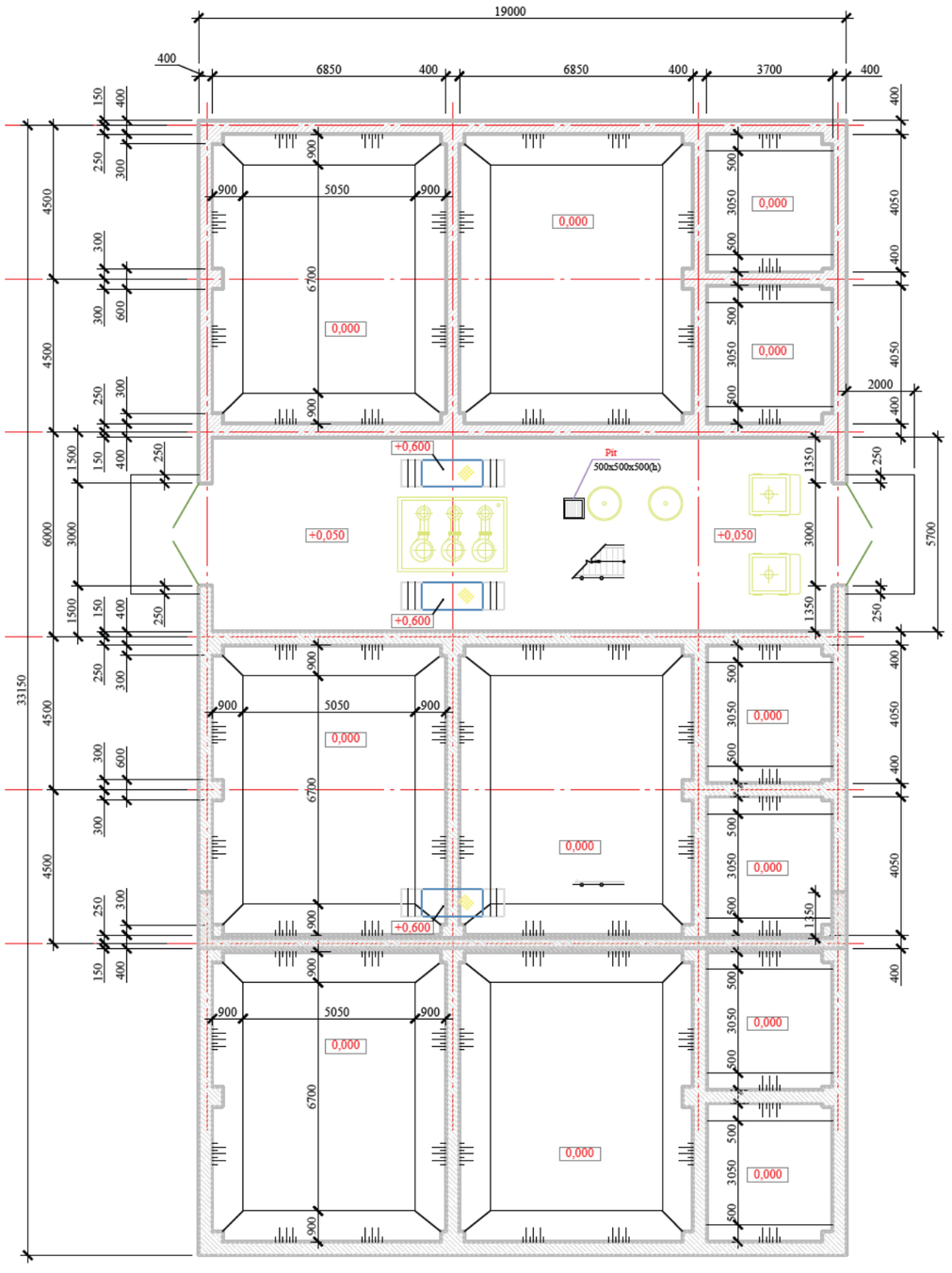

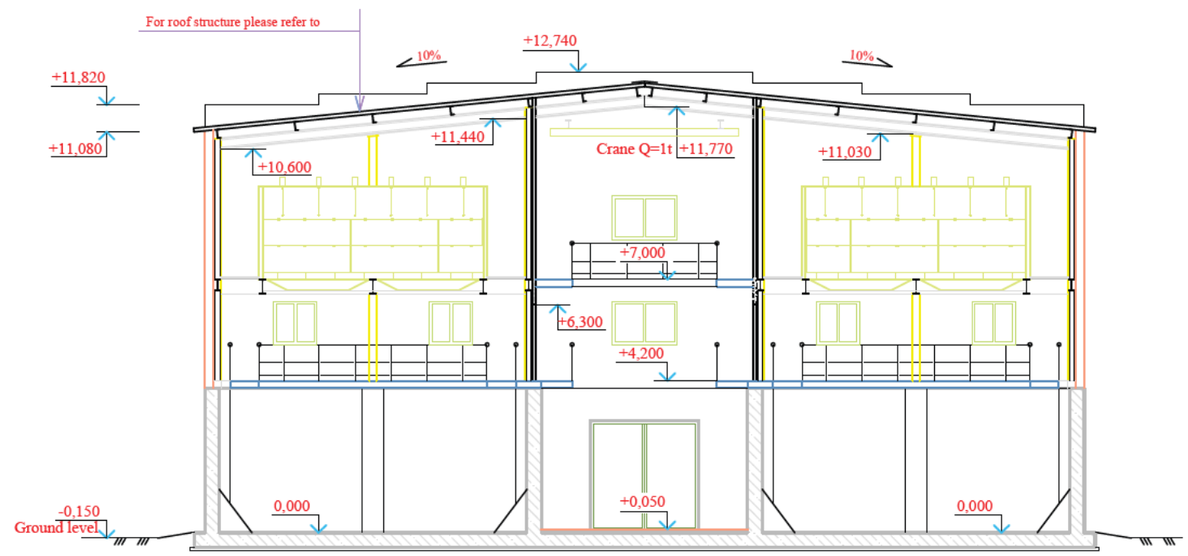

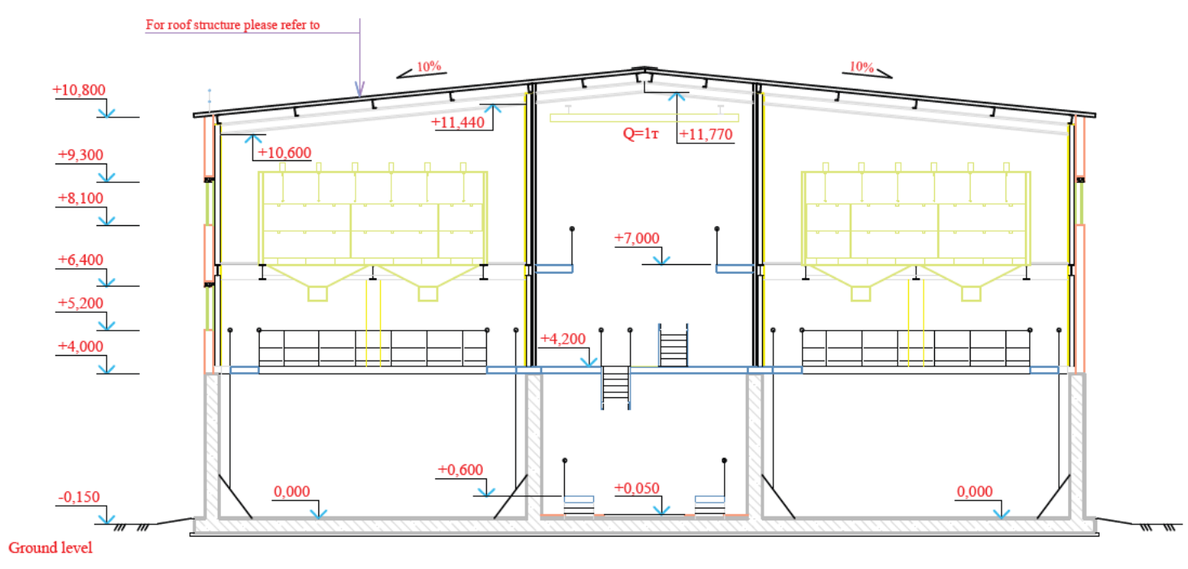

RAATH AND ASSOCIATES
source to consumption

CLIENT NAME	**Beachlands South Limited Partnership**	DRAWING TITLE	**1.35 ML/Day Concept**			PROJECT NUMBER	REV	DATE	REVISIONS	BY	CHK
CLIENT ADDRESS	**12 - 16 Tapora Street, Auckland**	DESIGNED	V Kolesnikov	09/10/2024	SCALE	RAA25053	1	---	---	--	--
		DRAWN	M Raath	09/10/2024	NTS	SIZE	2	---	---	---	---
PROJECT NAME	**1.35 ML/day Staged Wastewater Treatment**	CHECKED	M Raath	09/10/2024	DRAWING NUMBER	A 3	3	---	---	---	---
		APPROVED	M Raath	09/10/2024	RAA25053 1 of 3	REVISION 0	4	---	---	---	---
							5	---	---	---	---

APPENDIX C - INDEPENDENT TECHNOLOGY REVIEW

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[redacted]
Address: Suite 358, Private Bag X1, Melkbosstrand, 7437
Website: www.waterconsultants.co.za
Dr Chris Laubscher & Associates (Pty) Ltd
water and wastewater engineering consultants
2013/101430/07

To whom it may concern

I am a process treatment design engineer with 39 years of relevant experience in water and wastewater treatment. My attached resume includes a list of relevant projects in which I have been the chief process design engineer.

As an independent consultant I have been invited by CW Systems to investigate and comment on their Russian designed Combined Works (CW) process with regard to:

1. Compatibility of their process with the processes currently in use in South Africa.
2. Effectiveness of their process on the quality of wastewater effluent, compared to the requirements of the Water Act.
3. Cost effectiveness of their process compared to processes commonly applied in South Africa.

The findings of the investigation are summarized as follows:

a. Their process is a unique combination and application of the well-known biological filter and nutrient removal activated sludge treatment systems, therefore will not be a foreign concept to local wastewater treatment operators.
b. Aeration of the activated sludge is executed by means of an innovating system of vortexes in air stripping towers, which "sucks" air into the aerated sludge mixture. This, together with continuous sludge recycle, reduces the energy requirements normally associated with aeration by 2 to 3 times! This factor makes the CW process extremely competitive compared with most known wastewater treatment processes, especially with regard to operational costs.
c. The CW process has been found to present effluent conforming to at least the General Standards set by the Water Act. Most of the requirements set by Special Standards can usually also be met without any adaption to the CW process.

I therefore support the CW process completely and I am especially excited about its huge benefit of reduced energy requirements; thereby reducing operational costs!

Yours faithfully,

Dr CJP Laubscher Pr Eng

CURRICULLUM VITAE OF
DR CJP LAUBSCHER

Dr Laubscher graduated in 1974 as a civil engineer at the University of Stellenbosch (BSc BEng) and immediately entered the field of consulting engineering. After gaining valuable experience over a period of 6 years in the planning of civil services for townships, the design of water and purification works and the structural design of water retaining structures, he was the founder member of a consulting engineering practice in Southern Africa in 1980.

In 1980 he received a masters degree (MEng) in water utilization (University of Stellenbosch) and in March 1987 he received his doctoral degree (DEng) in water utilization at the University of Pretoria.

He is a registered Professional Engineer with the South African Engineering Council.

Dr Laubscher now specializes in process design for water and waste water treatment systems. He has gained valuable experience in the treatment of eutrophic water through the design of the Parys and Vredefort Water treatment plants; both treating water from the Vaal River. Also the design of the Ozone Process plant for Sable Hills Waterfront Estate, treating eutrophic water from the Roodeplaat Dam.

With regard to waste water treatment, his major interest lies with the design of nutrient removal activated sludge plant and the disposal of waste sludges.

He is a Fellow member of the Water Institute of South Africa.

A schedule of Water and Waste Water Treatment Plants in which he has been involved, is subsequently listed.

WATER TREATMENT WORKS

PROJECT DESCRIPTION	CLIENT	LOCATION	PROJECT COST (R) (Current Value)
Waterworks extension at Lebowa	SA Development Bank	Jane Furse	12 million
Extensions to water treatment works	Development & Services Board - Natal	Tugela	8 million
Plant treating eutrophic water	Ngwathe Local Municipality	Vredefort	12 million
Langeloop water treatment works 2Mℓ	Malelane Municipality	Malelane	6 million
Upgrading of Vergelegen water treatment works	Makhudu Thamaga Municipality	Vergelegen	12 million
Water treatment works 800Kℓ	Katanga Mining	Kolwezi Mine (DRC)	3 million
0.5Mℓ Ozone plant to treating eutrophic water	Sable Hills Waterfront Estate	Roodeplaat Dam	1 million
Water treatment works extension	Gert Sibande Municipality	Empuluzi	7 million
Refurbishment of Siyabuswa water treatment works	Dr JS Moroka Local Authority	Siyabuswa	14 million
Sabie River Echo Estate 0.5Mℓ water works	Fury Farms	Hazyview	1.5 million
10Mℓ Extensions treating eutrophic water	Ngwathe Local Municipality	Parys	30 million
2Mℓ Extensions	Chief Albert Luthuli Municipality	Badplaas	6 million

WASTE WATER TREATMENT PLANTS

PROJECT DESCRIPTION	CLIENT	LOCATION	PROJECT COST (R) (Current Value)
Sewage purification works 0.7Mℓ	Mpumalanga Public Works Department	Bourkes Luck	6 million
Extensions to sewage treatment plant with wetland system 1Mℓ	Municipality Bethlehem	Bethlehem	6 million
1Mℓ SBR system	Dihlabeng Local Municipality	Bethlehem	7 million
8Mℓ Trickling filter plant	Ngwathe Local Municipality	Parys	52 million
Activated sludge 4.5Mℓ	Anglo Platinum	Burgersfort	32 million
Sewage treatment works 1Mℓ	Katanga Mining	Kolwezi Mine (DRC)	7 million
Activated sludge 8Mℓ	Dihlabeng Local Municipality	Bethlehem	50 million
Biological filter plant 1Mℓ	Warden Municipality	Warden	6 million
Sewage treatment plant for two resorts 0.5Mℓ	Bronkhorst Bay	Bronkhorst Bay	4 million
Activated sludge 0.3Mℓ	Mpumalanga Dept. of Works	Shongwe Hospital	2 million
Activated sludge 6Mℓ	Biwater	Matsulu – Mpumalanga	40 million
Process design for 8Mℓ extension to sewage treatment works	City of Tshwane	Temba	40 million
Activated sludge plant for Pinnacle Point (1Mℓ)	Mossel Bay Municipality	Mossel Bay	7 million
Activated sludge 1.5Mℓ	Development & Services Board – Natal	Shakaskraal & Tugela	10 million
Sewage purification works 0.7Mℓ	Mpumalanga Public Works Department	Bourkes Luck	5 million
Refurbishment to Siyabuswa sewage treatment works	Dr JS Moroka Local Authority	Siyabuswa	3 million
Process design for extension to Klerksdorp sewage works	Matlosana Municipality	Klerksdorp	24 million
Sabie River Echo Estate 0.4Mℓ sewage works	Fury Farms	Hazyview	2 million
Activated sludge 4Mℓ	Tswaing Municipality	Delareyville	25 million
Modified 0.4 Mℓ Oxidation Pond System	Sable Hills Waterfront Estate	Roodeplaat dam	2 million
Activated sludge plant : 11,5Mℓ	Dipaleseng Local Municipality	Balfour	85 million

APPENDIX D - VERIFIED EFFLUENT RESULTS

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Translated Wastewater Laboratory Reports – 2024

Protocol of Wastewater Analysis No. 1

Date of Report: May 25, 2024

Sampling Location: Discharge No. 3 – Treatment Facilities Site

Sampling Date & Time: May 15, 2024, 09:00

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
Ammonium Ion	mg/dm³	61.2	1.42	0.5	PND F 14.1:2:3.1-95
Nitrites	mg/dm³	0.29	0.32	0.08	GOST 33045-2014
Nitrates	mg/dm³	8.17	5.3	40	PND F 14.1:2:4.4-95
Chlorides	mg/dm³	83.3	72.7	30	PND F 14.1:2:3.96-97
Sulfates	mg/dm³	187.7	134.9	100	PND F 14.1:2.159-2000
Total Phosphorus	mg/dm³	8.91	0.95	-	PND F 14.1:2:4.112-97
Iron (total)	mg/dm³	2.77	0.38	0.1	PND F 14.1:2:4.50-96
BOD_5	mgO/dm³	152.6	0.79	2.1	PND F 14.1:2:3:4.123-97
Total Dissolved Solids	mg/dm³	924	780	1000	PND F 14.1:2:4.114-97
Anionic Surfactants	mg/dm³	2.54	0.17	0.5	PND F 14:2:4.15-95
Suspended Solids	mg/dm³	284	6.0	1.75	PND F 14.1:2:3.110-97
Copper	mg/dm³	<0.001	0.006	0.001	PND F

(total)					14.1:2:3:4.48-2022
Zinc	mg/dm^3	<0.005	0.03	0.01	PND F 14.1:2:4.60-96
Nickel (total)	mg/dm^3	<0.005	0.01	0.01	PND F 14.1:2.46-96
Chromium (total)	mg/dm^3	<0.01	0.01	0.02	PND F 14.1:2:4.52-96
Oil Products	mg/dm^3	<0.04	<0.04	0.05	FR.1.31.2011.11313

Protocol of Wastewater Analysis No. 3

Date of Report: June 28, 2024

Sampling Location: Discharge No. 3 – Treatment Facilities Site

Sampling Date & Time: June 20, 2024, 09:30

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
Ammonium Ion	mg/dm³	56.4	4.11	0.5	PND F 14.1:2:3.1-95
Nitrites	mg/dm³	1.32	1.44	0.08	GOST 33045-2014
Nitrates	mg/dm³	103.6	9.9	40	PND F 14.1:2:4.4-95
Chlorides	mg/dm³	88.9	85.1	300	PND F 14.1:2:3.96-97
Sulfates	mg/dm³	182.1	117.4	100	PND F 14.1:2.159-2000
Total Phosphorus & Phosphates	mg/dm³	4.0	2.89	-	GOST 18309-2014
Iron (total)	mg/dm³	0.48	0.39	0.1	PND F 14.1:2:3:4.50-2023
BOD_5	mg/dm³	3.04	0.7	2.1	PND F 14.1:2:3:4.123-97
Dry Residue	mg/dm³	914.0	574.0	1000	PND F 14.1:2:4.114-97
Anionic Surfactants	mg/dm³	1.97	0.08	0.5	PND F 14:2:4.15-95
Suspended Solids	mg/dm³	110.0	4.0	1.75	PND F 14.1:2:3.110-97
Copper (total)	mg/dm³	0.006	0.004	0.001	PND F 14.1:2:3:4.48-2022
Zinc	mg/dm³	0.1	0.09	0.01	PND F 14.1:2:4.60-96

Nickel (total)	mg/dm^3	0.023	0.011	0.01	PND F 14.1:2.46-96
Chromium (total)	mg/dm^3	0.02	<0.01	0.02	PND F 14.1:2:4.52-96
Oil Products	mg/dm^3	<0.04	<0.04	0.05	FR.1.31.2011.11313

Protocol of Wastewater Analysis No. 4

Date of Report: July 22, 2024

Sampling Location: Discharge No. 3 – Treatment Facilities Site

Sampling Date & Time: July 12, 2024, 09:30

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
Ammonium Ion	mg/dm³	35.6	4.1	0.5	PND F 14.1:2:3.1-95
Nitrites	mg/dm³	0.61	1.16	0.08	GOST 33045-2014
Nitrates	mg/dm³	48.7	6.45	40	PND F 14.1:2:4.4-95
Chlorides	mg/dm³	65.6	76.2	300	PND F 14.1:2:3.96-97
Sulfates	mg/dm³	125.3	112.9	100	PND F 14.1:2.159-2000
Total Phosphorus & Phosphates	mg/dm³	2.73	2.29	-	GOST 18309-2014
Iron (total)	mg/dm³	1.2	0.6	0.1	PND F 14.1:2:3:4.50-2023
BOD_5	mg/dm³	170.0	1.75	2.1	PND F 14.1:2:3:4.123-97
Dry Residue	mg/dm³	726.0	626.0	1000	PND F 14.1:2:4.114-97
Anionic Surfactants	mg/dm³	1.82	0.09	0.5	PND F 14:2:4.15-95
Suspended Solids	mg/dm³	246.0	20.0	1.75	PND F 14.1:2:3.110-97
Copper (total)	mg/dm³	0.001	<0.001	0.001	PND F 14.1:2:3:4.48-2022
Zinc (total)	mg/dm³	0.03	0.03	0.01	PND F 14.1:2:4.60-96

Nickel (total)	mg/dm^3	0.03	0.01	0.01	PND F 14.1:2.46-96
Chromium (total)	mg/dm^3	0.02	<0.01	0.02	PND F 14.1:2:4.52-96
Oil Products	mg/dm^3	<0.04	<0.04	0.05	FR.1.31.2011.11313

Protocol of Wastewater Analysis No. 10

Date of Report: October 7, 2024

Sampling Location: Khvalynsk, Sewage Treatment Plant

Sampling Date & Time: October 7, 2024, 06:20–06:30

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
pH	-	6.23	7.12	-	PNDF 14.1:2:3:4.121-97
Transparency	cm	0	0	-	ISO 7027
Ammonium Ion (NH_4)	mg/dm^3	27.6	4.6	0.5	PND F 14.1:2:3.1-95
Nitrites (NO_2^-)	mg/dm^3	0.23	0.26	0.08	GOST 33045-2014
Nitrates (NO_3^-)	mg/dm^3	47	6.5	40	PND F 14.1:2:4.4-95
Chlorides (Cl^-)	mg/dm^3	106	95	300	PND F 14.1:2:3.96-97
Sulfates (SO_4^{2-})	mg/dm^3	219	155	100	PND F 14.1:2.159-2000
Total Phosphorus & Phosphates	mg/dm^3	1.6	1.9	-	GOST 18309-2014
Iron (Fe, total)	mg/dm^3	1.8	0.8	0.1	PND F 14.1:2:3:4.50-2023
Dry Residue	mg/dm^3	2065	934	1000	PND F 14.1:2:4.114-2023
Suspended	mg/dm^3	471	196	1.85	PND F

Solids					14.1:2:3.110-97
Permanganate Oxidizability	mg/dm^3	91	62	-	PND F 14.1:2:4.154-99
Dissolved Oxygen	mg/dm^3	<1	<1	-	PNDF 14.1:2.101-97

Protocol of Wastewater Analysis No. 10 (Second)

Date of Report: October 29, 2024

Sampling Location: Discharge No. 3 – Treatment Facilities Site

Sampling Date & Time: October 23, 2024, 09:30

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
Ammonium Ion	mg/dm^3	24.8	5.0	0.5	PND F 14.1:2:3.1-95
Nitrites	mg/dm^3	0.91	0.07	0.08	GOST 33045-2014
Nitrates	mg/dm^3	23.8	2.6	40	PND F 14.1:2:4.4-95
Chlorides	mg/dm^3	62	60	300	PND F 14.1:2:3.96-97
Sulfates	mg/dm^3	82	89	100	PND F 14.1:2.159-2000
Total Phosphorus & Phosphates	mg/dm^3	1.42	0.69	-	GOST 18309-2014
Iron (total)	mg/dm^3	0.57	0.35	0.1	PND F 14.1:2:3:4.50-2023
BOD_5	mgO/dm^3	189.2	6.0	2.1	PND F 14.1:2:3:4.123-97
Dry Residue	mg/dm^3	710	788	1000	PND F 14.1:2:4.114-97
Anionic Surfactants	mg/dm^3	0.6	0.3	0.5	PND F 14:2:4.15-95

Suspended Solids	mg/dm^3	12	36	1.75	PND F 14.1:2:3.110-97
Copper (total)	mg/dm^3	0.007	0.002	0.001	PND F 14.1:2:3:4.48-2022
Zinc (total)	mg/dm^3	0.05	0.05	0.01	PND F 14.1:2:4.60-96
Nickel (total)	mg/dm^3	0.28	0.06	0.01	PND F 14.1:2.46-96
Chromium (total)	mg/dm^3	0.04	0.02	0.02	PND F 14.1:2:4.52-96
Permanganate Oxidizability	mg/dm^3	30.6	12.8	-	PND F 14.1:2:4.154-99
pH	-	7.76	7.69	7–9	PND F 14.1:2:3:4.121-97
Hydrogen Sulfide	$\mu g/dm^3$	0.02	0.008	0.005	PND F 14.1:2.109-97

Protocol of Wastewater Analysis No. 11

Date of Report: November 22, 2024

Sampling Location: Discharge No. 3 – Treatment Facilities Site

Sampling Date & Time: November 13, 2024, 09:30

Purpose: Monitoring the quality of discharged water

Sample Type: Single (grab sample)

Sampling Method: Manual

Instrument Calibration: Verified and certified

Regulatory Reference: GOST R 59024-2020

Results:

Parameter	Unit	Inlet	Outlet	MAC	Method Ref.
Ammonium Ion	mg/dm³	41.4	4.7	0.5	PND F 14.1:2:3.1-95
Nitrites	mg/dm³	0.17	0.77	0.08	GOST 33045-2014
Nitrates	mg/dm³	5.0	18.9	40	PND F 14.1:2:4.4-95
Chlorides	mg/dm³	124	82	300	PND F 14.1:2:3.96-97
Sulfates	mg/dm³	166	121	100	PND F 14.1:2.159-2000
Total Phosphorus & Phosphates	mg/dm³	0.5	0.15	-	GOST 18309-2014
Iron (total)	mg/dm³	1.5	0.5	0.1	PND F 14.1:2:3:4.50-2023
BOD_5	mgO/dm³	187	<1	2.1	PND F 14.1:2:3:4.123-97
Dry Residue	mg/dm³	845	742	1000	PND F 14.1:2:4.114-97
Anionic Surfactants	mg/dm³	1.4	0.04	0.5	PND F 14:2:4.15-95

Suspended Solids	mg/dm^3	115	12	1.75	PND F 14.1:2:3.110-97
Copper (total)	mg/dm^3	0.007	0.004	0.001	PND F 14.1:2:3:4.48-2022
Zinc (total)	mg/dm^3	0.05	0.03	0.01	PND F 14.1:2:4.60-96
Nickel (total)	mg/dm^3	0.23	0.11	0.01	PND F 14.1:2.46-96
Chromium (total)	mg/dm^3	0.32	0.07	0.02	PND F 14.1:2:4.52-96
Permanganate Oxidizability	mg/dm^3	61.5	13.7	-	PND F 14.1:2:4.154-99
pH	-	7.60	7.57	7–9	PND F 14.1:2:3:4.121-97
Hydrogen Sulfide	$\mu g/dm^3$	0.06	0.02	0.005	PND F 14.1:2.109-97
Dissolved Oxygen	mg/dm^3	<1	12.1	-	PNDF 14.1:2.101-97

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 026/2021 о состоянии измерений в лаборатории
выдано 27.05.2021 действительно до 27.05.2024 г

Протокол исследований состава очищенных сточных вод №
от 25 мая 2024 года

1. Наименование и адрес организации,осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: **Водовыпуск №3- «Участок очистные сооружения»**
4 Дата и время проведения отбора: 15.05.2024 г., 09:00
5. Цель исследования: контроль качества сбрасываемой воды
6 Тип пробы: разовый
7. Способ отбора проб: ручной
8. Средства измерения поверены и имеются свидетельства о поверке
9. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
10. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС (сточная вода)	Выход с КОС (очищенная сточная вода)	НДС	НД на методы исследований
1	Аммоний-ион	мг/дм³	61,2	1,42	0,5	ПНД Ф 14.1:2:3.1-95
2	Нитриты	мг/дм³	0,29	0,32	0,08	ГОСТ 33045-2014
3	Нитраты	мг/дм³	8,17	5,3	40	ПНД Ф 14.1:2:4.4-95
4	Хлориды	мг/дм³	83,3	72,7	30	ПНД Ф 14.1:2:3.96-97
5	Сульфаты	мг/дм³	187,7	134,9	100	ПНД Ф 14.1:2.159-2000
6	Фосфор (суммарно)	мг/дм³	8,91	0,95		ПНДФ 14.1:2:4.112-97
7	Железо (суммарно)	мг/дм³	2,77	0,38	0,1	ПНД Ф 14.1:2:4.50-96
8	$БПК_5$	мгО/дм³	152,6	0,79	2,1	ПНД Ф 14.1:2:3:4.123-97
9	Общая минерализация (сухой остаток)	мг/дм³	924	780	1000	ПНД Ф 14.1:2:4.114-97
10	ПАВ(анионоактивные суммарно)	мг/дм³	2,54	0,17	0,5	ПНД Ф 14:2:4.15-95
11	Взвешенные вещества	мг/дм³	284	6,0	1,75	ПНД Ф 14.1:2:3.110-97
12	Медь (суммарно)	мг/дм³	<0,001	0,006	0,001	ПНД Ф 14.1:2:3:4.48-2022
13	Цинк	мг/дм³	<0,005	0,03	0,01	ПНД Ф 14.1:2:4.60-96
14	Никель (суммарно)	мг/дм³	<0,005	0,01	0,01	ПНД Ф 14.1:2.46-96
15	Хром (суммарно)	мг/дм³	<0,01	0,01	0,02	ПНД Ф 14.1:2:4.52-96
16	Нефтепродукты (суммарно)	мг/дм³	<0,04	<0,04	0,05	ФР.1.31.2011.11313

«25» мая 2024г. Начальник лаборатории: Антонова Е.А.

Исполнители:

General Director
Kolesnikov VP

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 22/2024 о состоянии измерений в лаборатории
выдано 27.05.2024 действительно до 27.05.2027 г.

Протокол исследований № 3
от 28 июня 2024 года

1. Наименование и адрес организации,осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: : **Водовыпуск №3- «Участок очистные сооружения»**
3 Дата и время проведения отбора: 20.06.2024 г., 09:30
4. Цель исследования: контроль качества сбрасываемой воды
5. Средства измерения поверены и имеются свидетельства о поверке
6. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
7. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС	Выход с КОС	НДС	НД на методы исследований
1	Аммоний-ион	мг/дм³	56,4	4,11	0,5	ПНД Ф 14.1:2:3.1-95
2	Нитриты	мг/дм³	1,32	1,44	0,08	ГОСТ 33045-2014
3	Нитраты	мг/дм³	103,6	9,9	40	ПНД Ф 14.1:2:4.4-95
4	Хлориды	мг/дм³	88,9	85,1	300	ПНД Ф 14.1:2:3.96-97
5	Сульфаты	мг/дм³	182,1	117,4	100	ПНД Ф 14.1:2.159-2000
6	Общий фосфор и фосфор фосфатов	мг/дм³	4,0	2,89		ГОСТ 18309-2014
7	Железо (суммарно)	мг/дм³	0,48	0,39	0,1	ПНД Ф 14.1:2:3:4.50-2023
8	БПК₅	мг/дм³	3,04	0,7	2,1	ПНД Ф 14.1:2:3:4.123-97
9	Сухой остаток	мг/дм³	914,0	574,0	1000	ПНД Ф 14.1:2:4.114-97
10	ПАВ анионноактивные вещества (суммарно)	мг/дм³	1,97	0,08	0,5	ПНД Ф 14:2:4.15-95
11	Взвешенные вещества	мг/дм³	110,0	4,0	1,75	ПНД Ф 14.1:2:3.110-97
12	Медь (суммарно)	мг/дм³	0,006	0,004	0,001	ПНД Ф 14.1:2:3:4.48-2022
13	Цинк (суммарно)	мг/дм³	0,1	0,09	0,01	ПНД Ф 14.1:2:4.60-96
14	Никель (суммарно)	мг/дм³	0,023	0,011	0,01	ПНД Ф 14.1:2.46-96
15	Хром (суммарно)	мг/дм³	0,02	<0,01	0,02	ПНД Ф 14.1:2:4.52-96
16	Нефтепродукты (суммарно)	мг/дм³	<0,04	<0,04	0,05	ФР.1.31.2011.11313

« 28 » июня 2024г. Начальник лаборатории: _____ Антонова Е.А.

Исполнители:

General Director
_____ Kolesnikov VP

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 22/2024 о состоянии измерений в лаборатории
выдано 27.05.2024 действительно до 27.05.2027 г.

Протокол исследований состава очищенных сточных вод № 4
от 22 июля 2024 года

1. Наименование и адрес организации,осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: : **Водовыпуск №3- «Участок очистные сооружения»**
4 Дата и время проведения отбора: 12.07.2024 г., 09:30
5. Цель исследования: контроль качества сбрасываемой воды
6 Тип пробы: разовый
7. Способ отбора проб: ручной
8. Средства измерения поверены и имеются свидетельства о поверке
9. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
10. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС	Выход с КОС	НДС	НД на методы исследований
1	Аммоний-ион	мг/дм³	35,6	4,1	0,5	ПНД Ф 14.1:2:3.1-95
2	Нитриты	мг/дм³	0,61	1,16	0,08	ГОСТ 33045-2014
3	Нитраты	мг/дм³	48,7	6,45	40	ПНД Ф 14.1:2:4.4-95
4	Хлориды	мг/дм³	65,6	76,2	300	ПНД Ф 14.1:2:3.96-97
5	Сульфаты	мг/дм³	125,3	112,9	100	ПНД Ф 14.1:2.159-2000
6	Общий фосфор и фосфор фосфатов	мг/дм³	2,73	2,29		ГОСТ 18309-2014
7	Железо (суммарно)	мг/дм³	1,2	0,6	0,1	ПНД Ф 14.1:2:3:4.50-2023
8	$БПК_5$	мг/дм³	170,0	1,75	2,1	ПНД Ф 14.1:2:3:4.123-97
9	Сухой остаток	мг/дм³	726,0	626,0	1000	ПНД Ф 14.1:2:4.114-97
10	ПАВ анионноактивные вещества (суммарно)	мг/дм³	1,82	0,09	0,5	ПНД Ф 14:2:4.15-95
11	Взвешенные вещества	мг/дм³	246,0	20,0	1,75	ПНД Ф 14.1:2:3.110-97
12	Медь (суммарно)	мг/дм³	0,001	<0,001	0,001	ПНД Ф 14.1:2:3:4.48-2022
13	Цинк (суммарно)	мг/дм³	0,03	0,03	0,01	ПНД Ф 14.1:2:4.60-96
14	Никель (суммарно)	мг/дм³	0,03	0,01	0,01	ПНД Ф 14.1:2.46-96
15	Хром (суммарно)	мг/дм³	0,02	<0,01	0,02	ПНД Ф 14.1:2:4.52-96
16	Нефтепродукты (суммарно)	мг/дм³	<0,04	<0,04	0,05	ФР.1.31.2011.11313

« 22 » июля 2024г. Начальник лаборатории: _____ Антонова Е.А.

Исполнители:

General Director

_____ Kolesnikov VP

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 22/2024 о состоянии измерений в лаборатории
выдано 27.05.2024 действительно до 27.05.2027 г.

Протокол исследований состава очищенных сточных вод № 10
от 7 октября 2024 года

1. Наименование и адрес организации, осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: **гХвалынск, канализационные очистные сооружения**
4 Дата и время проведения отбора: 7.10.2024 г, 6.20-6.30
5 Дата и время доставки пробы: 7.10.2024г, 9.00
5. Цель исследования: контроль качества сточной воды
6. Способ отбора проб: ручной
7. Средства измерения поверены и имеются свидетельства о поверке
8. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
9. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС (сточная вода)	Выход с КОС (очищенная сточная вода)	ПДК	НД на методы исследований
1	Водородный показатель	pH	6,23	7,12		ПНДФ 14.1:2:3:4.121-97
2	Прозрачность	см	0	0		ИСО 7027
2	Аммоний-ион (NH_4)	мг/дм³	27,6	4,6	0,5	ПНД Ф 14.1:2:3.1-95
3	Нитриты(NO_2^-)	мг/дм³	0,23	0,26	0,08	ГОСТ 33045-2014
4	Нитраты(NO_3^-)	мг/дм³	47	6,5	40	ПНД Ф 14.1:2:4.4-95
5	Хлориды(Cl^-)	мг/дм³	106	95	300	ПНД Ф 14.1:2:3.96-97
6	Сульфаты(SO_4^{2-})	мг/дм³	219	155	100	ПНД Ф 14.1:2.159-2000
7	Общий фосфор и фосфор фосфатов	мг/дм³	1,6	1,9		ГОСТ 18309-2014
8	Железо (Fe,суммарно)	мг/дм³	1,8	0,8	0,1	ПНД Ф 14.1:2:3:4.50-2023
9	Сухой остаток	мг/дм³	2065	934	1000	ПНД Ф 14.1:2:4.114-2023
10	Взвешенные вещества	мг/дм³	471	196	1,85	ПНД Ф 14.1:2:3.110-97
11	Перманганатная окисляемость	мг/дм³	91	62		ПНД Ф 14.1:2:4.154-99
12	Растворенный кислород	мг/дм³	<1	<1		ПНДФ 14.1:2.101-97

Доза ила в аэротенке - 900 см³

« 7 » октября 2024г. Начальник лаборатории: _____ Антонова Е.А.

Исполнители:

General Director
_____ Kolesnikov VP

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 22/2024 о состоянии измерений в лаборатории
выдано 27.05.2024 действительно до 27.05.2027 г.

Протокол исследований состава очищенных сточных вод № 10
от 29 октября 2024 года

1. Наименование и адрес организации, осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: **Водовыпуск №3- «Участок очистные сооружения»**
4 Дата и время проведения отбора: 23.10.2024 г., 09:30
5. Цель исследования: контроль качества сбрасываемой воды
6 Тип пробы: разовый
7. Способ отбора проб: ручной
8. Средства измерения поверены и имеются свидетельства о поверке
9. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
10. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС	Выход с КОС	НДС	НД на методы исследований
1	Аммоний-ион	мг/дм³	24,8	5,0	0,5	ПНД Ф 14.1:2:3.1-95
2	Нитриты	мг/дм³	0,91	0,07	0,08	ГОСТ 33045-2014
3	Нитраты	мг/дм³	23,8	2,6	40	ПНД Ф 14.1:2:4.4-95
4	Хлориды	мг/дм³	62	60	300	ПНД Ф 14.1:2:3.96-97
5	Сульфаты	мг/дм³	82	89	100	ПНД Ф 14.1:2.159-2000
6	Общий фосфор и фосфор фосфатов	мг/дм³	1,42	0,69		ГОСТ 18309-2014
7	Железо (суммарно)	мг/дм³	0,57	0,35	0,1	ПНД Ф 14.1:2:3:4.50-2023
8	$БПК_5$	мгО/дм³	189,2	6,0	2,1	ПНД Ф 14.1:2:3:4.123-97
9	Сухой остаток	мг/дм³	710	788	1000	ПНД Ф 14.1:2:4.114-97
10	ПАВ анионноактивные вещества (суммарно)	мг/дм³	0,6	0,3	0,5	ПНД Ф 14:2:4.15-95
11	Взвешенные вещества	мг/дм³	12	36	1,75	ПНД Ф 14.1:2:3.110-97
12	Медь (суммарно)	мг/дм³	0,007	0,002	0,001	ПНД Ф 14.1:2:3:4.48-2022
13	Цинк (суммарно)	мг/дм³	0,05	0,05	0,01	ПНД Ф 14.1:2:4.60-96
14	Никель (суммарно)	мг/дм³	0,28	0,06	0,01	ПНД Ф 14.1:2.46-96
15	Хром (суммарно)	мг/дм³	0,04	0,02	0,02	ПНД Ф 14.1:2:4.52-96
16	Перманганатная окисляемость	мг/дм³	30,6	12,8	-	ПНД Ф 14.1:2:4.154-99
17	Водородный показатель	pH	7,76	7,69	7-9	ПНД Ф 14.1:2:3:4.121-97
18	Сероводород	мкг/дм³	0,02	0,008	0,005	ПНД Ф 14.1:2.109-97

« 29 » октября 2024г. Начальник лаборатории: _____ Антонова Е.А.

Исполнители:

General Director
_____ Kolesnikov VP

Филиал ГУП СО «Облводоресурс»-«Вольский»

Химическая лаборатория водоотведения
г. Вольск, ул. Одесская, д.2; тел.:(84593) 5-09-04
Заключение № 22/2024 о состоянии измерений в лаборатории
выдано 27.05.2024 действительно до 27.05.2027 г.

Протокол исследований состава очищенных сточных вод № 11
от 22 ноября 2024 года

1. Наименование и адрес организации, осуществляющей отбор и исследование проб:
ФГУП СО «Облводоресурс» - «Вольский» г.Вольск, проезд Нижней Малыковки, д. 10 В
2. Место отбора пробы: **Водовыпуск №3- «Участок очистные сооружения»**
4 Дата и время проведения отбора: 13.11.2024 г., 09:30
5. Цель исследования: контроль качества сбрасываемой воды
6 Тип пробы: разовый
7. Способ отбора проб: ручной
8. Средства измерения поверены и имеются свидетельства о поверке
9. Нормативная документация, устанавливающая методы отбора проб: ГОСТ Р 59024-2020
10. Результаты исследований:

№, п/п	Анализируемые показатели	Ед. измер.	Вход на КОС	Выход с КОС	НДС	НД на методы исследований
1	Аммоний-ион	мг/дм³	41,4	4,7	0,5	ПНД Ф 14.1:2:3.1-95
2	Нитриты	мг/дм³	0,17	0,77	0,08	ГОСТ 33045-2014
3	Нитраты	мг/дм³	5,0	18,9	40	ПНД Ф 14.1:2:4.4-95
4	Хлориды	мг/дм³	124	82	300	ПНД Ф 14.1:2:3.96-97
5	Сульфаты	мг/дм³	166	121	100	ПНД Ф 14.1:2.159-2000
6	Общий фосфор и фосфор фосфатов	мг/дм³	0,5	0,15		ГОСТ 18309-2014
7	Железо (суммарно)	мг/дм³	1,5	0,5	0,1	ПНД Ф 14.1:2:3:4.50-2023
8	$БПК_5$	мгО/дм³	187	<1	2,1	ПНД Ф 14.1:2:3:4.123-97
9	Сухой остаток	мг/дм³	845	742	1000	ПНД Ф 14.1:2:4.114-97
10	ПАВ анионноактивные вещества (суммарно)	мг/дм³	1,4	0,04	0,5	ПНД Ф 14:2:4.15-95
11	Взвешенные вещества	мг/дм³	115	12	1,75	ПНД Ф 14.1:2:3.110-97
12	Медь (суммарно)	мг/дм³	0,007	0,004	0,001	ПНД Ф 14.1:2:3:4.48-2022
13	Цинк (суммарно)	мг/дм³	0,05	0,03	0,01	ПНД Ф 14.1:2:4.60-96
14	Никель (суммарно)	мг/дм³	0,23	0,11	0,01	ПНД Ф 14.1:2.46-96
15	Хром (суммарно)	мг/дм³	0,32	0,07	0,02	ПНД Ф 14.1:2:4.52-96
16	Перманганатная окисляемость	мг/дм³	61,5	13,7	-	ПНД Ф 14.1:2:4.154-99
17	Водородный показатель	pH	7,60	7,57	7-9	ПНД Ф 14.1:2:3:4.121-97
18	Сероводород	мкг/дм³	0,06	0,02	0,005	ПНД Ф 14.1:2.109-97
19	Растворенный кислород	мг/дм³	<1	12,1		ПНДФ 14.1:2.101-97

« 22 » ноября 2024г. Начальник лаборатории: _____ Антонова Е.А.

Исполнители:

General Director
_____ Kolesnikov VP

APPENDIX E - LIST OF OPERATIONAL PLANTS

№	Description of project	Contact person
1	Municipal plant Saratov region, city Berezovka; Capacity of the plant 1 400 m³/day;	Vinokurov Anatolii [redacted] Orlov Gennadii [redacted]
2	Private plant, Kuthaba Bush Lodge Modimole region, South Africa Capacity 20 m³/day;	Jason De Steur [redacted] https://kuthaba.co.za/
3	Municipal plant Saratov region, city Volsk Capacity of the plant 25 000 m³/day;	Tuktarov R [redacted]
4	Municipal plant Brjansk region, c.Staroduba Capacity of the plant 6 000 m³/day;	Nozik V. [redacted]
5	Municipal plant Moldova Republic c. Soroki Capacity of the plant 10 000 m³/day;	Pinzaru S. [redacted]
6	Municipal plant Voronez region, c. Kalacha Capacity of the plant 3 000 m³/day;	Tuktarov R [redacted]
7	Municipal plant g. Novorossiisk Capacity of the plant 50 m³/day	Rukin A. [redacted]
8	Private holiday resort c . Moscow Capacity of the plant 200 m³/day;	Kazakov I. [redacted]
9	Municipal plant South Sahalin, c. Dolinsk Capacity of the plant 7 000 m³/day;	Kobljukov I. [redacted]
10	Municipal plant South Sahalin, c. Timovskoe Capacity of the plant 4 200 m³/day;	Kobljukov I. [redacted]
11	Municipal plant Krasnodar, stanica Kushevskaja Capacity of the plant 2 700 m³/day;	Kasjanov O [redacted]
12	Municipal plant Chitinskii region, c. Darasun Capacity of the plant 1 000 m³/day;	Trifonov A. [redacted]
13	Municipal plant c. Novorosiisk, town Abrau-Durso Capacity of the plant 1 500 m³/day;	Skiba A. [redacted]
14	Municipal plant Ukraine, city Kirilovka Capacity of the plant 12 000 m³/day;	Grushko JU.
15	Municipal plant Moscow region, city Kubinka Capacity of the plant 7 000 m³/day;	Mjazdrikov S. [redacted]
16	Municipal plant Kazakhstan, city Turkmenistan Capacity of the plant 20 000 m³/day;	Kudaibergenova Gauhar [redacted]
17	Municipal plant Moscow region, city Krasnogorsk Capacity of the plant 1 000 m³/day;	Vorotoncev Anatolii [redacted]
18	Municipal plant Ivanovskii region, city Kineshma, Capacity 20 000 m3/day;	Minulin R. [redacted]

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Figure E-1: Shows a 10 000 000 m^3/day Residential and Commercial WWTP Module on Kazakstan Border

Figure E-2: Shows the outside of a 600 000 m^3/day Residential and Commercial WWTP Module in Krasnodar Territory. The Development team are also shown in the picture.

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Figure E-3: Shows the final treated Effluent at the 600 000 m^3/day Residential and Commercial WWTP Module in Krasnodar Territory.

Figure E-4: Indicates the internal construction of the 10 000 m^3/day Residential and Commercial WWTP Module on Kazakstan Border

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Figure E-5: Indicates a 200 000 m^3/day WWTP With a BOD Influent of 1500 mg/L

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EMERGING ORGANIC CONTAMINANTS (EOCs) AND NANOBUBBLE POLISHING MEMORANDUM

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0	9/06/2026	Final	M Raath	N/A

1. Purpose

This memorandum has been prepared to provide technical information regarding the anticipated removal of Emerging Organic Contaminants (EOCs) within the proposed Beachlands South Wastewater Treatment Plant and to describe the proposed incorporation of oxygen nanobubble technology immediately upstream of the marine outfall.

The information is intended to support the marine ecology assessment and provide additional context regarding the environmental performance of the proposed Combined Works (CW) wastewater treatment process.

2. Emerging Organic Contaminants

Emerging Organic Contaminants (EOCs) are trace compounds commonly found in municipal wastewater that are not always specifically regulated through conventional wastewater discharge consents but are increasingly recognised as having potential ecological significance.

Examples include:

- Pharmaceuticals and personal care products (PPCPs);
- Endocrine disrupting compounds (EDCs);

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- Steroid hormones;
- Household cleaning products;
- Surfactants;
- Industrial organic compounds;
- Trace pesticides and herbicides;
- Microplastics;
- Antibiotic residues and associated resistance markers.

These compounds are typically present at extremely low concentrations, generally within the microgram per litre (µg/L) and nanogram per litre (ng/L) range.

Although present at very low concentrations, they are often used as indicators of wastewater treatment performance because many are more difficult to remove than conventional parameters such as BOD, TSS and ammonia.

3. Combined Works Treatment Process

The proposed Beachlands South treatment plant utilises Combined Works (CW) technology developed for advanced municipal wastewater treatment.

The treatment train comprises:

- Preliminary screening and grit removal;
- Attached-growth biological treatment using ceramic media;
- Aerobic biological oxidation;
- Clarification and solids separation;
- Dedicated denitrification;
- UV disinfection;
- Oxygen nanobubble polishing prior to discharge.

The process differs from conventional activated sludge systems because biological treatment occurs predominantly within highly active attached-growth biofilms supported on engineered ceramic media rather than solely through suspended biomass.

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The CW process also operates with extended sludge age and long biomass retention times, which are recognised internationally as important factors in the degradation of slowly biodegradable organic compounds.

4. Mechanisms of EOC Removal Within the CW Process

4.1 Attached-Growth Biofilm Treatment

The ceramic media within the CW process supports a highly diverse microbial population.

Unlike conventional suspended growth systems where microorganisms are continuously removed through sludge wasting, attached biofilms allow long-term development of specialised microbial communities capable of degrading more complex organic molecules.

This increased microbial diversity is particularly important for compounds such as:

- Pharmaceuticals;
- Hormones;
- Personal care products;
- Trace industrial organics.

Many of these compounds require multiple biological degradation pathways and longer exposure times than those required for conventional BOD removal.

The biofilm environment in the CW system provides these conditions.

4.2 Extended Sludge Age

One of the key features described within the Combined Works process is the maintenance of extended sludge age (~40 Days) through endogenous biological stabilisation.

Long sludge age provides:

- Greater microbial diversity;
- Increased biological contact time;
- Enhanced degradation of slowly biodegradable compounds;
- Improved resilience to variable loading conditions.

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International research consistently identifies sludge age as one of the most important operational parameters influencing removal of trace organic contaminants.

The CW process therefore incorporates a process characteristic known to promote enhanced EOC degradation.

4.3 Multiple Biological Environments

The treatment train incorporates both aerobic and anoxic treatment zones. Different microbial populations develop under these differing environmental conditions.

This broadens the range of metabolic pathways available for contaminant degradation and increases the likelihood of transformation and breakdown of complex trace organic compounds.

The combination of aerobic oxidation and denitrification therefore provides multiple opportunities for EOC removal throughout the treatment process.

4.4 Adsorption and Solids Removal

Many EOCs exhibit an affinity for biological solids.

As wastewater passes through the CW process, a proportion of trace contaminants become associated with biofilms and suspended biological solids.

These solids are subsequently removed through clarification and sludge wasting processes.

This mechanism contributes to the reduction of:

- Hydrophobic pharmaceuticals;
- Steroid hormones;
- Personal care products;
- Microplastics;
- Organic micropollutants associated with particulate matter.

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4.5 UV Disinfection

The final UV disinfection stage provides an additional treatment barrier.

Although primarily designed for pathogen inactivation, UV irradiation can contribute to the breakdown of certain trace organic compounds through photolytic processes.

UV therefore acts as a supplementary polishing step immediately prior to discharge.

5. Expected EOC Removal Performance

The removal efficiency of individual EOCs is highly compound specific and depends on chemical structure, influent concentration and wastewater characteristics.

However, international studies of advanced biological treatment systems incorporating attached-growth biofilms, nutrient removal and extended sludge ages commonly report substantial reductions in:

- Pharmaceuticals;
- Hormones;
- Endocrine disrupting compounds;
- Surfactants;
- Personal care products.

The CW process incorporates the same fundamental treatment mechanisms responsible for these reductions.

Accordingly, significant removal of many common EOCs would be expected prior to discharge.

While compound-specific removal rates would require targeted monitoring, the proposed treatment configuration represents a higher level of treatment than conventional secondary wastewater treatment systems.

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6. Microplastic Reduction

Microplastics entering municipal wastewater typically originate from:

- Synthetic clothing fibres;
- Household products;
- Urban runoff;
- Domestic activities.

Removal occurs principally through:

- Attachment to biological solids;
- Biofilm capture;
- Clarification and sludge separation.

The CW process incorporates all of these removal mechanisms.
Consequently, substantial reduction in microplastic loading is expected prior to discharge.

7. Nutrient Reduction and Ecological Significance

The proposed Beachlands South treatment system incorporates a dedicated denitrification reactor specifically designed to achieve advanced nutrient removal.

The design targets for the treatment plant are:

- Total Nitrogen (TN) ≤ 5 mg/L
- Total Phosphorus (TP) ≤ 3 mg/L

These concentrations are substantially lower than those typically associated with conventional secondary wastewater treatment facilities.

From a marine ecology perspective, nutrient reduction is important because excessive nitrogen and phosphorus may contribute to:

- Algal growth;
- Increased biological oxygen demand;
- Changes in benthic community structure;
- Localised ecological enrichment.

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The proposed nutrient removal performance therefore significantly reduces the potential for nutrient-driven ecological effects within the receiving environment.

8. Nanobubble Polishing Technology

As a final environmental enhancement stage, treated effluent will pass through an oxygen nanobubble polishing system immediately upstream of the marine outfall.

Nanobubbles are extremely small gas bubbles, typically less than 200 nanometres in diameter.

For comparison, a conventional aeration bubble may be between 1 and 5 millimetres in diameter, making nanobubbles thousands of times smaller.

Because of their extremely small size, nanobubbles exhibit unique physical properties:

- Very slow buoyant rise velocity;
- Long residence times in water;
- Extremely high surface area;
- High oxygen transfer efficiency;
- Stable negative surface charge (zeta potential).

These properties allow oxygen to remain within the treated water for extended periods rather than rapidly escaping to the atmosphere.

9. Environmental Benefits of Nanobubbles at the Marine Discharge

The principal environmental benefits of nanobubbles occur within the outfall pipeline and the immediate receiving environment surrounding the diffuser.

Maintenance of Aerobic Conditions

Nanobubbles provide a reservoir of dissolved oxygen that remains available following discharge.

This assists in maintaining aerobic conditions within the immediate mixing zone and reduces the potential for localised oxygen depletion associated with residual biological oxygen demand.

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Enhancement of Benthic Conditions

Benthic organisms depend on adequate dissolved oxygen concentrations within both the water column and surface sediments.

The oxygen-rich discharge assists in supporting aerobic microbial communities responsible for natural nutrient cycling and organic matter degradation.

This reduces the likelihood of localised anaerobic conditions developing around the diffuser.

Support of Natural Assimilative Processes

The receiving marine environment naturally assimilates residual nutrients and organic matter through microbial activity.

These processes operate most effectively under aerobic conditions. The elevated dissolved oxygen associated with nanobubble treatment supports these natural assimilative mechanisms and enhances ecological resilience within the immediate mixing zone.

Reduction of Sulphide Formation

Maintaining aerobic conditions suppresses sulphate-reducing bacteria that would otherwise generate hydrogen sulphide under anaerobic conditions.

This assists in preventing odour formation, sulphide generation and associated adverse sediment chemistry.

Enhanced Water Quality Buffer

The nanobubble system effectively provides an additional oxygen reserve entering the marine environment.

This reserve improves the ability of the receiving environment to accommodate residual oxygen demand while maintaining healthy ecological conditions.

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10. Marine Discharge Performance

The final discharge entering the marine environment will therefore have undergone:

1. Preliminary screening and solids removal;
2. Advanced attached-growth biological treatment;
3. Clarification;
4. Nutrient removal through denitrification;
5. UV disinfection;
6. Oxygen nanobubble polishing;
7. Rapid dilution and dispersion through the marine diffuser.

The resulting discharge is expected to contain substantially reduced concentrations of:

- Suspended solids;
- Biodegradable organic matter;
- Nutrients;
- Pathogens;
- Microplastics;
- A wide range of trace organic contaminants.

11. Conclusion

The proposed Beachlands South wastewater treatment and marine discharge system incorporates multiple treatment barriers that collectively contribute to the reduction of Emerging Organic Contaminants and protection of the receiving marine environment.

The Combined Works process utilises attached-growth biofilm treatment, extended sludge age, clarification, nutrient removal and UV disinfection, all of which contribute to the removal of trace organic contaminants commonly present in municipal wastewater.

The proposed oxygen nanobubble polishing system provides an additional environmental enhancement stage immediately prior to discharge by increasing dissolved oxygen concentrations and supporting aerobic ecological processes within the immediate receiving environment.

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The combination of advanced wastewater treatment, nutrient removal, nanobubble oxygenation and diffuser-assisted marine dispersion represents a robust multi-barrier approach that is expected to minimise ecological effects and provide a high level of environmental protection for the receiving marine environment.

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AIR QUALITY AND ODOUR MANAGEMENT MEMORANDUM

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Document history

Revision	Date	Status	Prepared by	Reason for a new revision
0	4/06/2026	Final	M Raath	N/A

1. Purpose

This memorandum has been prepared to provide an overview of the anticipated air quality and odour management approach associated with the proposed Beachlands South Wastewater Treatment Plant utilising Combined Works (CW) technology.

The memorandum supports the Fast Track consenting process and addresses potential air discharges associated with the treatment plant, sludge handling facilities, and associated operational activities.

1.1 Auckland Unitary Plan – Chapter E14 Air Quality

This memorandum has been prepared with reference to the relevant provisions of the Auckland Unitary Plan (Operative in Part), Chapter E14 – Air Quality.

The assessment has specifically considered:

- E14.2 Objectives;
- E14.3 Policies;
- E14.4 Activity Table;
- E14.6 Standards relating to discharges to air;
- The requirement to adopt Best Practicable Option (BPO) measures to avoid, remedy or mitigate adverse effects associated with air discharges.

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The primary purpose of Chapter E14 is to protect human health, amenity values, property and the environment from adverse effects associated with discharges to air, including offensive and objectionable odour.

The proposed Beachlands South Wastewater Treatment Plant has been developed with these objectives in mind and incorporates process selection, plant layout and operational controls intended to minimise odour generation at source and prevent adverse effects beyond the site boundary.

Particular consideration has been given to:

- Avoidance of offensive or objectionable odour;
- Adoption of Best Practicable Option (BPO) odour control measures;
- Protection of surrounding residential and sensitive receiving environments;
- Enclosed treatment processes and controlled sludge handling facilities;
- Operational practices designed to minimise air emissions throughout the life of the facility.

The conclusions presented in this memorandum are therefore based on both the technical characteristics of the Combined Works (CW) treatment process and the relevant objectives and policies of Auckland Unitary Plan Chapter E14.

2. Proposed Wastewater Treatment Process

The proposed wastewater treatment facility is based on the Combined Works (CW) treatment process, a modular biological wastewater treatment technology developed for municipal wastewater applications.

The treatment process comprises:

- Inlet works and preliminary screening;
- Biological treatment within enclosed CW reactors;
- Clarification and solids separation;
- Sludge stabilisation through extended sludge age and endogenous respiration;
- Sludge storage;
- Mechanical sludge dewatering by centrifuge;
- Treated effluent discharge.

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Unlike conventional activated sludge systems, the CW process does not utilise open aeration basins, oxidation ponds, or sludge drying beds.

The treatment process is largely contained within enclosed treatment structures, substantially reducing the potential for odour generation and atmospheric emissions.

3. Potential Sources of Air Emissions

Potential air emissions associated with the wastewater treatment facility are expected to arise primarily from:

3.1 Inlet Works

The inlet works receives raw municipal wastewater and includes screening and grit removal processes.

Potential odorous compounds may include:

- Hydrogen sulphide (H_2S);
- Reduced sulphur compounds;
- Ammonia;
- Naturally occurring wastewater odour compounds.

3.2 Sludge Dewatering

Mechanical dewatering of stabilised sludge by centrifuge may generate localised odours during operation.

Potential emissions may include:

- Ammonia;
- Reduced sulphur compounds;
- Trace organic odorous compounds.

3.3 Sludge Storage and Removal

Dewatered sludge will be stored within dedicated sludge storage tanks prior to removal by licensed waste contractors.

Potential odours may occur during:

- Tank venting;

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- Sludge transfer operations;
- Vehicle loading activities.

4. Combined Works Process Characteristics

The Combined Works technology incorporates several features that inherently reduce the generation of odorous emissions.

Excess biological solids are retained within the treatment process for an extended period, allowing microorganisms to consume stored cellular material through endogenous respiration.

This process provides partial biological stabilisation of sludge within the treatment system and results in:

- Reduced sludge production;
- Reduced organic loading within sludge;
- Reduced odour generation potential;
- Reduced frequency of sludge removal.

The process does not incorporate dedicated anaerobic sludge digestion facilities and does not rely upon large open sludge storage lagoons.

Consequently, odour generation at source is substantially reduced when compared with many conventional municipal wastewater treatment facilities.

5. Ventilation and Odour Management Philosophy

The wastewater treatment facility will be designed to incorporate appropriate ventilation and odour management measures during detailed design.

The proposed design philosophy includes:

- Enclosed inlet works;
- Enclosed sludge dewatering facilities;
- Controlled ventilation of sludge handling areas;
- Extraction of air from enclosed odour-generating zones;
- Treatment of extracted air through an odour control system prior to discharge.

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Subject to detailed design, odour treatment may include ozone treatment, activated carbon filtration, or equivalent odour control technologies.

The selected system will represent Best Practicable Option (BPO) measures appropriate to the scale and nature of the facility.

6. Anticipated Air Discharge Characteristics

Air extracted from wastewater treatment facilities typically contains trace concentrations of:

- Hydrogen sulphide;
- Reduced sulphur compounds;
- Ammonia;
- Organic odorous compounds associated with municipal wastewater.

The concentration of these compounds is dependent upon wastewater characteristics, operational conditions, sludge age, ventilation rates, and treatment system performance.

Specific discharge concentrations will be confirmed during detailed design if required by the consent authority.

7. Environmental Effects Assessment

Based on the proposed CW treatment process and the enclosed nature of the facility, significant adverse air quality effects are not anticipated.

Factors supporting this conclusion include:

- Enclosed treatment process;
- Absence of open aeration basins;
- Absence of open sludge drying facilities;
- Reduced sludge production through endogenous respiration;
- Controlled sludge handling and dewatering;
- Odour treatment of extracted air where required;
- Separation distances between the treatment facility and surrounding sensitive receivers.

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Accordingly, the facility is not expected to generate offensive or objectionable odour beyond the site boundary.

8. Conclusion

The proposed Beachlands South Wastewater Treatment Plant utilising Combined Works technology incorporates several inherent process features that reduce odour generation at source.

The enclosed treatment configuration, extended sludge age, endogenous sludge stabilisation process, reduced sludge production, and controlled sludge handling systems collectively minimise the potential for adverse air quality effects.

Based on the assessment undertaken and having regard to the objectives, policies and performance expectations of Auckland Unitary Plan Chapter E14 – Air Quality, the proposed Beachlands South Wastewater Treatment Plant is expected to operate without generating offensive or objectionable odour beyond the site boundary. The enclosed Combined Works treatment process, reduced sludge production characteristics, controlled sludge handling systems and proposed odour management measures collectively represent a Best Practicable Option approach to air quality management for the proposed development.

Should Auckland Council require further quantitative assessment during detailed design, ventilation rates and air discharge characteristics can be provided to a suitably qualified air quality specialist for detailed dispersion modelling and confirmation of compliance.

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