Water Services Authority
Taumata Arowai

Discharge to water implementation materials

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The core elements of the discharge to water standard are set out below.

- Sets concentration limits for common contaminants in treated wastewater, dependent on the sensitivity of the receiving environment.
- Requires nationally consistent monitoring and reporting of wastewater treatment plant performance, dependent on the size of the plant.
- Has tailored requirements for facilities that qualify as small wastewater treatment plants.
- Implemented by consenting authorities as conditions of consent when granting new or renewal consents.

Exceptions to the discharge to water standard

Exceptions to the discharge to water standard are provided for in primary legislation, and the regulations containing the standards.

Discharge to water arrangements that are not captured by the standard (see table below) will be subject to the resource consent conditions set by the relevant regional council. The standard may be updated in future to cover a broader range of scenarios.

Exceptions	Description
Certain water bodies	The discharge to water standards does not apply to discharges to any aquifer, cave/karst system or geothermal water. Due to the high sensitivity of these environments, proposed discharges are exempt from the standard and must be considered and managed by the consenting authority. **Karst aquifers** are underground water systems where caves or conduits significantly contribute to the flow path. **An aquifer system** is defined as a geological formation that can transmit and store groundwater, characterized by its hydraulic conductivity and transmissibility, which influence the movement of fluids and contaminants within the groundwater flow system. **Geothermal waterway** is defined as water that originates from geothermal sources, often containing dissolved minerals and gases.
Sensitive (pristine) environments	The discharge to water standard does not apply to any discharge to a water body that meets either of the options below: • meets all **A band** attribute states specified in Appendix 2A of the National Policy Statement for Freshwater Management 2020 (NPS-FM) • meets all **A band** attribute states except any that the water body fails to meet due to naturally occurring processes. If a water body meets the A band values for all attributes, it will be considered a pristine freshwater body and is an exception to the standard. Note: at the time of writing, the NPS-FM is under review. Should this result in changes to or removal of the A band attribute values, reference should be made to their values as of 12 December 2025.
Drinking water abstraction points	The discharge to water standard does not apply to discharges where the point of discharge is within: • 1,000m upstream, or 100m downstream, of any **human drinking water abstraction point in a river** • 500m of any **human drinking water abstraction point in a lake** • 1,000m upstream of any **tributary that discharges to any lake** at a point that is within 500m of any **human drinking water abstraction point in the lake**. The concentration limits of the standard have been developed to achieve contact recreation guidelines but not drinking water guidelines. Any discharges proposed within these proximities are an exception to the standard and must be considered and managed by the relevant consenting authority.
Bypasses	The discharge to water standard does not apply to any discharge from, or associated with, any bypass of a treatment plant. Bypasses generally occur in times of significant rainfall, mechanical or plant failure, or when some treatment processes are shut down for maintenance or upgrading. During such times, the bypasses are unlikely to achieve the limits required of the standard and an exception to the standard applies. However, the management of bypasses is covered in the overflows and bypasses standard.

Determining what requirements apply based on the receiving environment

The first step in applying the standard to a discharge to water consent is to determine the type of environment that will receive the discharge. Network operators and consenting authorities should agree on the appropriate receiving environment early in the consenting process to avoid delays later.

The following table describes nine distinct receiving environments.

<table>
<tr><th>Receiving environment</th><th>Definition of category</th><th>Notes</th></tr>
<tr><td colspan="3">Freshwater receiving environments</td></tr>
<tr><td>Lake</td><td>Body of standing freshwater, which is entirely or nearly surrounded by land.</td><td>This definition has been adopted from section 2(1) of the RMA 1991.

It includes lakes and natural ponds but excludes any artificial ponds.

Typically, this is a low-energy environment in which dispersion / dilution is limited by an absence of strong water currents.</td></tr>
<tr><td>Very low-dilution river</td><td>The dilution ratio at the point of discharge is 10 or less.</td><td rowspan="4">Rivers are continually flowing bodies of fresh water, including streams and modified watercourses, but excluding artificial watercourses (including irrigation canals, water supply races, canals for the supply of water for electricity generation and farm drainage canals).

The definition also excludes a part of a river that is in the coastal marine area, and any part of a river that is an estuary.

River environments are categorised based on the dilution ratio of treated wastewater to volume of river flow at the point of discharge.

Further guidance for determining dilution ratios is provided below.</td></tr>
<tr><td>Low-dilution river</td><td>The dilution ratio at the point of discharge is more than 10 but 50 or less.</td></tr>
<tr><td>Medium-dilution river</td><td>The dilution ratio at the point of discharge is more than 50 but 250 or less.</td></tr>
<tr><td>High-dilution river</td><td>The dilution ratio at the point of discharge is more than 250.</td></tr>
<tr><td colspan="3">Coastal receiving environments</td></tr>
<tr><td>Estuaries</td><td>A body of water that is listed in the table in Schedule 3 of the standards.

If the body of water listed in Schedule 3 is a river, the estuarine category includes only that part of the river within the coastal marine area.</td><td>A partially enclosed coastal body of water that is either permanently or periodically open to the sea in which the aquatic ecosystem is affected by the physical and chemical characteristics of both runoff from the land and inflow from the sea.

The list of estuaries has been adopted from the Assessment of the eutrophication susceptibility of New Zealand Estuaries (2018) report by NIWA (page 53 onwards).

Tools such as the estuaries spatial database at https://www.doc.govt.nz/nature/habitats/estuaries/estuaries-spatial-database/ are available to help network operators and consenting authorities determine if the estuary category applies.</td></tr>
<tr><td>Open ocean</td><td>The point of discharge is:

• 500m or more seaward from the line of the mean high-water springs

• covered by water that is more than 10m deep throughout the entire tidal cycle.</td><td>These criteria allow an objective determination to be made of whether a proposed discharge falls in the category of an open ocean receiving environment.

The 500m distance criteria was set after reviewing Bradley (2016), Wastewater outfalls – International perspectives relative to New Zealand.

The 10m depth contour is easily definable using New Zealand bathymetric charts and typically occurs outside the surf zone.</td></tr>
</table>

Receiving environment	Definition of category	Notes
High-energy coastal	The point of discharge is: • not in an estuary or the open ocean • exposed to large and long period waves • not sheltered by a gulf, island, reef, harbour or embayment.	This category accounts for discharges in waters closer than 500m and shallower than 10m deep where there is increased mixing experienced on open coastlines – similar to the open ocean category. The definition for high-energy coastal is open to interpretation. Expert opinion on the narrative criteria should be sought early in the consenting process and agreed between the applicant and consenting authority.
Low-energy coastal	The point of discharge is in the coastal marine area but is not an estuary, open ocean or high-energy coastal water.	This category is intended to account for coastal marine waters not covered by the other categories. Typically, these areas are sheltered from large and long-period waves, occur in gulfs and behind islands and reefs on the open coast and can include recessed harbours and embayments. Again, expert opinion on the criteria for this category should be sought early in the consenting process and agreed between the applicant and consenting authority.

Calculating dilution ratios for freshwater river environments

A dilution ratio approach has been adopted because it is simple, understood by regulators/practitioners and removes the need for detailed and complex dispersion modelling. This approach is used in other jurisdictions including Canada, the US, Switzerland and the EU. It is intended to be a proxy for mixing and assimilative capacity in the receiving environment and the scale of the discharge relative to volumes/flows in the water body.

The dilution ratio of wastewater to freshwater at the point of discharge, for the purpose of classifying a river, is calculated by using this equation.

$$\text{Dilution Ratio} = \frac{Q\mathit{effluent} + Q\mathit{mean\ annual\ low\ flow}}{Q\mathit{effluent}}$$

Determining *Qeffluent*

To determine *Qeffluent*:

1. for each year covered by the requested resource consent, determine the median daily discharge volume of treated wastewater in cubic metres
2. identify the highest annual median from all the annual medians determined under point 1.

The design annual median discharge volume is used for *Qeffluent* because it is less likely to be skewed by peak flows and avoids the need to define peak flow, which is highly variable. The use of the design median predicted over the term of the consent means that the assigned limit is based on the highest potential for impact. The design median discharge volume is intended to enable plant design to accommodate both summer and winter treatment plant performance to meet treatment limits in the standard.

Some plants may experience significant growth over the term of the consent and the dilution ratio for flows at the start of the period may be more than at the end. This may result in application of a more stringent treatment requirement from the start of the term.

The point at which dilution ratios should be calculated is where the wastewater is discharged from the piped network into a water body. If the wastewater is discharged through an outfall that receives other inputs before releasing to the environment, only the volume of discharge from the wastewater treatment plant municipal stream (i.e. the subject of the consent) is considered when determining *Qeffluent*.

Determining *Qeffluent* requires discharge volumes to be forecasted across the duration of a 35-year consent. Below are the key steps.

- **Data collection:** Gather historical data on wastewater inflow, discharge flows, rainfall and population and industrial activity for the catchment area.
- **Identify influencing factors:** Determine the key drivers of wastewater flow, which typically include, but are not limited to, daily population changes, industrial and commercial activities and rainfall patterns.
- **Sewer network data:** Water level and flow sensor data from the sewer system can help model the complex dynamics of the network.
- **Model selection:** Choose an appropriate forecasting model.
- **Long-term projections:** Integrate future population projections, planned industrial developments and anticipated changes in land use into the model to forecast design flows for the future.

Determining *Qmean* annual low flow

The following steps are required to determine *Qmean* annual low flow.

1. Obtain actual or estimated low flow data for the river for each day in the previous five or more years.
2. From that low flow data, calculate the rolling average low flow in the river for each period of seven consecutive days in the year or years to which the flow data relates.
3. Add together the rolling averages calculated under point 2 and calculate the mean rolling average.

The seven-day Mean Annual Low Flow (MALF) is used for *Qmean* annual low flow as it provides a precautionary dilution ratio estimate for rivers or streams that receive wastewater discharge. The MALF also accounts for low-flow receiving environments and low-flow conditions that arise due to seasonal variations.

The MALF should be derived from real-time continuous measured flow data if it is available for the immediate receiving environment. The data record must cover a minimum of at least five years. Where MALF calculations are undertaken, they should be based on full hydrological years (1 July to June 30) and the MALF should be calculated by averaging the lowest seven-day rolling mean flow for each year on record.

Where measured data is not available, it is recommended that the MALF is determined using the latest version of the Ministry for the Environment '[River flows | MfE Data Service]'.

Alternative calculations for managed discharges schemes

Managed discharge schemes (also known as 'mix and match' schemes) are widely regarded as effective at managing effluent discharges and are used in many areas of Aotearoa New Zealand.

Dual schemes resolve technical issues associated with both discharge to water and discharge to land schemes where the suitability of receiving environments may be constrained or suboptimal. For example, a discharge to land may be preferred during dry periods that coincide with low baseflow in freshwater receiving environments or warmer (and lower dissolved oxygen) in coastal/estuarine receiving environments. Conversely, discharge to water may be preferred when the land's ability to receive the discharge is not optimal (e.g. where groundwater is too shallow or soil moisture content is so high that extra discharges cannot be assimilated).

When applying the discharge to water standard, the flows used to determine the dilution ratio should cover only the period in which discharge is intended. So the median wastewater flow should be tailored to the discharge period, not the full year, and low-flow data for the river should cover only the period during which discharge is intended, rather than the annual seven-day MALF.

Therefore, the amended calculation to determine your dilution ratio (and subsequently your receiving environment category) is:

(Qeffluent + Qmean low flow) ÷ Qeffluent

To calculate *Qeffluent* for the period during which wastewater will be discharged into a river (the **relevant period**):

1. for the relevant period of each year covered by the application, forecast the median daily discharge volume of treated wastewater, in cubic metres
2. from all of the years medians determined under point 1, identify the highest median daily discharge volume.

To calculate *Qmean* low flow, for the relevant period:

1. obtain actual or estimated low-flow data for the river for each day in the relevant period of the previous five or more years
2. from that low-flow data, calculate the rolling average low flow in the river for each period of seven consecutive days in the relevant period in the year or years to which the flow data relates
3. add together the rolling averages calculated under point 2 and calculate the mean rolling average.

Dilution and mixing requirements for lakes and coastal environments

The standard requires specific dilution and mixing requirements to be met by discharges to lakes and coastal environments. These are shown in the table below.

Receiving environment	Outfall and mixing requirements
Lakes	• The point of discharge must be fitted with a diffuser. • The point of discharge must be beyond the littoral zone of the lake. • The discharge must achieve a minimum centreline dilution of the plume of one part wastewater to 20 parts freshwater at 100m from the diffuser in slack water conditions.
Estuaries	• The point of discharge must be fitted with a diffuser. • The point of discharge must be in a part of the estuary where the water is affected by tidal conditions. • The discharge must achieve a minimum centreline dilution of the plume of one part wastewater to 20 parts freshwater at 100m from the diffuser in slack water conditions.
Low-energy coastal	• The point of discharge must be fitted with a diffuser. • The discharge must achieve a minimum centreline dilution of the plume of one part wastewater to 20 parts freshwater at 100m from the diffuser in slack water conditions.
High-energy coastal	• The point of discharge must be fitted with a diffuser. • The discharge must achieve a minimum centreline dilution of the plume of one part wastewater to 50 parts freshwater at 100m from the diffuser in slack water conditions.
Open ocean	• The point of discharge must be fitted with a diffuser. • The discharge must achieve a minimum centreline dilution of the plume of one part wastewater to 100 parts freshwater at 100m from the diffuser in slack water conditions.

Before a consent for discharges into any of these environments is granted, applicants must assure consenting authorities that the design and mixing requirements are met.

If an existing outfall does not achieve the required minimum centreline dilutions, modifications could be made to increase initial dilution, such as fitting a check valve to the ports to increase the velocity of the plume or adding ports to the outfall to spread the discharge. Alternatively, the outfall could be extended or relocated to an area with better dilutions or a different category of receiving environment.

Modelling to understand dilution and mixing requirements

Modelling to understand dilution and mixing characteristics of a receiving environment involves defining the mixing zone boundaries, using a recognised numerical model like CORMIX to simulate the effluent plume's trajectory and dilution at the centreline, and then analysing the results.

Comprehensive data on the receiving environment, pollutant discharge and outfall geometry are required.

Receiving environment data

- Detailed information on water current speeds, directions and tidal cycles is essential for accurately predicting the dilution of the discharge.
- Ambient water density and salinity are crucial for modelling the behaviour of a discharge.
- Understanding the vertical distribution of density is also required.

Discharge data

- Density, temperature and flow rate of the effluent must be known.
- Details such as the outfall pipe's height and diameter and the orientation of the discharge are necessary to accurately predict the initial dilution.

Small wastewater treatment plant guidance

The Authority has developed a small wastewater treatment plant standard for existing small plants that recognises and provides for the unique settings and challenges that such plants face. The following guidance to help network operators and consenting authorities implement the small plant standard covers:

- key differences between small plants and larger plants under the standards
- qualifying criteria and information requirements
- verification of small plant status
- transitional arrangements for plants moving off small plant status
- operational requirements
- example consent conditions.

Key differences between requirements for small plants and other plants under the standards

	Normal standard requirements	Small plant standard requirements
Concentration limits	• Annual median limits for Total Nitrogen, Total Phosphorus, Total Suspended Solids and $cBOD_5$. • 90th percentile limits for Total Suspended Solids, $cBOD_5$, Ammoniacal Nitrogen and *E. Coli* or Enterococci.	• No concentration limits for Total Nitrogen and Total Phosphorus (including where discharging to a hard-bottomed stream). • Annual median limits for Total Suspended Solids and $cBOD_5$. • 75th percentile limits for Total Suspended Solids, $cBOD_5$, Ammoniacal Nitrogen and *E. Coli* or Enterococci.
Monitoring and reporting frequency	• Either daily or fortnightly sampling required. • Monthly and annual reporting required.	• Quarterly sampling required. • Quarterly and annual reporting required.
Operational requirements	• No operational requirements imposed by the standards.	• Regular sludge surveys and desludging triggers required.

Qualifying criteria and information requirements

A wastewater treatment plant qualifies as a **small wastewater plant** if it meets either of the following criteria.

- **Load-based qualification:** The plant takes in an average total load of less than 85kg of $cBOD_5$ per day.
- **Population-based qualification:** The plant services fewer than the equivalent of 1,000 people (calculated as an annual average).

In either scenario, the intention to seek a resource consent under the small plant standard should be discussed between the applicant and the consenting authority early in the process.

Small-plant status using the load-based qualification

An influent $cBOD_5$ average load of less than 85 kg per day provides an objective and measurable qualifying criterion for small plants that accounts for the variability in flow and load factors present when using the population-based qualification.

In determining small-plant status under this qualifier, the consenting authority will need to be satisfied that an adequate number and representative set of influent samples has been provided. Samples must be taken before primary treatment has occurred.

Ongoing influent $cBOD_5$ load monitoring, at a frequency determined by the consenting authority, will be required to ensure the facility continues to qualify for small-plant status.

Small-plant status using the population-based qualification

Not all small plants will monitor influent $cBOD_5$ loads so the Authority has developed an alternative qualifying criterion. Plants serving a population equivalent of 1,000 people or fewer may qualify for the small-plant standard. However, factors such as seasonal population fluctuations, abnormal connections or the possibility of significant industrial or trade waste inputs bring more variability to this qualifying option.

A consenting authority will need to consider the following to determine if a facility qualifies as a small plant under the population-based criterion:

- the number of connections to the wastewater network
- the estimated number of people served by each connection and any abnormal connections such as campgrounds or schools
- seasonal variation in the population served by the network
- significant trade waste or industrial inputs.

Verification of small-plant status required every 12 months

Every 12 months, consent holders under the small plant standard will be required to verify their small-plant status to the consenting authority by providing information for the preceding year that supports either of the two qualifying criteria. The consenting authority will then determine whether the facility continues to qualify as a small plant.

Should the consenting authority consider that the plant has not met the qualifying criteria during the preceding year, the plant must undertake monthly influent $cBOD_5$ monitoring for the following 12 months.

At the end of this period:

- if the plant evidences an average daily influent $cBOD_5$ load of **less** than 85kg, it may continue to operate under the small plant standard
- if the plant evidences an average daily influent $cBOD_5$ load of **more** than 85kg, it may no longer operate under the small plant standard.

The extra 12 months of monitoring will provide small plants that may experience fluctuations in influent levels, or the population they serve, with a grace period. It also ensures that plants showing sustained exceedances can transition effectively to the requirements for larger plants.

Transitional arrangements for plants moving off small-plant status

Plants that continue to exceed the small-plant qualifying criteria after the additional 12 months of monitoring must transition to the standard requirements for larger plants. These include:

- completion of a periphyton risk assessment if the plant discharges to a hard-bottomed stream
- changes to wastewater treatment requirements including concentration limits for Total Nitrogen and Total Phosphorus and shifting from 75th percentile limits to 90th percentile limits
- more frequent monitoring and reporting requirements.

Should the plant require upgrades to meet the new requirements, the operator has three years to complete them and comply with the new requirements. During this period, compliance can continue to be assessed against the small plant requirements. This period allows operators to plan for and deliver any necessary upgrades.

Operational requirements for oxidation ponds

Sludge accumulates at the bottom of an oxidation pond over time. The rate of accumulation varies according to a range of factors. These can include the length of time since last desludging, the age of the sludge, the history of chemical addition to the sludge, the presence or absence of aeration and mixing, the climate and influent loading. Sludge therefore requires site-specific management.

Increased sludge in a pond-based system results in compromised effectiveness of treatment due to such things as:

- reduced effective pond volume available for treatment
- reduced hydraulic retention time (HRT)
- increased risk of odour nuisance and sludge rising to the surface
- reduced likelihood of converting sludge to biosolids (to meet grading requirements).

The standards place additional operational requirements on small wastewater plants with oxidation ponds as outlined below.

- Consent holders must survey the oxidation pond every three years and provide results to the consenting authorities. The survey must cover:
  - » sludge levels, volumes and proportions within the oxidation pond
  - » the profile of the sludge (i.e. the proportion of volatile solids it contains)
  - » the impact of the sludge on the effectiveness of wastewater treatment.
- Based on the results of the surveys, the consenting authority must impose de-sludging requirements as a condition of consent.

Consent conditions for small plants

Consenting authorities should enable the continued use of a single resource consent for small plants through a set of staged conditions, as outlined below.

- Small plant requirements to apply for as long as the plant qualifies.
- Annual verification of small-plant qualifying criteria.
- 12 months of influent monitoring if it is determined that qualifying criteria are not met.
- Three years of being treated as a small plant while required upgrades and/or assessments are undertaken.
- Application of larger plant requirements after completion of upgrades.

The consenting authorities should be clear about what conditions apply in what circumstances. Where conditions are no longer relevant, they should cease to apply without the need for a change of conditions. It should be possible to determine all the conditions that may apply to a small plant throughout a 35-year consent at the time the consent is granted and apply them as staged conditions.

Small plants discharging to hard-bottomed rivers or streams

The exception to the staged conditions described above, is when a small plant discharges to a hard-bottomed stream. In such cases, a plant would need to undertake a periphyton risk assessment to determine the Total Nitrogen and Total Phosphorus concentration limits as soon as it is determined to no longer to be a small plant. As these could not be determined at the time the consent is granted, it is likely that a change of conditions would be required to impose the new concentration limits.

Concentration limits, monitoring and reporting requirements

Monitoring and reporting are essential components of a resource consent to discharge treated wastewater. The following offers practical assistance for network operators and consenting authorities to help them meet the monitoring and reporting requirements of the standards. It outlines how treatment and monitoring requirements vary depending on the classification of the wastewater treatment plant, and covers:

- contaminants covered and concentration limits
- sampling frequency and methodology
- testing and analysis
- reporting requirements
- elements not covered by the standard.

Contaminants covered and concentration limits

Resource consents for discharges to water must specify discharge concentration limits for all contaminants covered by the standard. The Authority used existing receiving environment guidelines to develop the concentration limits, taking existing in-water contaminant guidelines and back-calculating the limits based on the receiving environment dilution ratio. The objective is to ensure treated wastewater meets quality standards that protect both human health and aquatic ecosystems. The concentration limits for the discharge to water standard can be viewed in **Appendix 1**.

The Authority used the following guidelines.

- Australian and New Zealand Guidelines for Freshwater and Marine Water Quality (ANZG, 2018).
- Ministry for the Environment and Ministry of Health. Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (2003).
- Ministry for the Environment (2022). Guidance on Look-up Tables for Setting Nutrient Targets for Periphyton: second edition.

Additional commentary is provided below.

Contaminant	Commentary on proposed concentration limits
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Measures the amount of biodegradable organic material remaining after treatment, reflecting the efficiency of biological processes. Reflects the potential for the discharge to reduce the oxygen in the receiving water. No receiving water guidelines are available for $cBOD_5$ in Aotearoa New Zealand. Instead, the environmental effect is monitored through dissolved oxygen concentrations in the receiving environment and oxygen depletion effects in receiving waters.
Total Suspended Solids (TSS)	Measures the concentration of particulate matter that can affect water clarity and ecosystem health. Relates to a number of potential effects including smothering of the riverbed and visibility of the plume. No receiving water guidelines are available for TSS in Aotearoa New Zealand. Instead, the environmental effect is monitored through visual clarity and deposited sediment measurements in the receiving environment.
Ammoniacal Nitrogen (Amm-N)	Measures nitrogen in the ammonia form, which can be toxic to aquatic life and signal incomplete treatment. The concentration limits have been compared to default guideline values for toxicity for ammoniacal nitrogen in fresh and marine waters (ANZG, 2018) at the 95th and 99th percentile levels of species protection.
Total Nitrogen (TN)	Measures the combined forms of nitrogen, providing an overall measure of nutrient load and potential for downstream eutrophication or nutrient overload. Concentration limits have been compared against default guideline values for general nutrient effects (physico-chemical stress) from ANZG, 2018, using the Aotearoa New Zealand region for rivers and the southeastern region of Australia for other categories (e.g. coastal).
Total Phosphorus (TP)	Measures the total phosphorus present, another nutrient of concern for algal growth in surface waters. Concentration limits have been compared against default guideline values for general nutrient effects (physico-chemical stress) from ANZG, 2018, using the New Zealand region for rivers and the southeastern region of Australia for other categories (e.g. coastal).
Pathogens indicator organisms	Measures the potential for risks to public health through exposure to pathogens from contact with the discharge in the water body, primarily through contact recreation and consumption of shellfish. The concentration limits for *E.coli* and Enterrococci were back-calculated from the Microbiological Assessment Category (MAC) A based on a sample 95th percentile of less than or equal to 130 *E. coli* per 100mL (assuming the lowest dilution ratio).

Sampling frequency and methodology

The frequency of sampling required depends on the population served by the wastewater treatment plant and whether the facility qualifies for the small-plant standard.

Plant size	Sampling frequency
Large (serving >10,000 people)	At least daily sampling of all required parameters.
Medium (serving 1,000–10,000 people)	At least fortnightly sampling of all required parameters.
Qualifying small plants	At least quarterly sampling of all required parameters.

To ensure that water quality data accurately reflects system performance and environmental impact, sampling must be carefully planned and carried out at the appropriate points in the treatment process.

- Samples must be collected after full treatment has been completed and before the treated water mixes with other discharges or receiving waters. This will ensure results accurately represent the effectiveness of the treatment system and the quality of the treated wastewater being discharged to the environment.
- In cases where a treatment system includes a constructed wetland, the sampling point must be after the wetland.

Beyond these requirements for sampling frequency and location, consenting authorities maintain discretion to specify how the sampling must be done. Requirements may include (but are not limited to):

- the specific sampling techniques used (i.e. grab samples or composite samples)
- the timing of sampling (to ensure that representative sampling is done)
- weather-dependent sampling protocols (i.e. distinguishing between wet- and dry-weather events)
- quality assurance and control procedures to maintain data reliability.

All sampling must comply with recognised and approved methodologies, such as the following.

- Standard Methods for the Examination of Water and Wastewater – APHA, 24th Edition.
- New Zealand Municipal Wastewater Monitoring Guidelines.

Any alternative method formally approved by the consenting authority when the consent is granted.

Testing and analysis

Accurate testing and analysis are fundamental to understanding treatment performance and protecting receiving environments. All monitoring activities should provide a reliable picture of system operation, pollutant removal and compliance with consent conditions.

All analysis must be conducted by laboratories accredited by International Accreditation New Zealand (IANZ). In exceptional cases, the consenting authority may approve alternative testing methods in writing, provided these meet equivalent quality assurance standards.

Samples must be collected, stored and transported using recognised best-practice procedures to preserve their integrity from field to laboratory. This includes maintaining correct temperatures, avoiding contamination and ensuring samples reach the lab within prescribed holding times.

All sample analyses must be recorded and reported transparently, including:

- compliant results that meet discharge limits
- non-compliant results that exceed thresholds
- routine monitoring data collected at regular intervals
- results of follow-up or intensified monitoring undertaken after an exceedance or operational issue.

All sampling results must be securely stored for at least 10 years in a form that allows retrieval and verification.

This approach ensures a complete record of plant performance, supports timely corrective action when issues arise and maintains public confidence in the safety and reliability of wastewater management systems.

Reporting requirements

A nationally consistent reporting regime is a key feature of the standards. Consent holders are responsible for reporting all monitoring and compliance performance data transparently so that councils and communities have a clear and accurate picture of how wastewater infrastructure is performing.

The frequency of reporting required depends on the size of the treatment plant.

- Large and medium plants (i.e. those serving a population of 1,000 people or more) are required to publish monthly reports.
- Qualifying small plants are required to publish quarterly reports.
- Additionally, all plants are required to publish an annual report.

The reports will contain key information about the performance of the plant and assessment of the plant's compliance with the requirements of the standards. This information will include:

- the raw data and sampling results of all testing and a summary of the plant's compliance against concentration limits
- information on any exceedances of concentration limits that occurred during the reporting period, the reasons for them and actions taken in response.

The reports must be provided to the:

- relevant consenting authority
- Water Services Authority – Taumata Arowai

The reports must also be made available on a publicly accessible website.

Elements of discharges to water not covered by the standards

Resource consents for discharges to water from wastewater treatment plants cannot be granted with conditions that are contrary to the standards unless specific exceptions apply.

Consenting authorities will continue to have discretion to manage (through the imposition of consent conditions) elements of the discharge activity that are not covered by the standards. This could include factors such as:

- treatment and monitoring requirements for other contaminants
- receiving environment monitoring such as upstream and downstream monitoring or cultural monitoring programmes
- the timing and volumes of discharges (insofar as they align with dilution ratio calculations and requirements)
- requirements for community engagement or liaison.

This discretion ensures that effects of wastewater discharges into specific receiving environments are understood and managed appropriately.

However, consenting authorities cannot impose conditions on matters outside the standard that inadvertently contravene a requirement of the standard. For example:

- introducing a receiving environment limit for Total Nitrogen that would require treatment beyond that needed for the end-of-pipe concentration limit of the standard
- introducing an end-of-pipe concentration limit for other contaminants (e.g. PFAS or heavy metals) if achieving that would require treatment beyond that required by the standard.

For some receiving environments or aspects of the standards, no limits apply for certain contaminants. In these cases, consenting authorities cannot impose limits on those contaminants. These include:

- limits on Total Phosphorus in the high-energy coastal environment
- limits on $cBOD_5$, Total Nitrogen and Total Phosphorus in the open ocean environment
- limits on Total Nitrogen and Total Phosphorus for small plants.

Quantitative Microbial Risk Assessment (QMRA)

Gathering and consumption of shellfish is a way that people can be directly exposed to pathogens from wastewater discharges and this activity – popular among many people in New Zealand – presents significant risk. The standards address this by requiring a Quantitative Microbial Risk Assessment (QMRA) in certain scenarios.

QMRA is a scientific, evidence-based method used to assess the potential public health risks associated with pathogens in treated wastewater discharges. It has been applied in New Zealand for more than a decade, forming a core part of the consenting process for wastewater treatment plants. QMRA combines microbiological data, environmental modelling and local knowledge to estimate infection risks to people through exposure to contaminated water or shellfish. It enables operators and regulators to:

- distinguish the effects of wastewater discharges from other contamination sources
- determine appropriate treatment levels for specific locations
- evaluate different management and infrastructure scenarios
- assess risks under a range of environmental and operational conditions
- support evidence-based consent decisions that protect public health.

This guidance covers:

- qualification and experience requirements
- the trigger for requiring a QMRA
- information requirements and the assessment process
- acceptable levels of risk
- interpretation and implementation of results.

Qualification and experience requirements

A QMRA must be undertaken by a Suitably Qualified and Experienced Practitioner (SQEP), independent of the applicant. While there is no formal definition of a SQEP for a QMRA in New Zealand legislative documents, the Users' Guide: *NES for Assessing and Managing Contaminants in Soil to Protect Human Health 17* provides some guidance on the skills and background needed. The SQEP should:

- be independent to the proposal and activity
- apply good professional practice and report against relevant industry guidelines
- be expert in a specific and relevant field to the activity
- be experienced in drawing together multidisciplinary inputs and drawing conclusions
- be willing to stand by their experience and qualifications (e.g. provide expert testimony in the Environment Court that stands up to Court scrutiny).

Professionals completing a QMRA should demonstrate:

- advanced understanding of microbiology and pathogen behaviour
- experience with hydrodynamic and dilution modelling
- knowledge of dose-response relationships for key waterborne pathogens
- familiarity with New Zealand regulations and customary gathering practices.

In most cases, QMRAs should be delivered by multidisciplinary teams that include:

- microbiologists or public health specialists.
- wastewater treatment experts
- hydrodynamic modellers
- freshwater and marine ecologists
- cultural advisors.

SQEPs must maintain up-to-date knowledge of international best practice and be able to justify all assumptions, models and data sources used.

Trigger for requiring a Quantitative Microbial Risk Assessment

Under the standards, a QMRA is required when the point of discharge is:

- no more than four kilometres from a shellfish-gathering area in a lake or coastal marine area
- no more than four kilometres upstream from a shellfish-gathering area in a river.

To determine whether shellfish-gathering areas are present, network operators should consider:

- community and mana whenua knowledge obtained through engagement
- regional council records of recognised shellfish or recreation areas.

Network operators and consenting authorities should agree on the need for a QMRA early in the consenting process to avoid potential delays later.

Information requirements and assessment process

Under the standard, the following steps are required in the QMRA process:

Steps	Guidance notes
Engagement with local communities and mana whenua.	• Local communities and mana whenua hold essential knowledge about customary food -gathering practices. Engagement is essential to identify how waterbodies and shellfish beds are used and ensure mātauranga Māori and community experience inform the assessment.
Identify the concentration or likely concentration of pathogens in treated wastewater to be discharged by the wastewater treatment plant.	• Consider the flows over the intended lifespan of the wastewater treatment plant. • Review available data sources (e.g. site-specific or similar catchments in New Zealand or overseas). • Identify whether human enteric pathogens, such as norovirus, are present in the wastewater that may be ingested via shellfish. Identify the range of pathogen concentrations in wastewater under normal and outbreak scenarios. • Consider the appropriate Log Reduction Value (LRV) of pathogens anticipated through the treatment process.
Identify the concentration or likely concentration of pathogens in the environment after receiving the treated wastewater.	• Confirm the locations of all shellfish-gathering beds that need to be considered in the assessment. • Consider the anticipated dilution of wastewater in the receiving water at the location of each shellfish-gathering bed. This typically requires carrying out hydrodynamic modelling to develop a 365-day dilution profile under La Nina and El Nino conditions or assessing worst-case dilution at each location. • Determine the extent of assumed die-off or inactivation in the environment for each pathogen of concern.
Quantify the likely rates of human exposure to pathogens in the treated wastewater by ingesting shellfish.	• Determine the risk of exposure by considering the appropriate bioaccumulation rate(s) and the quantity and frequency at which raw shellfish is gathered and consumed.
Determine the risk of humans becoming ill as a result of being	• Consider appropriate illness-risk models for pathogens of concern and state any additional assumptions (e.g. the percentage of infections that progress to illnesses) and state the basis of the modelling carried out.
Determine the risk of humans becoming ill as a result of being exposed to pathogens.	• Summarise the results of illness-risk modelling for each scenario and shellfish-gathering location. Present the results as a mean Individual Illness Risk (IIR) and compare with the acceptable risk level. • If required, recommend how to reduce risk below the acceptable level.

Acceptable level of risk

The Ministry for the Environment's Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (MfE, 2003) include a Microbiological Assessment Category (MAC) system for contact recreation in marine waters, comprising the following four-tiered scale based on illness risk.

- **No observed adverse effect level** (NOAEL) in most epidemiological studies – taken to be less than one illness in every 100 exposures (i.e. <1%).
- **A detectable increase in risk level above the threshold level** for reported illness (LOAEL) – equivalent to an average probability of five illnesses in every 100 exposures (i.e. between 1% and 5%).
- **A substantial elevation in the probability of all adverse health outcomes** for which dose-response is available – equivalent to an average probability of one illness in every 10 exposures (i.e. between 5% and 10%).
- **A significant risk of high levels of illness**, i.e. greater than a 1 in 10 chance of illness (or >10%).

Recent QMRAs prepared for consent applications for the discharge of treated wastewater to marine waters have often considered that a mean Individual Illness Risk (IIR) from raw-shellfish ingestion gathered at all potential exposure site of less than 1% as acceptable. This has been adopted as the accepted level of risk under the standard.

Interpretation and implementation of results

The output of a QMRA is a report providing:

- a determination of the risk of illness for each shellfish-gathering location presented in the form of mean IIR
- a summary of the findings, including any recommendations to reduce the public health risk to below an acceptable level.

Recommendations may include treatment requirements (e.g. minimum UV dose under defined conditions) or monitoring requirements (e.g. treated wastewater enterococci monitoring as an indication of UV disinfection system performance).

Consenting authorities are required to review and interpret QMRA results when they consider a wastewater discharge application. Their role is to ensure assessments are methodologically sound, site-relevant and based on current data. The responsibilities of consenting authorities include:

- confirming the QMRA addresses all potential exposure pathways
- imposing consent conditions based on (but not bound by) QMRA findings, including:
    - » end-of-pipe concentration limits for pathogens of concern
    - » any other mitigation measures recommended in the QMRA to achieve an acceptable level of risk.

Periphyton risk assessment guidance

Periphyton growth is primarily a concern in hard-bottomed rivers and streams where nutrient inputs can significantly alter ecological balance. The Authority considered *The New Zealand Periphyton Guidelines* in developing the nutrient-based standards but the proposed Total Nitrogen and Total Phosphorus limits may not provide sufficient protection in all settings – especially in sensitive ecosystems.

To address this, operations proposing to discharge to hard-bottomed streams must undertake a site-specific assessment to determine appropriate nutrient limits and mitigation measures. This will ensure that nutrient effects are managed in a way that reflects the sensitivity of the receiving environment.

This guidance covers:

- qualification and experience requirements
- the trigger for requiring a periphyton risk assessment
- information requirements and the assessment process
- interpretation of results and implementation of a response.

Qualification and experience requirements

A periphyton risk assessment must be undertaken by a Suitable Qualified and Experienced Practitioner (SQEP).

While there is no formal definition of a SQEP in New Zealand legislative documents, the *Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health 17* provides some guidance on the skills and background needed. The SQEP should:

- be independent to the proposal and activity
- apply good professional practice and report against relevant industry guidelines
- be expert in a specific and relevant field to the activity
- be experienced in drawing together multidisciplinary inputs and drawing conclusions
- be willing to stand by their experience and qualifications (e.g. provide expert testimony in the Environment Court that stands up to Court scrutiny).

Professionals completing a periphyton risk assessment should demonstrate:

- an advanced understanding of freshwater ecology with at least 10 years' relevant experience
- experience in environmental science or a related field for assessing impacts on the broader ecosystem and water quality
- experience in statistical analysis and ecological modelling for creating predictive models and interpreting monitoring data.

In most cases, QMRAs should be delivered by multidisciplinary teams that include experts in:

- hydrology and geomorphology
- ecology
- chemistry
- wastewater treatment
- cultural advisors.

Trigger for requiring a periphyton risk assessment

Under the standards, a periphyton risk assessment is required when, within 100m of a point of discharge, more than half the substrate (the material that makes up the bed of the river) is made up of particles that are the same size or larger than gravel.

Stream-bed substrate percentages should be evaluated using protocols such as the visual estimation method, shuffle method, grid point intercept method, sediment cover scoring and reference condition comparison. These protocols are based on the sediment assessment methods developed by Clapcott et al. (2011) for New Zealand streams.

To assess whether the water body is a hard-bottomed stream for the purposes of the standard, the area 100m surrounding the discharge should be evaluated using one of these methods. If the definition is met, a periphyton risk assessment is required under the standard.

Network operators and consenting authorities should agree on the need for a periphyton risk assessment early in the consenting process to avoid delays later.

Information requirements and assessment process

The standards require that specific matters (see table below) are considered by the SQEP undertaking the periphyton risk assessment. The assessment should be led and reported by the SQEP and include a multidisciplinary risk assessment workshop involving relevant subject matter experts including a freshwater ecologist with at least 10 years' relevant experience.

Assessment matter	Guidance notes
Scheme risks	
The effects of shade or shadow on the river	Assessed using methods adapted from *Stream Ecological Valuation (SEV): A Method for Assessing the Ecological Functions of Auckland Streams* (Technical Report 2011/009, October 2011) or equivalent and carried out by trained practitioners. The effectiveness of any shading present should be evaluated in relation to its impacts on water temperature. Warmer waters are known to increase the risk of periphyton growth. Measurement involves calculating the mean percentage shade across 10 cross-sections within a 100m reach, approximately centred on the discharge point.
The timing of the discharge	Assessments should be conducted during mid-summer.
	Assessed based on the timing of discharge relative to environmental risk periods such as lower flows and in summer months.
The effects of the water in the river being naturally flushed	Assessed based on the typical accrual period for periphyton growth in between rainfall events and based on whole year mean daily flow data and where a flood is defined as three times the median flow.
Dilution ratio class at the point of discharge	Categorised as high, medium, low and very low as per the discharge to water standard freshwater categories. Assessed on the anticipated dilution of wastewater at the point of discharge and subsequent risk of periphyton growth.

Assessment matter	Guidance notes
Environmental risks	
The climate and the source of the water in the river	Reference should be made to the Ministry for the Environment's *Data Service, River Environment Classification New Zealand* (2010) and the River Environment Classification (REC) of the receiving waters. See https://data.mfe.govt.nz/layer/51845-river-environment-classification-new-zealand-2010/ and https://environment.govt.nz/assets/publications/acts-regs-and-policy-statements/rec-user-guide-2010.pdf The REC classification of a river or stream is a way of categorising it in relation to physical and biological characteristics at a range of spatial scales. Characteristics that are important for management such as hydrology, hydraulics, water quality and biological communities are similar within classes and significantly different between classes.
The physical and chemical characteristics of the riverbed	Assessed by subject matter experts based on the variability of bed morphology, including the number of riffle/run/pool features and the relative risk of riverbed features contributing to the establishment and growth of periphyton.
Any action that would, if imposed as a condition of the resource consent, avoid, remedy or mitigate the risk or extent of periphyton growth, or the effects of periphyton on the environment	Consider proposed mitigations to reduce scheme and environmental risks, including: • increasing shading through riparian planting • inducing flows to flush the stream and clear emerging periphyton growth • improving freshwater habitat, including increasing periphyton grazers. The SQEP must demonstrate the applicability and effectiveness of proposed mitigation measures and their impact on risk ratings. Where effective mitigation is confirmed, the risk assessment process should be repeated with adjusted numerical standards applied.

The SQEP must then:

- consider any relevant existing monitoring data and the degree to which it indicates any increased risk of periphyton growth
- consider all factors to determine the risk of a degradation in water quality which has resulted, or has the potential to result, in an increased presence of periphyton
- determine an overall periphyton risk assessment category for the proposed wastewater discharge of low, medium, high or very high.

Second independent review and certification

The assessment must be technically reviewed by a second independent SQEP from a separate organisation. The reviewer cannot have been involved in the original assessment process and must assess:

- the appropriateness of the methodology
- the accuracy of calculations and data analysis
- the robustness of the risk assessment process and outcomes.

Where there is any disagreement with process or findings, the final report must state the reasons for the disagreement and the respective positions of the SQEPs.

Interpretation and implementation of results

The output of the risk assessment process is a technical report prepared by the SQEP which sets out:

- the risk assessment process followed
- the subject matter experts involved and their credentials
- the evidence and references used in selecting their methodology and reaching their decision
- the outcomes of the risk assessment process, including identification of the overall risk category and consequent concentration limits for Total Nitrogen and Total Phosphorus
- a statement from a second independent SQEP certifying their review of the report.

The amended concentration limits for Total Nitrogen and Total Phosphorus are dependent on the risk category and dilution ratio at the point of discharge, as shown in the table below.

Risk category	Very-low dilution	Low dilution	Medium dilution	High dilution
Low-risk category				
Total Nitrogen	4 mg/L	5 mg/L	10 mg/L	35 mg/L
Total Phosphorus	0.5 mg/L	1 mg/L	3 mg/L	10 mg/L
Medium-risk category				
Total Nitrogen	4 mg/L	4 mg/L	7 mg/L	20 mg/L
Total Phosphorus	0.3 mg/L	0.7 mg/L	1 mg/L	5 mg/L
High-risk category				
Total Nitrogen	4 mg/L	4 mg/L	4 mg/L	10 mg/L
Total Phosphorus	0.25 mg/L	0.5 mg/L	0.5 mg/L	1 mg/L
Very high-risk category				
Total Nitrogen	4 mg/L	4 mg/L	4 mg/L	4 mg/L
Total Phosphorus	0.25 mg/L	0.25 mg/L	0.25 mg/L	0.25 mg/L

The concentration limits were developed considering:

- the Ministry for the Environment's *Guidance on Look-Up Tables for Setting Nutrient Targets for Periphyton* (2022)
- site-specific conditions within the receiving environment, including the REC, the National Objectives Framework and dilution factors
- acceptable level of risk of effect (assumed to be 10% of under-protection of water quality)
- the limit of technological ability to treat for these contaminants.

As technology and treatment capability will potentially improve over time, the Authority will review the limit of technological ability to treat for Total Nitrogen and Total Phosphorus every 10 years. This will enable the wastewater sector to respond to and manage the risk of periphyton growth in hard-bottomed streams more effectively.

Appendix 1: Discharge to water concentration limits

Parameter and statistic	Lakes	Rivers and streams (very low dilution – <10)	Rivers and streams (low dilution – >10 and <50)	Rivers and streams (moderate dilution – >50 and <250)	Rivers and streams (high dilution – >250)	Estuaries	Low energy coastal	High energy coastal	Open ocean
Carbonaceous Biochemical Oxygen Demand (cBOD$_5$) **Statistic:** Annual median	15 mg/L	5 mg/L	10 mg/L	15 mg/L	20 mg/L	20 mg/L	30 mg/L	50 mg/L	Not applicable
Statistic: 90%ile	30 mg/L	10 mg/L	20 mg/L	30 mg/L	40 mg/L	40 mg/L	60 mg/L	80 mg/L	Not applicable
Total Suspended Solids (TSS) **Statistic:** Annual median	15 mg/L	5 mg/L	10 mg/L	15 mg/L	30 mg/L	25 mg/L	30 mg/L	50 mg/L	100 mg/L
Statistic: 90%ile	30 mg/L	10 mg/L	20 mg/L	30 mg/L	60 mg/L	50 mg/L	60 mg/L	80 mg/L	150 mg/L
Total Nitrogen **Statistic:** Annual median	10 mgN/L	4 mgN/L	5 mgN/L	10 mgN/L	35 mgN/L	10 mgN/L	10 mgN/L	50 mg/L	Not applicable
Total Phosphorus **Statistic:** Annual median	3 mgP/L	0.5 mgP/L	1 mgP/L	5 mg/L	10 mgP/L	10 mgP/L	10 mgP/L	Not applicable	Not applicable
Ammoniacal-nitrogen (ammonia) **Statistic:** 90%ile	3 mgN/L	1 mgN/L	1 mgN/L	3 mgN/L	25 mgN/L	15 mgN/L	20 mgN/L	35 mg/L	50 mgN/L
E. coli **Statistic:** 90%ile	3,250 cfu/100mL	130 cfu/100mL	650 cfu/100mL	3,250 cfu/100mL	16,250 cfu/100mL	Not applicable	Not applicable	Not applicable	Not applicable
Enterococci **Statistic:** 90%ile	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	2,000 cfu/100mL	4,000 cfu/100mL	8,000 cfu/100mL	40,000 cfu/100mL