Water quality is one of the greatest areas of concern affecting the health and mauri of the Hauraki Gulf Marine Park. Water quality is degraded in some parts of the Hauraki Gulf, however, there are many other parts for which there is not enough information to draw conclusions on the current state. This lack of information is a risk.

The most common known causes of water quality degradation trace back to contaminants that are washed from the land into the coastal marine area through freshwater runoff. These contaminants include sediments, nutrients, heavy metals, and microbial pathogens. Poor water quality impacts virtually all uses and values associated with the Hauraki Gulf Marine Park. It is therefore vitally important that we identify the causes and effectively address them, in order that healthy water quality is restored where it is currently degraded.

Mana whenua consider the state of the moana as an imbalance caused by humans. Tikanga requires that appropriate action is taken to restore balance. This is expressed as take–utu–ea, meaning that when events result in an injury a response commensurate with the scale of the offending action is required, in order to return to a state of equilibrium. In this case, the issue is the state of the Hauraki Gulf Marine Park, a response is needed to restore the mauri.

Although there have been considerable efforts to address water quality issues in recent years, these have not been sufficient to cope with the scale of the problem. A step change in effort is required if the current situation is to be turned around. There remains a great deal to be done!

This Chapter describes four categories of contaminant that are together significant contributors to water quality problems in the Hauraki Gulf Marine Park. Accordingly objectives and actions are presented for the water quality themes of sediment, nutrients, heavy metals, and microbial pathogens.

While each of these main drivers of water quality is considered separately, we recognise that, in reality, there are many overlapping causes and solutions, so that an integrated approach to catchment management is ultimately required. This section identifies the desired future state for water quality and the actions that we need to take to get there. The objectives for each of the four themes are explained in detail, and supporting information provided, in Appendix 4.
A selection of quotes from members of the public at listening posts

Hamilton
With the Hauraki Gulf Marine Park it’s about what’s coming down the catchment. Look at the land that drains into it. It’s rare through land based exercises that someone says ‘what about the impact on the Hauraki Gulf Marine Park or the marine environment?’ The commissioners don’t mention the impact. Get the land aspect right, what’s draining into the Hauraki Gulf Marine Park, and you’ll get the rest right.

Thames
Ensure the waterways into Tikapa and indeed all moana are controlled and managed in a way that ensures the protection of all waterways, particularly activities that occur on farmlands and ngahere that might threaten our waterways.

Maraetai
I think the little things matter – the Whitebait, the Cockles. That means land use is important – say for Inanga to follow their life cycle. If we control sediment, we get water clarity for filter feeders especially where both sides of a channel have a bit of protection (planting). From the little things, the big things are sustained – a good paddock gives good seabeds.

Whitianga
Water and land for me are inseparable.

THEME A. SEDIMENT

What is the problem?
Excessive sediment runoff from the land is the main cause of degraded marine habitats in estuaries, harbours and the Inner Hauraki Gulf.

Our overall goal is to reduce sediment entering the coastal marine area to levels which support healthy marine habitats. This will, in turn, support more abundant marine life and fish stocks and provide greater opportunities for people and communities to enjoy the Hauraki Gulf Marine Park.

What do we need to achieve?
Our objectives for sediment are to:

- Minimise sediment erosion off the land;
- Capture sediment runoff before it reaches the marine environment; and
- Stabilise sediment already deposited in the marine environment including the Firth of Thames.

How will we do it?

1. Catchment management plans
   a) By 2025, prepare an integrated harbour and catchment management plan for every catchment that drains into the Hauraki Gulf Marine Park, in consultation with local communities, and using Mātauranga Māori, local knowledge and scientific information.

Catchment management planning enables an integrated approach to be applied to the reduction of sediment and other contaminants from individual catchments, taking into account the special characteristics of each area. The catchment management plans will help drive statutory planning processes and budget allocation by management agencies. They will also provide support for action by landowners and local communities. Appendix 1 discuss catchment management plans in more detail.
b) By 2019, develop and begin implementing catchment management plans for the following highest priority catchments to achieve significant sediment reductions:

i. Whangapoua (noting that a Harbour and Catchment Plan has been prepared by Waikato Regional Council but needs to be fully resourced and implemented).

ii. Waihou/Piako.

iii. Wairoa.

iv. Mahurangi (noting that a great deal of work has already been undertaken in the catchment, but greater resourcing and effort is still required).

These priority catchments have been selected as places to start on the basis of the following criteria:

• The largest impact on the marine environment (levels of sediment produced and sensitivity of receiving environment).

• The greatest threat from current and future activities (e.g. future forestry harvesting).

Additional plans will then need to be prioritised for development.

2. Establish catchment sediment load limits

c) By 2022 reach agreement with agencies, communities and mana whenua on overall sediment load limits for all catchments draining into the Hauraki Gulf Marine Park by:

i. Developing implementable sediment targets applicable to the estuaries and inner coastal waters of the Hauraki Gulf Marine Park that can be converted into objectives and then catchment sediment load limits.

ii. Implementing a comprehensive set of workable catchment sediment load limits for protecting ecosystem integrity, functioning and associated values throughout the Hauraki Gulf Marine Park.

iii. Implementing a framework for ensuring compliance and accountability.

iv. Implement land use practice changes required and reporting on monitoring with reference to achieving the 2050 target.

v. Achieving catchment sediment load limits by 2050, to achieve generational change. Appendix 1 contains a more detailed explanation of load limit settings.

Prioritisation of catchments:

Considerable land owner, council, industry and community resources will be required to bring about the required changes to reduce sediment inputs, and obviously not everything can be done all at once. Prioritisation of spending requires careful consideration of the ability to make a difference, cost, and capability and capacity of landowners to work with council.

Models can assist with prioritisation. They can be used to identify ‘critical source areas’ in the catchment – areas where, for instance, sediment erosion or nutrient loss is greatest. Where these areas are connected by transport pathways to vulnerable aquatic receiving environments, they should receive priority attention. Models can also be used to estimate the cost of taking action to reduce the flow of sediment and of applying mitigation. In addition, they can estimate the benefits of likely improvements (reduction in sediment runoff or nutrient loss, for instance) following mitigation (Appendix 1 has more detail on this approach).
3. **Increase sediment traps in contributing freshwater waterways**

a) Progressively increase the number and spread of natural, managed (wetlands, floodplains and ponding areas) and engineered sediment traps:

   i. By 2021 initiate at least five significant new wetland systems along river courses, at the nexus of tributary streams and/or at the heads of estuaries.

   ii. By 2026 initiate the construction of at least 15 significant new wetland systems.

   iii. Encourage and incentivise the establishment of wetlands and sediment traps on private land through the deployment of on-farm advisers and targeting of co-funding schemes.

   iv. Incorporate green infrastructure such as swales, wetlands and permeable surfaces into all new urban developments.

   v. Facilitate and incentivise wetland restoration and/or creation through inclusion as mitigating or offsetting conditions for sediment-generating activities requiring resource consent (such as forestry harvesting and earthworks).

   vi. Where practicable, engineer sediment traps into future capital works for new and existing infrastructure (such as the Waihou Valley and Piako River Schemes and roading developments).

   vii. By 2035, have in place a network of natural and/or artificial sediment traps at strategic points in all catchments draining into the Hauraki Gulf Marine Park.

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**Managing sediment loads**

Catchment sediment load limits enable the cumulative effects of sediments on the Hauraki Gulf Marine Park to be managed. Reaching agreement on the limits to sediment runoff, and keeping within those limits, will preserve what we value about the Hauraki Gulf Marine Park, enhance the mauri and provide a firm basis on which councils, mana whenua and communities can manage land use within catchments. It has taken generations to create today’s sediment problems. These actions will start reversing that, the timeframes recognise the realities and scale of the task.
4. **Waterway management**

a) Significantly improve the management of waterways, to reduce transportation and loss of sediment to the marine environment including:

i. Continue and significantly increase the extent of stock exclusion, and riparian planting programmes along waterways to stabilise stream banks and to provide ecological co-benefits. Each catchment management plan is to include a specific target for the percentage of natural waterways which are to have riparian planting in place within 10 years of plans being agreed.

ii. Apply active and pragmatic management of waterways and drains to reduce sediment loss, streambank erosion and bankside collapse.

Industry, mana whenua and regulatory agencies need to

**Steep slopes and erodible soils**

Given the steep slopes and erodible soils within Hauraki Gulf Marine Park catchments, and frequency of storm events, it is not possible to stop excess sediment washing off the land through good land management alone. This means that a network of natural and engineered sediment traps is required at strategic points in all catchments to intercept sediment before it reaches the coastal area.

Wetland systems are particularly effective in reducing sediment and other contaminant discharges from land from reaching the marine area. They also provide a range of other co-benefits by providing habitat for native plants, freshwater fish and birds, and increasing local amenity value through the provision of public walkways and viewing spots.
banks and capture sediment

Guidelines for riparian planting

Dairy NZ has an online Riparian Planner tool\(^1\) designed to assist with planning, budgeting and managing riparian planting. Waikato Regional Council provides extensive advice on planting for waterways and wetlands\(^2\), including guidelines for the selection of trees in different parts of the Region, a guideline for native planting for soil conservation, biodiversity and water quality, and best practice guidelines for vegetation management and controlling weeds in riparian margins. Auckland Council has a streamside planting guide\(^3\), with information on the key steps for planting and maintaining a riparian area, and species to plant. ‘Managing Riparian Zones: A contribution to Protecting New Zealand’s Rivers and Streams’ is a detailed DOC publication\(^4\) that includes information and advice on planning riparian management, managing channel and bank stability, and managing water temperature and light.

work together to achieve the above.

5. Ensure good sediment management practice

a) By 2017, councils in partnership with mana whenua and sector groupings, should establish a standard set of good management practice guidelines for adoption by land users within the Hauraki Gulf Marine Park catchments. This includes pastoral farming, forestry, urban development, horticulture and cropping, roading (development and maintenance), and DOC owned and managed land.

b) By 2017 undertake a specific review of the standardised forestry good management practices, recognising the strong relationship between forestry practices and sediment runoff. Actively work with the sector to ensure those practices will be universally adopted.

c) Promote the universal adoption of good management practice by:

i. Requesting each land use sector to advise the Hauraki Gulf Forum and councils of their plan to ensure universal uptake of good management practices by 2018.

ii. Every two years thereafter, sectors formally reporting to the Hauraki Gulf Forum and councils on progress in achieving universal uptake. Council compliance teams should provide advice on the standard of this reporting and the achievements being reached for the period.

iii. Councils, Government and Industry bodies must actively support land holders to overcome knowledge, financial and practical barriers to implementing recommended good practices.

iv. If substantive progress in achieving universal adoption of good management practice has not occurred after four years (i.e. the second update) Councils should review the adequacy and application of the current regulatory framework and amend if required to ensure universal adoption.

v. Removing unnecessary legal barriers to good management practices such as the requirement in some forestry leases to replant down to stream and coastal edges.

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1. www.dairynz.co.nz/environment/waterways/riparian-planner/
d) Encourage land management that decreases the risk of sediment loss by:

i. Significantly scaling up the one-on-one approach with landowners, by doubling resources to employ additional land management officers and to provide co-funding for initiatives that improve water quality on private land within two years.

ii. Encouraging the establishment of coordinated catchment care groups.

e) Ensure rigorous and consistent enforcement of existing earthworks regulations by councils. Where guidelines have been agreed, include the use of chemical flocculants (Appendix 1 has a more detailed explanation).

Compliance monitoring

There is a need for uniform, quality monitoring of both consented and permitted activities, particularly higher risk activities such as earthworks. Councils need to increase the staff resource available to competently and consistently monitor these activities.

Working with landowners

Working one-on-one with landowners on a voluntary basis has proven to be successful in changing land-management practices and improving water quality (this applies to both sediment and nutrients). It therefore makes sense to scale this activity up.
6. **Review of forestry impacts on sedimentation**

   a) By 2017, identify the location of current and soon to be harvested (pre 31/12/18) forest sites. Initiate a comprehensive review of the impacts of those forestry harvesting-related activities on sedimentation affecting estuaries and embayments within the Hauraki Gulf Marine Park. Review and consider the adequacy of current practices and regulations to minimise sedimentation occurring. Work with the sector (small and large) to recommend and implement measures to minimise sedimentation until good practice is universally adopted in 2018 as above. This may include the review of current leasehold obligations regarding harvest and replanting close to waterways or on specific problematic slopes.

7. **Protect highly erodible soils**

   a) Implement effective pest control on all steep bush-clad slopes, particularly conservation, reserves and stewardship land on the Coromandel Peninsula and Kaimai Ranges, so that the understorey is thick, robust and able to protect underlying soils from erosion.

   b) Ensure appropriate use of highly erodible land:

      i. By 2017, identify land and land use which is generating disproportionally high amounts of sediment and work with land owners to investigate alternative land uses.

      ii. Retire steep slopes and riparian areas from production forestry and farming (including reviewing the replanting requirements of Crown forest leases).

      iii. Incentivise and encourage native timber (high value, long rotation) production. Planting of Manuka for honey production is a recent new alternative landuse.

      iv. Avoid urban subdivision of areas with highly-erodible soils.
8. **Addressing sediment in the coastal marine area**

   a) Actively investigate innovative solutions to addressing sediment already in the marine area including:

   i. Restoring large bivalve (including green-lipped and horse mussel) beds in the Inner Gulf to enhance filtering and trapping of fine sediment already in the marine system.

   ii. Options to cap sediment with waste shells or other hard substrates which allow re-establishment of natural marine seabed life.

   iii. Extraction or harvesting of sediment, possibly for reuse on land.

   iv. Retaining coastal mangroves where appropriate as effective natural means of trapping sediment.

   v. Transitioning seafood harvesting methods that disturb seabed sediment out of the Hauraki Gulf Marine Park (link to fish stocks provisions).

   vi. Other novel techniques to stabilise fine sediments already in the Hauraki Gulf and otherwise impairing recruitment of high value benthic bivalve populations

Excess sediment already in the coastal marine area is resuspended by wave action and currents resulting in cloudy water, reduced light levels and clogging of filter feeders. Effective solutions to such resuspension are not currently known but need further research.

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**Pest control**

Poorly managed indigenous vegetation is unable to hold soil during storm events. Effective pest control needs to be a priority for DOC as the single largest manager of highly erodible land in the Hauraki Gulf Marine Park.

Irrespective of the application of good sediment management practice, some land uses are unsuitable for highly erodible soils. In such cases, there needs to be a change of use for the land by working with land owners.

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**Forestry**

Sediment runoff from forestry blocks may be relatively low under the mature forest canopy, but is elevated during logging and re-foresting operations. Much of the sediment runoff arises from roads constructed to service the forest blocks. Forestry operators have a range of sediment mitigations available to them, including:

- avoiding winter earthworks;
- staging earthworks;
- stabilising disturbed areas as soon as possible by compacting, benching, mulching and planting;
- installing perimeter controls;
- Avoid trimming felled trees within waterways;
- diverting clean-water runoff;
- protecting steep slopes;
- avoiding direct discharges to streams;
- using small check dams to slow runoff;
- discharging runoff from roads at regular intervals;
- using soak holes where the soil allows;
- minimising side-casting when constructing roads;
- building roads to match natural contours of the land;
- keeping landings clear of streams;
- directing stormwater runoff from landings and roads to stable outlets;
- stabilising approaches to stream crossings and protecting abutments;
- protecting stream headwaters and stream banks;
- applying riparian setbacks.
How will we know when we’ve got there?

Naturally sandy seabeds will not be muddy, and seabeds already affected by sediment will be returned to their naturally sandy state. Healthy and abundant shellfish beds, inter-tidal seagrass beds and nearshore fisheries will return. Mangrove expansion will stop or naturally reverse.

Three sediment objectives

Objective WQ1 is intended to limit the sedimentation rate in estuaries and coastal embayments. Reducing the sedimentation rate will improve ecosystem health and functioning, improve human amenity, and extend the lifespan of estuarine and coastal systems.

- Objective WQ1: Sedimentation rate across the appropriately selected monitoring sites in the Hauraki Gulf Marine Park to be no more than 2mm per year above the baseline rate by 2050. Baselines vary throughout the Hauraki Gulf Marine Park.\(^5\)

By 2019 all monitoring to be in place and baselines established. Specific reporting to be made on sedimentation rate monitoring in 2025, 2030, 2035, 2040, 2045 and 2050. 2030 and 2040 reporting to include a review of progress to 2050 target, comment on likelihood of reaching the target and any additional actions likely to be required. It is expected that the majority of these measures will be put in place by 2030 to achieve this objective by 2050.

Refer to Appendix 4 for text on implementation and assessing achievement on this and the following objectives. Map 7.1 shows muddiness monitoring results for the Auckland Region and Map 7.2 locates possible sedimentation rate monitoring sites across the whole Park.
Map 7.1  Muddiness monitoring in the Auckland region
Map 7.2
Possible sedimentation rate monitoring sites
Objectives WQ2 and WQ3 are intended to prevent sandy seaboards from becoming muddy, and help already-affected seaboards return to their natural state.

With less mud in the seabed, habitats will be more suitable for a wider range of plants and animals. The seabed will feel better underfoot and the water will tend to be clearer, which will provide for a better swimming experience.

- Objective WQ2: Proportion of intertidal area with seabed mud content greater than 25% not to expand in all estuaries of the Hauraki Gulf Marine Park.
- Objective WQ3: Seabed muddiness to be less than 10% at 95% of intertidal flats that are exposed to winds and waves by 2050.

Further details on Sediment objectives are given in Appendix 4.

### THEME B. NUTRIENTS

#### What is the problem?

The marine environment is generally nitrogen limited. The introduction of nutrients, particularly nitrogen, promotes the growth of phytoplankton which is the basis of the marine food chain. Nutrients in the marine environment come from upwelling of nutrient-rich bottom waters from the sea and from land-sourced discharges.

Some enhanced levels of nutrient can be beneficial, as they increase the productivity of the marine system, but too much can cause excessive phytoplankton growth. When the phytoplankton die, they drop to the seabed and decompose in a process that uses oxygen in the water and generates carbon dioxide that acidifies the seawater. Low oxygen levels can damage marine life. Acidification of seawater can affect species which use carbon to build structures, especially bivalves such as mussels. Nutrients from the land are not usually a problem where harbours and estuaries are often well flushed by the tide.

The Firth of Thames is sensitive to excessive nutrients because it is not well flushed and the water column is sometimes stratified. In summer and autumn, the Firth has higher levels of phytoplankton than the rest of the Hauraki Gulf Marine Park. In autumn, oxygen depletion and water acidification have been measured in the outer Firth. In addition, dissolved nitrogen levels at the outer Firth have risen over the past 15 years despite total nitrogen loads in rivers draining to the Firth of Thames being stable or increasing only slowly for at least the past 20 years but stable to slightly declining over the last 14 years (Vant 2011). Green and Zeldis (2015) estimated that, at least when there is no strong ocean upwelling (which is the case for about 90% of the time), inputs from the land are the dominant source to the total nutrient loading of the Firth. Furthermore, point and diffuse human sources contribute about 8% and 70% respectively, of the total nitrogen load to the Hauraki rivers, with natural sources making up the remainder (Vant, 2011). Before human settlement, the landside loads would have been much lower.

#### What do we need to achieve?

Our objective for nutrients is to ensure that human-derived nutrients entering the Hauraki Gulf Marine Park are not at a level which cause adverse effects such as oxygen depletion and acidification of seawater.

#### How will we do it?

1. **Establish a long term monitoring programme**
   
   b) Within a year, Waikato Regional Council should engage a multi-agency scientific team, including mana whenua experts, in a targeted research programme to:
   
   i. Understand the effects of changing nutrient levels in the Firth of Thames; and
   
   ii. Determine the assimilative capacity of the Firth of Thames within required thresholds for healthy ecosystems as a basis for the establishment of catchment nutrient load limits (see Appendix 1 for further detail). This will underpin the WRC Plan Change Two as a ‘receiving environment’ load limit on nitrogen and phosphorus carried by the Hauraki rivers.

   The programme will:
   
   • Assess the nature of the monitoring and research required;
   
   • Identify the sources of nutrient inputs (external and internal);
   
   • Develop a model able to integrate with catchment water quality models and simulate current nutrient loads accurately in the Firth;
• Utilise the model to generate a robust nutrient load limit by 2020; and
• Incorporate mātauranga Māori and kaitiaki methods.

Expected outcomes from this programme would be increased understanding of the processes governing nutrient availability in the Firth of Thames, impacts of nutrients (including from the catchment and from in situ sediment regeneration) on those processes and, with the development of an appropriate model, a recommendation on nutrient load limits to ensure no adverse effects on marine life.

c) By 2018 have a comprehensive monitoring programme in place to provide ongoing scientific data and mātauranga Māori necessary to monitor and understand nutrient levels. This includes the deployment of a significant number of additional monitoring buoys in the Firth of Thames.

d) Within five years develop an integrated catchment economic model as part of the Waikato Regional Council Plan Change Two, for the Firth of Thames catchment as a management tool. Use this model to understand how values are likely to change as a result of policy decisions when establishing safe nutrient load limits.

e) Include provisions in Plan Change Two to achieve the nutrient load limits within an appropriate time frame.

2. **Ensure no increase in the interim**

   f) Ensure nutrient loads, particularly nitrogen, are kept at or below current levels as an interim measure until sufficient information is available to set nutrient load limits by:

   i. Encouraging land managers to adopt good nutrient management practices, such as the minimum standards for dairy farms developed by Dairy NZ and with milk companies for use elsewhere in the Waikato. These address issues such as effluent capture and storage, application to land, stock exclusion from waterways and wetlands and riparian management (see breakout box below for more detail).

   ii. Ensuring that any new sources of nutrient but especially nitrogen input, such as through land use intensification or the introduction of fish farms, do not result in an overall increase of nutrients available in the Firth of Thames.

Although the impacts of the current nitrogen loadings entering the Firth of Thames are not fully understood it is prudent to ensure that there is no increase whilst further urgent research is undertaken.

3. **Establish catchment nutrient load limits**

   g) Establish catchment nutrient load limits for the Firth of Thames that ensure there are no adverse effects such as oxygen depletion and acidification of seawater:

   i. By 2020, reach scientific, mana whenua, and community agreement on appropriate catchment nutrient load limits for the Firth of Thames.

   ii. By 2021, have in place agreed minimum standards for more intensive landuse such as horticulture, cropping and dairy farming, adapted to local conditions as necessary, in all catchments draining into the Firth of Thames.

   iii. By 2022, have in place agreed minimum standards for less intensive landuse such as drystock, using relevant parts of the above minimum standards as appropriate.

Once safe nutrient levels for the Firth of Thames have been established, these can provide a firm basis for catchment management and any measures required to reduce nutrient inputs.

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**Dissolved nitrogen levels**

There are still uncertainties about the causes and impacts of higher dissolved nitrogen levels in the outer Firth of Thames including whether these indicate greater overall nitrogen levels (these are not yet monitored in the outer Firth). Further research is required to fully understand the issue and to establish safe limits, and this needs to be undertaken as a matter of urgency, both within the Firth and it’s outer reaches.
**Integrated catchment economic and scientific modelling**

The Hauraki Gulf Marine Park is a complex and dynamic combination of natural and artificial systems that interact with each other like a giant, ever-changing puzzle. Māori conceptualise the moana as integrally connected by whakapapa. They also recognise the indivisibility of the land and sea as a functioning system – as described by the phrase ki uta ki tai – mountains to the sea. When making policy and management decisions about such a system, we often think about particular pieces of the puzzle. But there is a danger that decisions aimed at outcomes for one part of the puzzle will have unintended consequences for another part.

One way of overcoming such issues is to develop an ‘integrated model’ (see Appendix 1 for a more detailed description) that incorporates all the key features of the catchment, and the ways in which these interact. The overall question that this type of modelling tries to answer is how do values change as a result of our policy decisions? This approach can help us to figure out what policies might be needed, what effect they will have, and who will be affected.

Mana whenua have accumulated a vast body of knowledge about the Firth of Thames. It is imperative that this knowledge, and Māori management and restorative methods, be included in the development of an integrated model, and that this be accorded equal weight to that of Western scientific information and methods.

**Dairying minimum standards**

The Sustainable Dairying: Water Accord (2013) commits all dairy farmers to, amongst other things, riparian action plans that will reduce nutrient (and sediment & E. Coli) loss from farms to waterways and, ultimately, the coast. The Water Accord requires that all dairy farms with waterways have a riparian planting plan by 31 May 2020, and that by this time half of riparian actions are completed with full implementation of plans by 2030. Well prior to this, all dairying stock must be excluded from waterways (by 31 May 2017) and all crossings used more than once monthly, bridged or culverted by 31 May 2018 to prevent crossing related discharges and disturbance of stream bed habitat. This covers not only milking but also supporting land. To support this initiative, a wealth of information has been produced with regional authorities nationwide and published on how best to design, plant and maintain riparian margins for water quality.

In the Waikato Region, the dairy sector is promoting a draft package of minimum standards for dairy farms for inclusion in the Healthy Rivers Plan on the Waikato and Waipa Rivers. Amongst other things, the minimum standards address nutrient loss to waterways, and include expectations concerning effluent capture, storage and application to land (including a maximum annual nitrogen application rate to land from effluent, and a requirement that there be no discharge of effluent to water); stock exclusion from waterways and wetlands; and riparian management (as above). There is also an expectation for creation and maintenance of farm-level spatial risk plans that identify where there is a high risk of contaminants (nitrogen, phosphorus, E. coli and sediment) being lost to water, and target these with actions to minimise those risks pragmatically. These actions are to be auditable and reported on annually by an independent third party.

Standards and associated rules and practices for dairy farms at least as high as those being promoted by the dairy sector elsewhere in the Waikato need to be adopted for catchments that drain to the Hauraki Gulf, adapted for local conditions (e.g., soils, climate, ecology and stream hydrology) as necessary (Note that land draining to deep, low turnover hydro dam lakes may need more stringent measures that are not appropriate in this catchment).

The progress made on dairy farms is urgently needed across the full suite of land uses contributing sediment, nutrients and/or faecal pathogens into the Hauraki Gulf in a “whole of catchment” approach to reaching water quality objectives. Minimum standards for drystock (sheep and beef) farms, horticultural and cropping farms, and forestry operations need to be agreed, using relevant parts of the dairy minimum standards as appropriate (e.g., rules around riparian management for drystock farms).
How will we know when we’ve got there?

The Firth of Thames will be a healthy marine system with no excess phytoplankton levels, significant oxygen depletion or seawater acidification.

Three nutrient objectives

The overall goal is to manage nutrient loss from the land to the coastal marine area to maintain primary production at optimum levels and prevent the potential adverse effects of eutrophication such as macroalgal proliferation and depletion of dissolved oxygen.

Nutrient objectives designed to prevent excessive growth of phytoplankton in coastal embayments (including the Firth of Thames) aim to maintain nitrogen and phosphorus in the water column to provide optimum phytoplankton levels. Further detailed explanation of the objectives below is provided in Appendix 1.

Objective WQ4 intends to control nutrients in the water column, which are a driver of eutrophication:

- **Objective WQ4**: 80% of subtidal areas and coastal embayments with increasing trends in water-column ammonia-N, nitrate+nitrite-N, soluble reactive phosphorus and total phosphorus have the trend reversed within 15 years.

Objectives WQ5 and WQ6 focus on the symptoms of eutrophication – the amount of phytoplankton (primary symptom) and dissolved oxygen (secondary symptom) in the water column:

- **Objective WQ5**: Within 10 years, chlorophyll a in the surface water (i.e., above the thermocline) of subtidal areas and coastal embayments does not exceed 5 mg m⁻³ during the summer when primary production is greatest.

- **Objective WQ6**: Within 20 years, dissolved oxygen concentration in subtidal areas and coastal embayments is no lower than 5 mg L⁻¹.

Map 7.3 shows trends in coastal nutrient concentrations in the Auckland region, and Map 7.4 where water-column eutrophication objectives apply within the Park.

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Figure 7.13  Cows on a Hauraki Dairy Farm
Map 7.3 Auckland regional trends in coastal nutrient concentrations.
Map 7.4  Locations where water-column eutrophication objectives apply
THEME C. HEAVY METALS

What is the problem?

Stormwater draining from roads and other impermeable surfaces like roofs contains dissolved metal contaminants such as zinc and copper. These are carried to the coast and accumulate in muddy sediment. The main sources of these contaminants are from tyre and brake wear and uncoated surfaces of zinc and copper. Corroding or uncoated galvanised roofs are a typical source of zinc. The health and productivity of some marine habitats near urban areas is being reduced by the toxic accumulation of heavy metal contaminants in the sediment, sourced from urban stormwater and runoff.

The overall goal is to reduce heavy metal loss from the urban landscape to the coastal marine area and thereby limit the buildup of heavy metals in seabed sediments to protect benthic ecological health (Appendix 1 describes this in more detail). Map 7.5 depicts heavy metal problem areas in the Auckland Region.

What do we need to achieve?

Our objectives for heavy metals are to:

- Reduce contaminants at source.
- Prevent contaminants entering waterways.

How will we do it?

1. **Reduce contaminants at source**
   
   h) Transition to materials that are not sources of heavy metals:
   
   i. By 2018 amend building codes to require exposed galvanised and copper surfaces to be coated in urban areas.
   
   ii. Strongly encourage brake pad alternatives that don’t contain copper.
   
   i) Reduce vehicle use through investing in infrastructure to support alternatives including public transport, cycling and walking.

2. **Prevent contaminants entering waterways**
   
   j) Embrace green urban design that minimises heavy metal generation at source and that slows and filters runoff in urban areas such as filter strips, constructed wetlands, sand filters, grass swales, infiltration trenches, porous pavements, catchpits and sumps, sediment traps, litter baskets, detention basins and oil and grit separators.
   
   k) Put in place stormwater devices to trap heavy metals.
   
   l) Use public education to increase awareness and change behaviours such as washing cars on grass to reduce contaminant runoff into stormwater.
   
   m) Incentivise rainwater reuse, beneficial reuse and groundwater recharging.
   
   n) Promote innovative technologies for boat anti-fouling.
   
   o) Incentivise or require third pipe (grey water) networks for all new subdivisions.
   
   p) Promote the use of permeable surfaces rather than sealed ground surfaces, where practical, particularly in residential and domestic situations.

Appendix 4 describes these in more detail. Map 7.5 locates heavy metal hotspots, showing concentrations of copper, lead and zinc in coastal sediments from the Firth of Thames to the Waitematā Harbour.6

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6 Bubble colour relates to threshold effects level (TEL) and probable effects level (PEL) guideline values: bubble size is proportional to metal concentration (mg/kg). Reproduced from State of the Gulf 2014.
Map 7.5  Heavy metal hotspots as concentrations of copper, lead and zinc in coastal sediments. Appendix 4 describes these in more detail.
How will we know when we’ve got there?

Heavy contaminants in the seabeds of the Hauraki Gulf Marine Park will be at healthy levels which do not impact on marine life.

Four heavy metals objectives

Objective WQ7 intends to arrest the increasing trends in heavy-metal concentrations in seabed sediments. Arresting trends that are currently increasing indicates a reduction in heavy metals that can adversely affect animals that live in and on the seabed.

- **Objective WQ7**: 95% of intertidal and subtidal seabed with an increasing trend in heavy metals have trend arrested within 15 years.

Objectives WQ8 and WQ9 intend to reduce heavy-metal concentrations in seabed sediments to levels that do not pose a threat to the animals that live in and on the seabed. Seabed heavy-metal concentrations above certain known levels pose a threat to seabed animals; reducing concentrations below those levels reduces the threat.

- **Objective WQ8**: 95% of intertidal and subtidal seabed with heavy-metal concentration above threshold effects level (TEL) have concentration below the TEL within 30 years, and 95% of intertidal and subtidal seabed with heavy-metal concentration above probable effects level (PEL) have concentration below the PEL within 30 years.

- **Objective WQ9**: All intertidal and subtidal seabed with heavy-metal concentration below the threshold effects level (TEL) remain below the TEL.

A key objective is to maintain and improve the health and functioning of seabed fauna. Abundant and diverse seabed fauna supported by appropriate habitat will underpin the functioning of the wider estuarine and marine ecosystems and provide a range of benefits to people.

- **Objective WQ10**: No decline in benthic ecological health from present day and improvement in benthic ecological health at 25% of monitoring sites within 15 years.

This will be achieved by protecting seabed habitats from loss and physical disturbance, and by reducing sediment and heavy-metal runoff to the coastal marine area. Map 7.6 includes maps showing heavy metal trends in the Auckland Region for copper, lead, and zinc.

Benthic ecological health

Animals that live in and on the seabed (shellfish, crabs, worms and so on) underpin the proper functioning of the wider estuary and marine ecosystems and the benefits derived from those ecosystems by people. “Benthic ecological health” is assessed from routine measurements of seabed fauna. Assessments focus on species abundance and diversity, and the resilience of benthic communities to withstand disturbances such as excessive sediments and heavy metals. There are different indicators or metrics available for assessing benthic ecological health from monitoring data; some apply to intertidal flats only, others are more generally applicable.

Good benthic ecological health means that things are right with the habitat and that stressor levels (e.g., sediments, heavy metals) are low. Conversely, a poor or declining benthic ecological health signifies that something is going wrong, for example, a buildup of heavy metals in the seabed.

Auckland Council assesses the benthic ecological health grade from seabed monitoring data (see Map 7.7). The grade combines information on seabed mud content and metal concentration and the types and abundances of animals in the seabed. Sites are scored from 1 (healthy) to 5 (unhealthy). In 2015, all harbours and estuaries had monitoring sites that were scored as only moderately healthy and most had sites scored as unhealthy. Most sites near the older urban centres scored as unhealthy (scores of 4 to 5), particularly within the Waitemata Harbour and Tamaki Inlet, where the issue is elevated concentrations of at least one heavy metal. However, sites further away from urban Auckland were also rated as unhealthy, which was attributed to sediment runoff from rural land.

This key objective is to maintain and improve the health and functioning of seabed fauna. Abundant and diverse seabed fauna supported by appropriate habitat will underpin the functioning of the wider estuarine and marine ecosystems and provide a range of benefits to people. This will be achieved by protecting seabed habitats from loss and physical disturbance, and by reducing sediment and heavy-metal runoff to the coastal marine area.
Map 7.6  Trends in concentrations of heavy metals.

Trends in the concentrations of A) copper, B) lead, and C) zinc in coastal sediments around the Auckland urban isthmus. Arrow colour indicates whether the trends are statistically significant (red) or not (blue). Arrow size is proportional to the rate of change (mg/kg/yr). Concentrations were obtained using strong acid digestion of the <500 μm sediment fraction. Data provided by Auckland Council.
This is a combination of the Benthic Health Index (Mud and Metals) and the Traits Based Indicator. Reproduced from Auckland Council State of the Environment Report 2015.
THEME D. MICROBIAL PATHOGENS

Microbial pathogens (“disease-causing”) are microscopic organisms that live within the waters of the Hauraki Gulf Marine Park.

What is the problem?

Microbial pathogens are capable of causing illness and disease in humans and animals that swim or otherwise come into contact with polluted water. In addition, consumption of contaminated shellfish can cause illness in humans. Microbiological contamination is also an issue for marine farmers, affecting suitability of sites and the ability to harvest. Any untreated human or animal waste entering waterways is offensive in terms of tikanga Māori. This includes disposal of human remains into the marine environment, which should be immediately banned.

Much of central Auckland is connected to a system that carries both wastewater (sewage and washing water) and stormwater together in the same pipes. This system, and some other urban systems, are unable to cope during large storms and are designed to overflow during these events. Untreated wastewater and its pathogens then runs into the sea directly or via streams and rivers.

Runoff from the land, particularly during and soon after storm events, also contains pathogens from animal faeces and wastewater from poorly functioning individual on-site wastewater systems. As a result, some locations are unsafe for swimming and shellfish gathering because there is too much bacteria in the water (see Map 7.8). This is of considerable concern to mana whenua and the broader community.

What do we need to achieve?

Our objective for pathogens is to avoid the discharge of untreated sewage into the marine area, except in exceptional circumstances.

How will we do it?

1. **Ensure adequate wastewater infrastructure**
   - Ensure that properly functioning wastewater systems are in place for all communities in the Hauraki Gulf Marine Park:
     i. Urgently proceed with the Auckland’s Central Interceptor upgrade, which will collect, store and convey wastewater to the Mangere Wastewater Treatment Plant.
     ii. Significantly reduce overflows to a minimal level including by installing adequate holding tanks to ensure that overflows do not occur in heavy rainfall events.
     iii. Ensure that all on-site wastewater systems are properly maintained and operated.
     iv. Assist communities without (or with failing) sewage systems to upgrade their wastewater treatment facilities.
     v. Separate and effectively maintain sewage and stormwater piping networks.
     vi. Disallow further subdivision unless a proper sewage system, with adequate capacity, is in place.

Wastewater infrastructure

The Central Interceptor Project aims to significantly reduce the major wastewater overflows into the Meola Creek catchment, and it will provide the opportunity to further reduce existing wastewater overflows from the combined sewer system into urban streams and the Waitematā Harbour. Environmental benefits will include significant reduction in potentially harmful pathogens, reduced nutrient and organic loads, improvements in water quality, and reduction in the likelihood of conditions that cause ecological stress and adverse ecological change in the Meola Creek, Meola Creek estuary and associated coastal waters. Amenity and cultural benefits are also anticipated.

Investment in wastewater infrastructure is important if overflows are to be reduced. Reticulated systems are preferred but not always affordable. Good maintenance of septic tanks is important, and in some areas can be covered by rates so that the council can ensure they are operating correctly. Appendix 1 discusses the use of innovative technologies and habitat wetlands in municipal new treatments.
2. Address sewage discharge from recreational vessels
   r) Work towards eliminating raw sewage discharges from recreational vessels in inshore areas by:
      i. Avoiding the discharge of untreated sewage from vessels within areas that have been identified as inappropriate due to the proximity to shore, marine farms, marine reserves, or shallow water depth while providing for the health and safety of vessels and their occupants.
      ii. Providing encouragement and assistance to boat owners to install appropriate equipment on board, acknowledging that not all vessels will have room for holding tanks.
      iii. Requiring provision of sewage collection and disposal facilities for vessels at ports, marinas and other allied facilities, or at the time of significant upgrading of these facilities.
      iv. Promoting the installation of public toilet facilities at high use boat ramps and boating destinations, at construction, or during significant upgrades of such facilities.

3. Reduce pathogen runoff from agricultural and conservation land
   s) Encourage uptake of good management practice to reduce pathogen runoff from agricultural and conservation land in conjunction with riparian management practices for the prevention of sediment loss to waterways. This would include:
      i. Effective effluent management systems and onsite wastewater treatment systems.
      ii. Livestock excluded from waterways and the coast.
      iii. Effective pest and wild fowl management.
      iv. Control of populations of feral mammals in forest and bush areas.

4. Immediately ban all disposal of human remains into the coastal marine area
   Disposal of human remains to water is culturally offensive to Māori. According to tikanga Māori, human remains (including ashes) are considered tapu and must be kept separate from any food gathering areas or places where humans could come into contact with them. For this reason tangata whenua seek to avoid the practice of scattering ashes into the sea.

How will we know when we’ve got there?
A safe and enjoyable swimming experience at all popular swimming spots in the Hauraki Gulf Marine Park.

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**Figure 7.14 Boats at Islington Bay**

Discharges from recreational vessels

The discharge of raw sewage from recreational vessels can create a health hazard in crowded anchorages and is of cultural concern to mana whenua. The Auckland cruising fleet consists mainly of boats more than 30 years old which were built without holding tanks being installed.
Map 7.8  Swimming safety within Auckland Council.
Swimming safety within Auckland Council, from data collected over the three summer seasons (2011 – 2014).
Three microbial objectives

Objectives WQ11 and WQ12 aim to reduce microbial pathogens in the coastal marine area in order to achieve the goal of providing safe swimming for people, while WQ13 relates to seafood being safe for human consumption.

- Objective WQ11: All popular swimming spots in the Hauraki Gulf Marine Park (see Map 7.8) to be in Microbial Assessment Category A by 2030.
- Objective WQ12: People can swim at any beach within the Hauraki Gulf Marine Park Marine Park 95% of the time by 2025.
- Objective WQ13: aims to provide for safe kaimoana. Objective WQ14: Kaimoana is safe to eat from anywhere within the Hauraki Gulf Marine Park Marine Park by 2025.

RISKS AND THREATS

What is the problem?

Infrequent events such as ship sinking, chemical spills and major sewage discharges are risks. Actions to reduce the impact on the marine area from storm and flood events are often not anticipated in advance and planned for. Consequently the damage is greater. Poor regulation or enforcement, inadequate monitoring and poor coordination between agencies are also risks to water quality.

Lack of information is also a risk. For many areas of the Hauraki Gulf Marine Park there is insufficient water quality monitoring. This means that early detection of water quality issues and reversal of negative changes may not occur.

What do we need to achieve?

Our objectives for risks and threats are that:

- All significant risks are identified and minimised.
- Rapid response measures are in place.

How will we do it?

1. Understand the risks
   t) By 2018 Auckland Council and Waikato Regional Council, in consultation with the Hauraki Gulf Forum, need to instigate a formal audit of water quality risk factors, particularly storage facilities.

2. Reduce the risks
   u) By 2020, have in place plans, and implement mitigation actions, to address water quality risks affecting the Hauraki Gulf Marine Park including the potential damage from large storms, ship grounding, oil leaks, flooding and tsunami:
      i. Determine the volume of oil on the Niagara wreck and remove it if required.
      ii. Ensure Maritime New Zealand has a plan and capacity for prompt removal of oil from an above-surface wreck e.g. the Rena in coordination with Northland Regional Council.
      iii. Enforce designated shipping routes.
      iv. Ensure equipment and trained personal are in place and available to respond to emergencies.
      v. Ensure monitoring is sufficient to report on trends or incidents.

How will we know when we’ve got there?

Significant risks in the Hauraki Gulf Marine Park will have been identified and planned for. All reviews of responses to events like those described find that agencies have been optimally prepared.

7 The Niagara was in Northland until the regional boundary was moved in 2010 so the Northland Regional Council has previous experience with monitoring the wreck.
PLACE STUDY:
KAUAERANGA
(THE THAMES MUDFLATS),
MANA WHENUA, AND WATER QUALITY

The Kauaeranga (Thames) mudflats, adjacent to the mouth of the Waihou River, hold an important place in Sea Change. This is where the Waihou dumps its thousands of tonnes of sediment into Tikapa Moana / Te Moananui-ā-Toi. The Waihou channel is navigable at low tide, and the area is a prized fishery today, as it was in pre-colonial times. It is prime potential aquaculture space, as evidenced by the large wild beds of pacific oysters crowding the mouths of the Waihou and Piako Rivers. It is also on the edge of an internationally protected RAMSAR site that supports rare migrating seabird populations amongst wetlands and large stands of old mangroves.

Kauaeranga and mana whenua

While iwi and hapū typically hold discrete sections of coastline across Tikapa Moana / Te Moananui-ā-Toi, the Thames Foreshore is an example of a location prized for its rich resources, where there were complex interests. The area is under the mana of Marutuahu, but other hapū had long-standing access to certain places and resources on the Kauaeranga mudflats. These arrangements were formalised into legal boundaries when the mudflats were the first Māori foreshore lands put before the Native Land Court. Hori Ngakapa Whanaunga claimed a strip from the mountains to the middle of the Firth, bounded by Willoughby Street on the south and Richmond Street on its north, as shown in Figure 7.15.

Figure 7.15 Native Land Court survey number ML 1892, 1869. Inset ML 2252-9
Others commissioned surveys, some shown in the inset of Figure 7.15. In the Marlborough Sounds case more than 150 years later, which triggered the 2004 Foreshore and Seabed Act, Kauaeranga was argued to have confirmed Māori legal rights to the seabed. Sinclair referred to the cases as “a major precedent for non-territorial Māori fishing rights” (Sinclair, 1999). These parcels still extend into the Firth of Thames, and some remain in Māori ownership, as shown in Map 7.9.

Map 7.9 Kauaeranga foreshore showing sediment plumes.

Kauaeranga foreshore showing sediment plumes from the Waihou and Piako Rivers, legal parcel boundaries (yellow lines), remaining Māori-owned land (red), and Ahu Moana (light blue). Map is drawn south-north. (Sources. CRS LINZ NZ, Māori Land data Māori Land Court. Photo Google Earth 2016).

**Historic loss and degradation**

Local iwi gave lands for the establishment of Thames, and leased land for mining, forestry and fishing. But within a few years it became clear that Māori were being deprived of their prized fisheries, they witnessed degradation of their ancestral lands and waters. Māori sought to defend their fishing places, as expressed in this 1869 petition against the Thames Beach Bill by Te Moananui and other Hauraki chiefs to the Governor:

“The word has come to us that you are about taking our places from high-water mark outwards. You, the Government have asked for the gold of Hauraki; we consented. You asked for a site for a town; you asked also that the flats of the sea off Kauaeranga should be let; and those requests were acceded to and now you have said that the places of the sea that remain to us will be taken.”
O friends, it is wrong, it is evil. Our voice, the voice of the Hauraki, has agreed that we shall retain the parts of the sea from the high water-mark outwards. These places were in our possession from time immemorial; these are the places from which food was obtained from the time of our ancestors even down to us their descendants. ... It was thought that the taking of land by you ceased at Tauranga and other places; but your thought has turned to Hauraki.”

The petition fell on deaf ears, and an ever increasing fleet of ships obliterated the rich fishery, as described by Sinclair (1999):

“The foreshore opposite the towns of Shortland and Grahamstown (now Thames) was a broad mudflat formed by sediments from the Waibou and Kaurawaeranga rivers. It was an important flounder fishing ground. Godwits and shellfish were also taken. In times past, stakes had been driven into the mud to support fishing nets. By 1870, these had mostly been broken off by ships, but there apparently remained some stone walls associated with fishing. It seems that the mudflat was difficult to cross by foot except near the beach, and there had been some encroachment by the sea over what had once been dry ground.”

Already in 1870 colonial efforts had significantly degraded the Thames foreshore, and expanding mud was encroaching on fisheries in the Firth of Thames. This remains one of the most polluted sites in the Hauraki Gulf, and mana whenua still maintain their efforts for meaningful participation in its management. Sediment plumes from the Waibou and Piako can be seen below. Pending Treaty settlements are expected to create a new mana whenua-council co-management body for the Waibou, Piako, and Coromandel Peninsula streams. This will be an important vehicle for reducing the sedimentation of Tikapa Moana / Te Moananui-ā-Toi.