Appendix O: **Recreation Assessment**

May 2020

Porirua Wastewater Treatment Plant Reconsenting

Recreation Assessment

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Porirua Wastewater Plant Reconsenting
Recreation Assessment

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Abbreviations and definitions

95th percentile	95% of measurements lie below the number referred to
cfu/100ml	Colony forming units per 100 millilitres
DHB	District Health Board
DOC	Department of Conservation
EOC	Emerging organic contaminants
GWRC	Greater Wellington Regional Council
L/s	Litres per second
MfE	Ministry for the Environment
MoH	Ministry of Health
MPN/100mL	Most probable number per 100 millilitres
NOAEL	No observable adverse effects level
PCC	Porirua City Council
PNRP	GWRC Proposed Natural Resources Plan
RCP	GWRC Regional Coastal Plan
QMRA	Quantitative Microbial Risk Assessment
SUP	Stand-up paddle board(ing)
UV	Ultraviolet light, used to disinfect treated wastewater
WWTP	Porirua Wastewater Treatment Plant

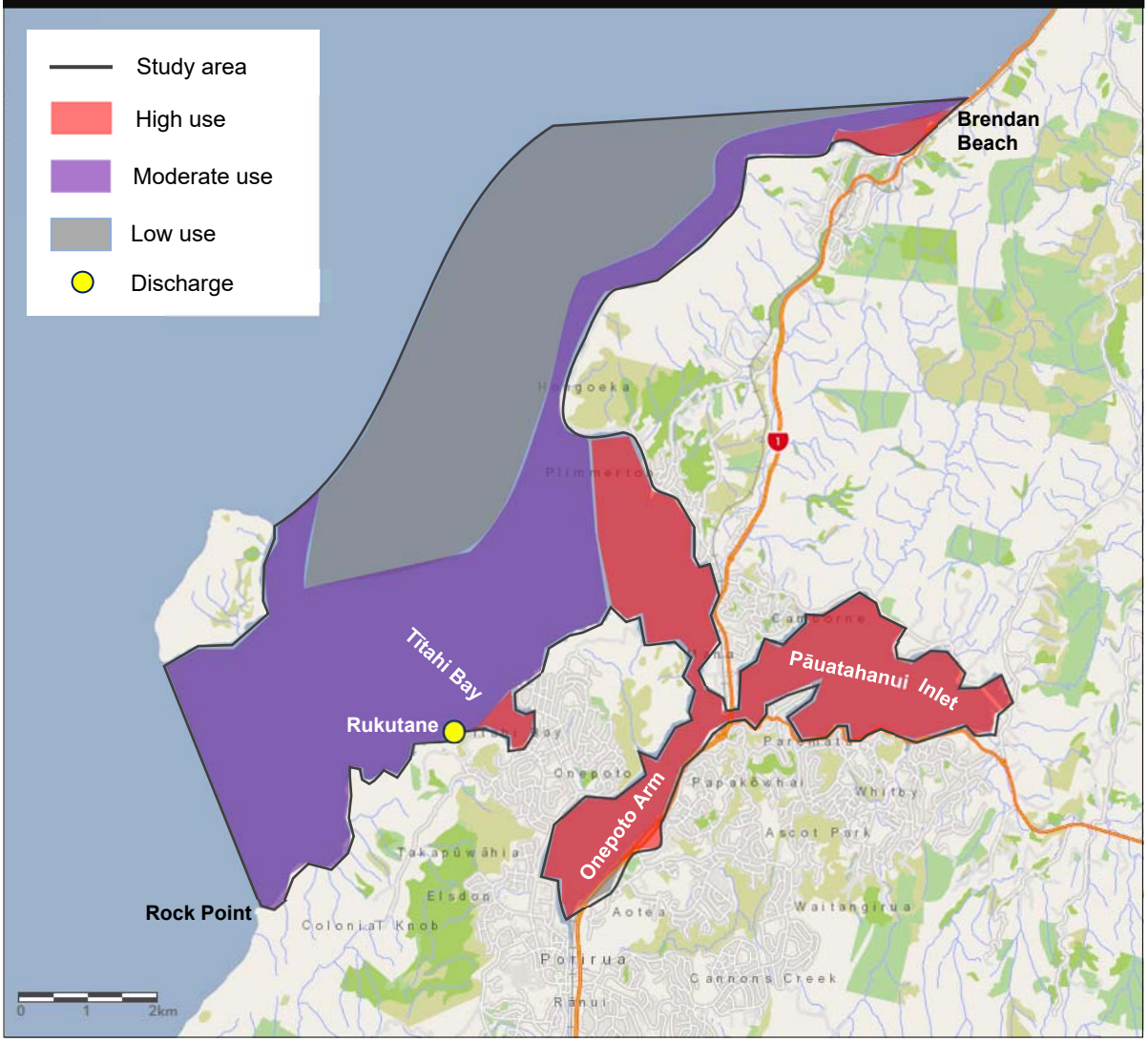
1 Summary – method, recreation values, effects assessment

Consent for the discharge of treated wastewater from the Porirua Wastewater Treatment Plant (WWTP) into coastal waters at Rukutane (Figure 1) will expire in July 2020. Porirua City Council is applying to renew this consent; and is proposing upgrades to the treatment process to better cope with peak inflows and population growth. The treated discharge has the potential to adversely affect recreation opportunities by introducing pathogens into the coastal marine environment.

This report:

- Describes the recreation values of the study area shown in Figure 1 (defined by hydrodynamic modelling of virus concentration dilution patterns by Oldman & Dada (2020)). The area includes Te Awarua-o-Porirua Harbour (Onepoto Arm), Pāuatahanui Inlet, Tītahi Bay and the coastal area extending from Rock Point in the south to just north of Brendan Beach at Pukerua Bay. For completeness, the main forms of recreation in all inshore areas are described although, under the proposed future discharge regime, modelling shows only extremely low viral concentrations – with a conservation approach – entering the mouths of the Onepoto Arm and Pāuatahanui Inlet (and low concentrations generally beyond the mixing zone near the discharge);

Figure 1: Study area and relative levels of recreational use



- Identifies the relative scales of recreational use of each part of the study area (also summarised in Figure 1); and
- Considers the effects of additional treatment capacity at the Porirua Wastewater Treatment Plant and the continued but improved discharge from the WWTP at Rukutane Point into the study area.

This assessment is based on:

- A site visit with Stantec staff to identify treatment options and components of the study area (the author of this report once lived in Camborne);
- Literature review (Sections 2 and 3);
- Thirty interviews with recreational users of the study area and special interest groups. A summary is provided in Section 4 and more detailed responses are available separately;
- Review of parallel technical reports, particularly:
  - Loughran, P., Jenner, G. & Haverland, R. 2020. Technical Memorandum – *Porirua Wastewater Treatment Plant - Disinfection Performance* Connect Water. Prepared for Wellington Water Ltd.
  - Oldman, J.W. & Dada A.C. 2020. *A Quantitative Microbial Risk Assessment of the Porirua WWTP discharge and receiving environment*. DHI1901, Streamlined Environmental. Prepared for Wellington Water Ltd
  - DHI. 2018. *Porirua Outfall Options*. Report 44801313 prepared for Wellington Water.
  - Morrisey D, Berthelsen A, Clark, D, Cunningham S, Edhouse S, Floerl L, Sneddon, R, D'Archino R. 2019. *Porirua wastewater treatment plant outfall: assessment of effects of different outfall options on the marine environment*. Prepared for Wellington Water Ltd. Cawthron Report No. 3380
- Review of draft assessment findings with the project team.

1.1 Recreation activities and values

Much of the study area is heavily used for a wide variety of recreational activities and is of regional significance for recreation values.

1.1.1 Recreation activities

Immediate receiving environment

This area is defined as the coastline near the outfall and Tītahi Bay, where modelling shows relatively low dilution levels for the shoreline discharge.

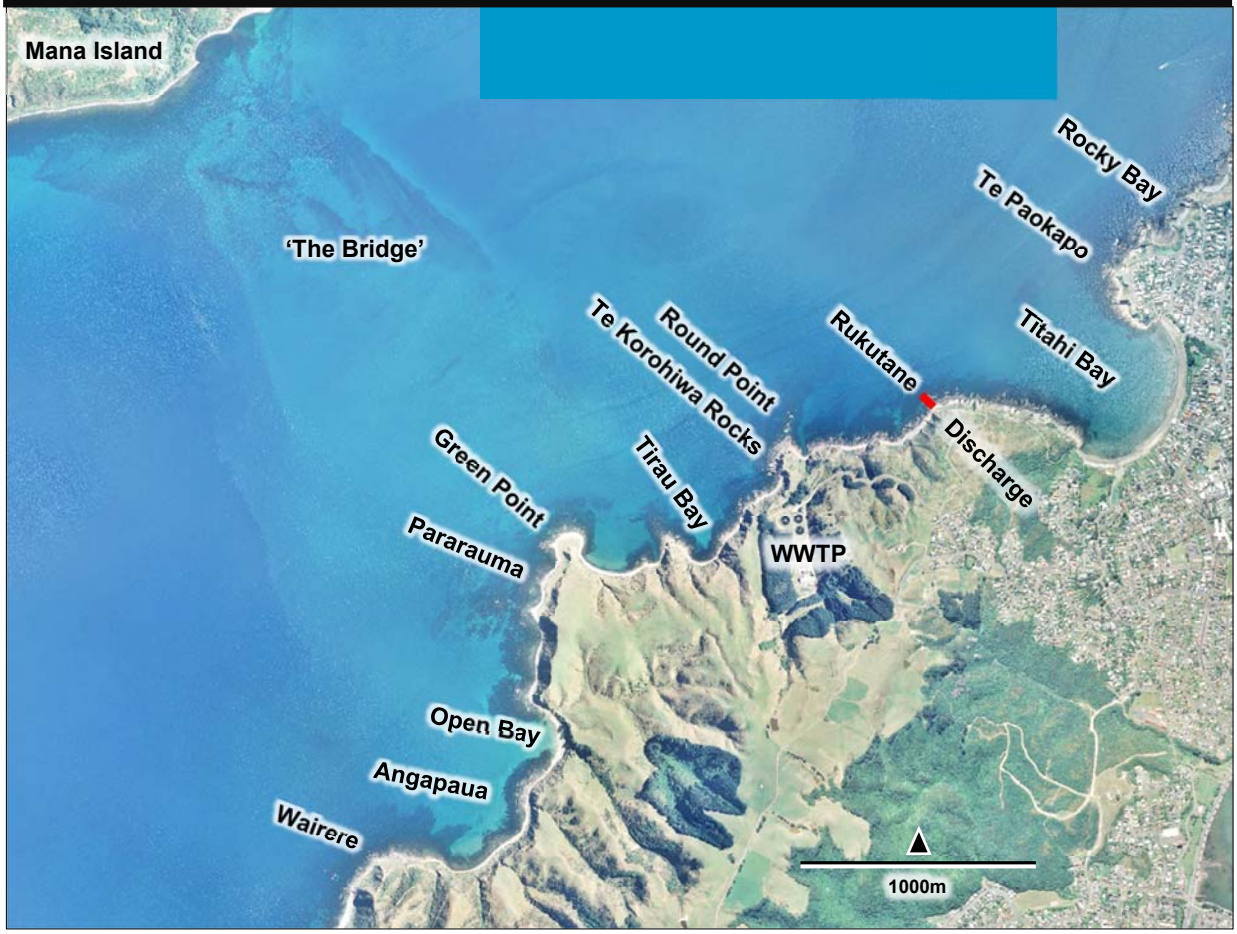
Tītahi Bay is a popular surfing site, particularly for beginners, and an important swimming beach, with the Tītahi Bay Surf Lifesaving Club located centre-stage. The Bay has high levels of use for a wide variety of shore- and water-based activities, including walking, dog walking, paddling, windsurfing, events and general family beach recreation, as well as small boat activity, such as kayaking and stand-up paddle boarding (SUP), and fishing. Three sites are monitored by the GWRC for water quality for bathing.

Several locally significant surf breaks are located south of Tītahi Bay and the outfall discharge, at Tirau Bay and Open Bay and the regionally significant Stevo's at Wairere (see Figure 2 for coastal place names).

Most of the coast in the study area has easy public access, and almost all has some form of access. Fishing is popular offshore along the Mana Island marine bridge ('The Bridge') – which is largely outside the immediate receiving environment – and from many rocky coastal areas.

Morrisey et al (2019), in their assessment of ecological values in the vicinity of the outfall, noted a relatively high number of pāua at Rukutane Point – most likely due to a reluctance to harvest near the discharge – while they were also present at other nearby sites. Mussels were only represented by the little black variety at Rukutane Point, which are not taken recreationally due to their very small size. No scallops were observed in the soft sediments offshore. Few kina were found and only at Round Point. Pāua gathering occurs throughout the wider Wellington coastal area, although the gut is rarely eaten, meaning the consumption of pāua washed in clean water has relatively low health risks compared with cockles or pipi, which are eaten whole.

Figure 2: Coastal place names near WWTP and discharge



Wider environment

This area is defined as the remainder of the study area, including the enclosed waters of the Onepoto Arm, Pāuatahanui Inlet and the exposed coast north of Mana, where modelling shows relatively high dilution levels for the discharge. (Place names are shown in Figure 3.)

The Onepoto Arm of the study area (often also referred to as Te Awarua-o-Porirua Harbour), is used extensively for: waka ama, rowing, wind surfing, flat-water kayaking, kite surfing, small boat sailing and power boating. Five relevant clubs are based around its edge: the Toa Waka Ama Club, Porirua Rowing Club, Tītahi Bay Boating Club, Wellington Power Boat Club and the Porirua Canoe Kayak Club. There are also: three public boat launching ramps, two areas set aside for personal watercraft, defined boat mooring areas at Onepoto and nearer the Paremata Bridge, and a row of private boat sheds at Onepoto. While shellfish gathering is not advised

Figure 3: Inshore place names

due to multiple sources of contamination in the Harbour[1], cockle harvesting is popular, and flounder are available. Water quality for bathing is measured by the Greater Wellington Regional Council (GWRC) at the Porirua Rowing Club site (Onepoto) and this is a sheltered swimming site. Two sites are monitored by the GWRC for water quality for bathing and one for shellfish gathering.

Pāuatahanui Inlet is popular for: small boat sailing and training, swimming – particularly at the Dolly Varden Beach and off the Paremata Bridge – shellfish harvesting, floundering, set-netting, jet skiing, flat water kayaking, waka ama, wind surfing, kite surfing, bird watching and conservation work – particularly at the Pāuatahanui Wildlife Reserve – power boat racing, stand-up paddle boards (SUP) and motor boating. Two relevant clubs are located on the Inlet – the Paremata Boating Club and the Camborne Water Ski Club. Inadequate water depth means the water ski club now operates from Wellington Harbour. There are three reserved

[1] For example, the Porirua webpage for 'Te Awarua-o-Porirua Harbour FAQs' states: "We would advise against [taking] fish or shellfish from around stormwater outfalls, particularly next to Porirua Stream and the city centre, where there is a danger from faecal and other bacterial and viral matter. Keep to the harbour entrance and outer harbour." https://poriruacity.govt.nz/your-council/city-planning-and-reporting/our-strategic-priorities/healthy-harbour/te-awarua-o-porirua-harbour-faqs/

water ski lanes and a personal watercraft area, four boat launching ramps (including the Mana ramp at the Paremata Bridge) and four boat mooring areas. Private boat sheds are located at Camborne and Ivey Bay, with several dotted further along the coastal edge. Several bays and beaches provide picnic and swimming opportunities. Two sites are monitored by the GWRC for water quality for bathing.

The inshore area from the Paremata Bridge to Hongoeka Bay is popular for: swimming, wind surfing, kite surfing, sea kayaking, sailing, surf-casting, surfing and beach activities. Five recreation clubs are located in the area: Plimmerton Boat Club, Ngāti Toa Sea Scouts, TS Taupo Sea Cadet Corps, Mana Pasifika Outrigger Canoe Club and the Mana Cruising Club. Four sites are monitored by the GWRC for water quality for bathing, including at Onehunga Bay on the western side of the channel.

Pukerua Bay supports fishing, shellfish gathering, rock-pooling, conservation work, surfing and swimming.

While most of those interviewed stated that they would not collect shellfish from within enclosed waters due to health concerns – and all avoided the activity after rain or if health warnings were present – this activity was frequently observed and is described in a recent survey by Wellington Regional Public Health (WRPH 2018), with an activity focus – in the enclosed waters – around the Paremata Railway Station area.

1.1.2 Recreation values

Interviewees noted that the core value of the study area was, mostly, that it exists and is readily accessible, with many relevant club facilities conveniently located. The harbour setting is the only recreation setting of its type in the region, with large areas of shallow and relatively warm water that – due to its scale – is relatively safe. The surf lifesaving club at Tītahi Bay adds to the safety of the most popular beach in the study area. Paddlers, wind surfers, kite surfers, sailors and the like, when using the Inlet or Onepoto Arm, are never far from a shore and shallows, which means it is an ideal setting for training and education – although some sailing activities are limited by low tides. There is always some shelter from wind within the enclosed arms. The outer harbour areas and Tītahi Bay offer more excitement and advancement as skills improve. Many interviewees lived locally and treasured the ability to immediately access a natural setting with good beaches, good walking options and excellent fishing, including out to Mana Island. Walking tracks were considered to be extensive with many quality settings.

Seven interviewees mentioned, without prompting, occasional poor water quality as a limiting factor for recreation. All other unprompted responses about access limitations related to weather and tides. With prompting (“Are you aware of any water quality issues …”) almost all interviewees stated that they were aware of poor water quality, particularly in Porirua Stream and the Onepoto Arm – which most referred to as Porirua Harbour. A typical individual response was: “Aware of poor water at Porirua Harbour and Porirua Stream (poor clarity, run-off and high coliform counts); Pāuatahanui Inlet monitoring shows that quality is compromised – mostly due to sewerage infrastructure and storm water drains; Aware of poor quality of Tītahi Bay; Don’t know about Pukerua Bay.”

The Toa Waka Ama Club has a particular relationship with the Harbour based on the intertwined nature of their recreational use and cultural association with the study area; considering Porirua is the awa of the Takapuwhahia Marae, and Ngāti Toa paddlers have a multigenerational relationship with the setting and their waka ama activities.

There are many community groups and clubs with an interest in improving recreation and natural values in the study area. There are community expectations for improvements in water

quality in the study area. The Proposed Natural Resources Plan for the Wellington Region, for example, identifies, as first priorities for water quality improvements for contact recreation:

- Te Awarua-o-Porirua Harbour (Onepoto Arm) at Rowing Club
- South Beach at Plimmerton
- Tītahi Bay at South Beach Access Road

and as second priorities:

- Pāuatahanui Stream
- Porirua Stream

Porirua City Council, via its PCC Reserve Management Plan (2013), states expectations for improved recreation amenity on or by most of the identified freshwater courses.

Figure 1 (page 6) shows the relative levels of use of the study area based on data obtained via literature review and interviews. There are no user counts available for any of the activities identified.

The study area is regionally significant for recreation, but due to its regional scarcity and wide range of recreation opportunities and quality values, it is a pivotal recreation setting for Porirua City. There do not appear to be any nationally significant recreation attributes.

1.2 The Porirua Wastewater Treatment Plant and its consent

Consent for the discharge of treated wastewater from the Porirua Wastewater Treatment Plant (WWTP) will expire in July 2020. The WWTP treats wastewater collected from Porirua City and the northern catchments of Wellington City and has been progressively upgraded over the last six years to improve the quality of its discharge. However, during peak wet weather events, over-capacity flows still bypass the secondary treatment process (the aeration basin and clarifiers) and are treated to only a primary level (screening) before being combined with the secondary treated wastewater. This 'combined' wastewater is then UV irradiated and discharged from the Rukutane Point shoreline outfall. Normal inflows (that is, the majority of flows) are fully treated before discharge.

Further improvements are scheduled for completion over two stages: by July 2021, an upgrade of the UV system will allow disinfection of flows to a capacity of 1,500 L/s; and by July 2023 an upgrade of WWTP inlet works will increase the flow capacity from 1,000 L/s to 1,500 L/s and the capacity of the secondary treatment processes to 1,500 L/s. The outcome will be that all flows received at the WWTP are secondary treated and UV irradiated. The application seeks resource consent for:

- A maximum average discharge flow of 38,016 cubic metres per day (up from 24,000 m^3 under the current consent); and
- A peak discharge flow of 129,600 cubic metres per day (up from 92,800 m^3 under the current consent).

A new 20-year consent is being sought, and during this time the discharge quality is expected to show an initial sharp improvement because of the capacity and treatment upgrades, followed by a gradual decline due to population growth, which will progressively increase wastewater inflows and contaminant loads, although with respect to contaminants relevant to recreation use, it will remain superior to that which existed prior to the plant upgrades.

1.3 Effects summary

The effects considered in this recreation assessment relate to water quality for:

- Water contact recreation ('primary contact' where swallowing water is likely),
- Recreation where the water might be contacted but not ingested, such as boating and beach activities ('secondary contact', where contaminated water can be aerosolised and inhaled or enter the body via a cut); and
- Effects on fish and shellfish species which are taken recreationally. All assessments for eating kaimoana assume that they are eaten raw, which is not common, but is quite enjoyed by some (including the author of this report, but only from sites remote from habitation).

This assessment compares the effects of the treated discharge, including proposed system upgrades, against the 'existing environment' which for the purposes of the consent application:

- Includes the past effects of the activity (that is, the extent to which the environment may have already been altered by the operation of the WWTP up until now);
- Includes any structures which it would be fanciful or unrealistic to assume would be removed if the consent renewal was declined; but
- Does not include the ongoing effects of the activity which is the subject of the resource consent application.

This means that this assessment must assume that the consent renewal should be considered more similarly to a new proposal rather than only an improvement to an existing activity. Ongoing effects of the past operation of the WWTP plant should be considered, but if discharge ceased, its residual effects on recreation and ecological values would rapidly fade; although in many inshore locations, including Tītahi Bay, water quality for contact recreation and shellfish harvesting would not notably improve unless the many other sources of contamination were are able to be eliminated or significantly reduced.

Health risk modelling (based on a Quantitative Microbial Risk Assessment or QMRA) carried out parallel to this assessment found that – based on the results of current discharge monitoring for faecal coliforms and enterococci, and the proposed upgrading of the WWTP UV disinfection system – it is projected that an enterococci discharge limit of <500 cfu/100mls (95 percentile) will be met at 15 modelled exposure sites under current and future wastewater flows, which meets the targets of the Proposed Natural Resources Plan (PNRP). However, the AEE notes that modelling the impact of concentrations of several varieties of virus in the receiving environment was considered a more effective measure of health risk associated with primary and secondary contact recreation and shellfish gathering.

Considering exposure to active viruses, the quality of the discharge is projected to decrease over time (due to population growth and without further upgrades to the WWTP), but to remain within the 'no observable adverse effects' for illness risk throughout the consent period.

All health risk assessments used in the QMRA are conservative, and are made for children, who are the most susceptible, and assume no further inactivation in the natural environment as a result of die-off from natural solar disinfection. The assessments for contact recreation would therefore reflect the risk exposure for, for example, a child surfing in the early morning near the discharge when natural UV light has had no time to inactivate viruses. This scenario could occur, albeit rarely. In the case of shellfish-gathering at sites distant from the discharge, natural disinfection means the stated gastrointestinal illness risk for eating raw shellfish (cockles and pipi where the gut is consumed) is also quite conservative. Pāua are normally eaten without the gut, and risks from consuming this species are therefore extremely small if they are washed

in clean water. The risk assessment also assumes that all enterovirus infections result in an illness (due to a lack of dose-response data) while illness/infection ratios of 0.6 and 0.5 are applied for noroviruses and adenoviruses respectively (where dose-response data are available).

Effects on recreation values are assessed according to the matrix in Table 1. This considers the magnitude of the effect and the value of the setting for recreation. The magnitude of the recreation effect is usually identified by other specialists for water quality and ecological values, considering, for example:

- The spatial scale and duration of the effect;
- The magnitude or consequences of the effect occurring;
- The value of the organism or habitat affected for recreationally harvested species; and
- The likelihood of the effect occurring.

Recreation value in this assessment correlates to the different levels of use of the setting identified in Figure 1.

Table 1: Scale of impact on recreation values considering magnitude of effect

		Recreation value			
		Very High	High	Moderate	Low
Magnitude of effect	High or severe	Significant	Significant	Moderate	Minor
	Moderate or medium	Significant	Moderate	Minor	Minor
	Low or minor	Moderate	Moderate	Minor	Minor
	Negligible	Negligible	Negligible	Negligible	Negligible

A 'significant' adverse effect is likely to displace[2] many or most users from a setting for prolonged periods, but not necessarily for all activities which occur there; although it is likely that amenity for all activities will be degraded. A 'moderate' adverse effect will periodically displace some activities and users, but amenity will not be degraded for all activities. A 'minor' adverse effect will displace a small number of users for short periods, but amenity will almost always be preserved for the majority of activities and users.

The scale of effect may be reduced if the area affected is confined and there are ample suitable alternative opportunities for relevant activities.

There is no 'minor' scale of impact for 'high' or 'very high' use recreation settings. This reflects community expectations that very popular settings are managed for extremely small or negligible human health risk (as expressed through interviews for this assessment and the experience of the report author).

The QMRA indicates, at the modelled log reduction levels for all three viral pathogens (adenovirus, enterovirus and norovirus), that the illness risk at all sites is at the "no observable adverse effects level" (NOAEL) for all contact recreation and shellfish gathering at all exposure sites, including those at 200m of the discharge. Therefore, the discharge activity will have negligible adverse effects on coastal and marine recreation within the study area and beyond the mixing zone, when compared to a scenario where the current discharge is discontinued, and based on the conservative health risk assessment.

[2] Force people to recreate in other settings or not at all.

These effects would, however, only be meaningful for recreation beyond the mixing zone if the other sources of contamination in Tītahi Bay and the enclosed waters of the Harbour area are able to be removed. Otherwise, any effect which limits recreation is local to the discharge and within an expansive coastal environment with many alternative recreation settings. Beyond the outfall area, there are unlikely to be any changes to real health risks from recreation or shellfish-gathering due to the many other sources of contamination which affect the most heavily used parts of the study area (compared with both a 'no discharge' scenario and for the life of the proposed consent).

2 Regional and local strategies

This section considers Department of Conservation and Porirua City Council strategies which give direction to resource management for local recreation, public access and open space values.

A full review of the following policies is given in the Resource Consent Application & Assessment of Environmental Effects for the WWTP (the AEE), and these documents are not reviewed again here:

- NZ Coastal Policy Statement
- Regional Policy Statement for the Wellington Region
- Regional Coastal Plan for the Wellington Region
- Proposed Natural Resources Plan for the Wellington Region
- Porirua District Plan

In summary, these policies seek to protect recreation activities and make particular mention of the need to protect access to and along the coast. They also clearly link maintaining or improving water quality with the protection of recreation activities.

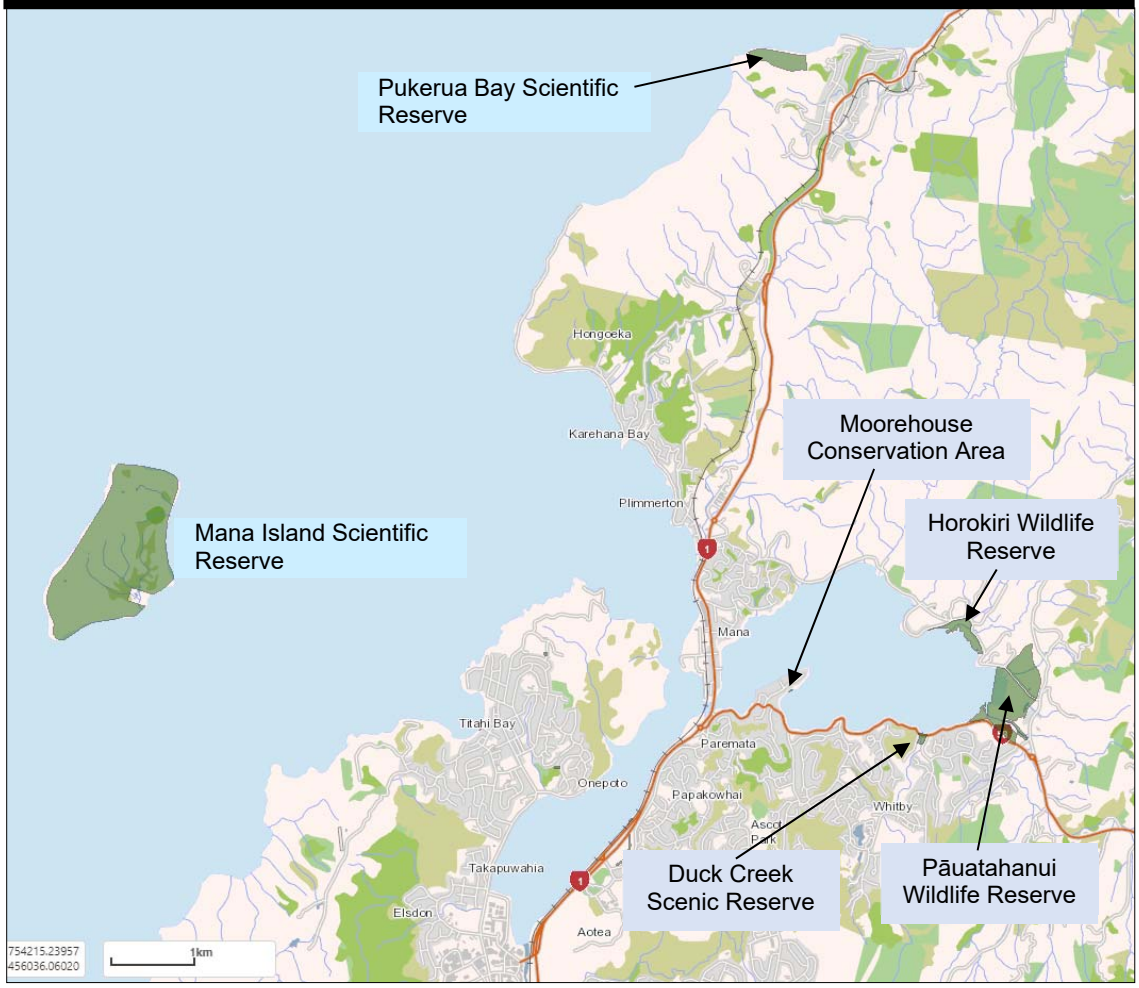
2.1 Department of Conservation

The *Recommended Draft Wellington Conservation Management Strategy 2018* (DOC 2016) describes the study area within the 'Coastal and Marine Place', although with little reference to recreation beyond engaging with natural values (11.1, p 140):

> *Another notable feature is Te Awarua-o-Porirua Harbour (Pāuatahanui Arm), including the Pāuatahanui Wildlife Reserve, a nationally significant site for plant and birdlife. The Department's management of this area contributes to the implementation of Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan, which seeks to address issues of sedimentation, pollution and habitat loss. It is the largest relatively unmodified estuarine area in the southern half of Te Ika-a-Māui/the North Island and one of the largest areas of saltmarsh vegetation in the region. It provides habitat for a diverse range of flora and fauna and supports numerous waterfowl and wading birds…..*
>
> *11.2 Outcome*
>
> *Marine environments in the Coastal and Marine Place are valued and cared for by the local community. The ecological health of marine ecosystems and the marine and coastal land interface within the Place is improving, and marine species thrive.*
>
> *People have the opportunity to observe marine mammals and sea birds at various locations along the coast, and increased public awareness ensures that wildlife remain safe and undisturbed. Coastal recreation use is increasing in ways that enhance public understanding and appreciation of coastal ecosystems and species, while avoiding adverse effects on those ecosystems and species. Any vehicle use avoids wildlife disturbance, vulnerable ecosystems and historic sites….*
>
> *11.3.2. Natural values: Issues and opportunities*
>
> *The main threats in this Place are illegal fishing, grazing stock entering reserves, habitat modification, pest plants (aquatic and terrestrial), climate change, and pollution, including from untreated shoreline discharges on the Wellington south coast, the Kāpiti coast, and in the Wellington (Port Nicholson) and Te Awarua-o-Porirua harbours….*

Figure 4 shows the DOC-administered coastal reserves in the study area, based on the DOC Maps online GIS database.[3]

Figure 4: DOC Maps GIS database of DOC-administered sites in the study area



2.2 Porirua City Council

One of the Porirua City Council's four high-level strategic priorities[4] is a 'Healthy Harbour':

> *Te Awarua-o-Porirua Harbour is our greatest environmental taonga and we are working hard to protect it.*
>
> *We want a harbour that is the centrepiece of our community culturally, recreationally and environmentally, and is:*
>
> - *a clean and natural habitat.*
> - *a safe and beautiful recreational environment.*
> - *supported by a robust ecological restoration programme.*
> - *treasured by the community, businesses and visitors.*
> - *supported by infrastructure that has minimal negative effects on the harbour and catchment.*

[3] See: http://maps.doc.govt.nz/mapviewer/index.html?viewer=docmaps
[4] https://poriruacity.govt.nz/your-council/city-planning-and-reporting/our-strategic-priorities/healthy-harbour/

An extensive library of research findings to support the Healthy Harbour programme is provided, mostly relating to environmental and cultural values and very little to recreation.[5] Relevant data are reviewed in Section 3.2 of this report.

There is little information provided by Council about recreation development on the Harbour; but via the *Porirua City Reserve Management Plan* (updated to 2016), outcomes are specified for settings bounded by reserve.[6] These include:

> **Onepoto Esplanade Reserve** is identified as supporting' 'Water sports, including rowing, waka ama, kayaking, jetty and boat launching'.
>
> **Wi Neera Esplanade Reserve** is identified as supporting, 'Relaxing, waka launching, picnicking, children's play, sightseeing, commercial recreation (mini-golf)' with an objective:
>
> > *6 Continue to provide a mix of recreation opportunities that are focused on the coastal environment and access to the sea, including provision of opportunities for organised water sports, along with children's play spaces, and informal recreation.*

[5] https://poriruacity.govt.nz/your-council/city-planning-and-reporting/our-strategic-priorities/healthy-harbour/research-publications/
[6] https://poriruacity.govt.nz/your-council/city-planning-and-reporting/reserves-management/

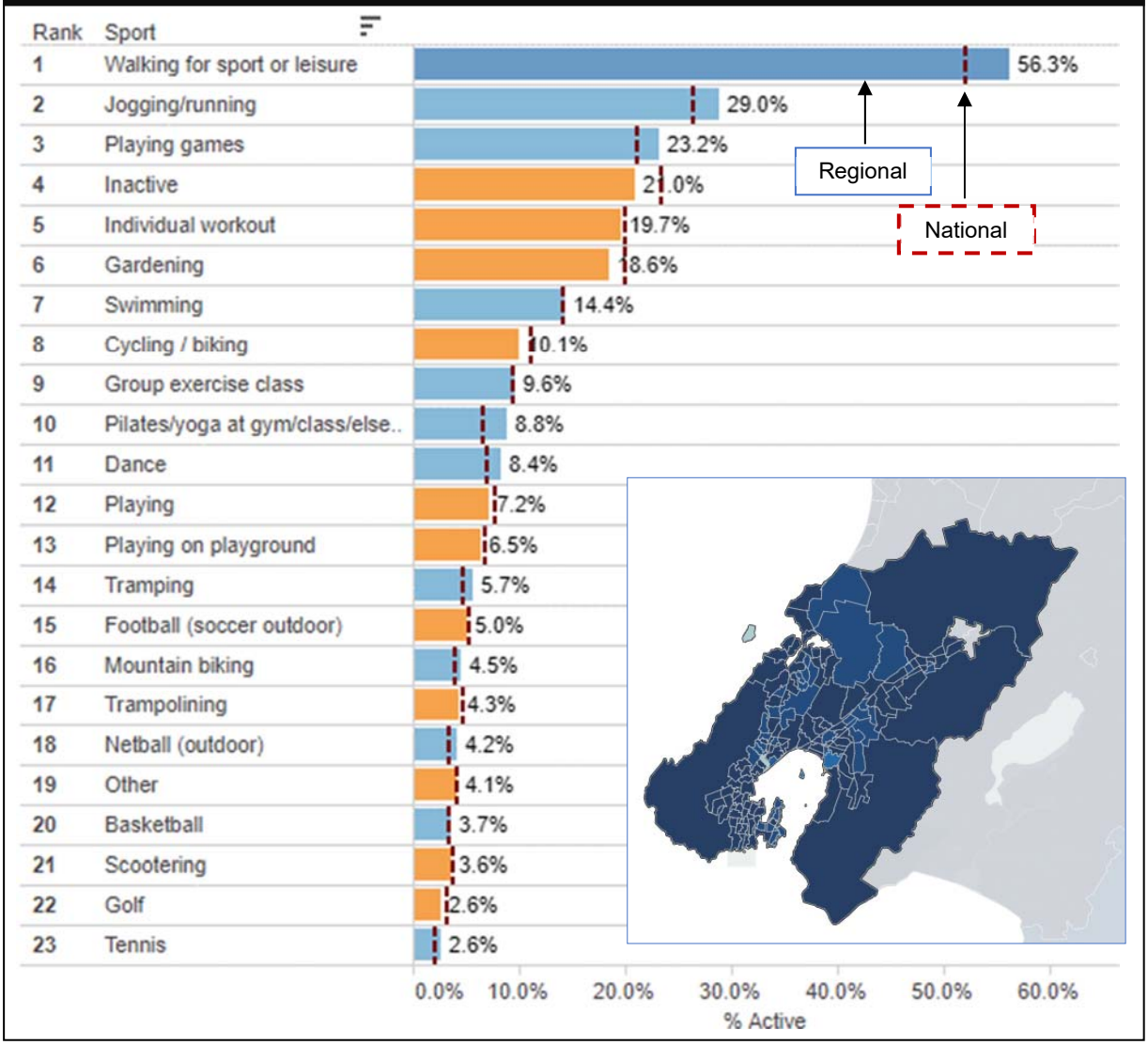
3 Existing recreation values – literature review

This section reviews national and regional recreation patterns, relying on national recreation participation research. A summary of this section (and the data gained from interviews) is presented in Section 1.1 of this report (the Executive Summary).

3.1 National and regional recreation participation

At the national level, reliable sport and recreation participation data (relative if not absolute) are provided by the Active NZ Surveys carried out by Sport New Zealand. The latest results are based surveys completed between 5 January 2017 and 4 January 2018 among 6,004 young people (aged 5–17) and 27,038 adults (aged 18+). Data are presented for both participation in an activity over the 7 days prior to the questionnaire and for the preceding 12 months.[7] Figure 5 shows the 7-day participation rates for recreation and sport activities for the selection of

Figure 5: Sport and recreation activities with the highest participation levels for the Wellington sub-region shown, regional participation compared with national (SPARC 2017)



[7] These are modelled data based on the Active NZ survey results. For areas with a smaller population base – such as the Eastern Bays meshblock only, the survey sample size becomes to small and the errors too great. See: https://sportnz.org.nz/managing-sport/search-for-a-resource/research/active-nz-survey-2017. This modelled participation data differs from that presented in the national and regional data from the same survey (see Sport NZ 2018).

Census meshblocks shown, for all ages. Walking and jogging or running are by far the most popular forms of physical activity, and the sample area (a subset of the Wellington Region) appears to have higher participation rates than the national average.[8]

Over the 12 month period preceding completing the Active NZ questionnaire, 85% of New Zealand adults (18+) walked for recreation, 38% ran or jogged, 33% swam (in a pool or natural area), 20% road cycled, 14% mountain biked, and 15% went marine fishing – compared with 11% who played golf and 7% who played football.

For adults (18+, 7-day participation), 42% described roads or footpaths as a location for recreation (the most popular setting of all), 25% named walkways and 15% 'on, in or beside the coast' and 6% on a 'cycleway or cycle lane specifically set aside for cyclists' – compared with 32% for 'private property, home, garden or pool', 20% for 'public park, field, playground, skate park or BMX track', 18% for a gym or fitness centre and 10% for 'outdoor sports facility or purpose-built environment'.

For young people (5-17, 7-day participation), 52% of activity was at 'other outdoor locations (e.g., beach, lake, bush, footpath)' compared with 71% for 'at school or in the school grounds' and 52% at 'indoor facilities (e.g. gym, community hall, church, marae or indoor pool)'. Their three most popular activities (7-day) were running, jogging or cross-country (52%), playing (41%) and swimming (36%). Walking for fitness was enjoyed by 29%, cycling or biking by 29%, scootering by 20% and football, soccer or futsal by 19%.

Kalafatelis & Magill (2013) completed a national survey of recreational boating activity for Maritime NZ with 1500 respondents. The results do not appear to have been filtered for marine activity only. This indicated, at the national level, that 24% of New Zealanders aged over 18 owned or used a vessel for recreation boating purposes (57% male and 43% female):

- 15% owned or used a canoe or kayak,
- 9% owned or used a power boat under 6m,
- 9% owned or used a dinghy,
- 5% owned or used a power boat over 6m,
- 3% owned or used a sail boat under 6m,
- 2% owned or used a sail boat over 6m,
- 2% owned or used a jet ski.

During periods when boaties are 'most active', such as over summer, 24% of users of power boats under 6 m went at least weekly, and another 25% went out once every couple of weeks. Similar levels of activity were evident for other vessels, but power boats under 6m were the most frequently used.

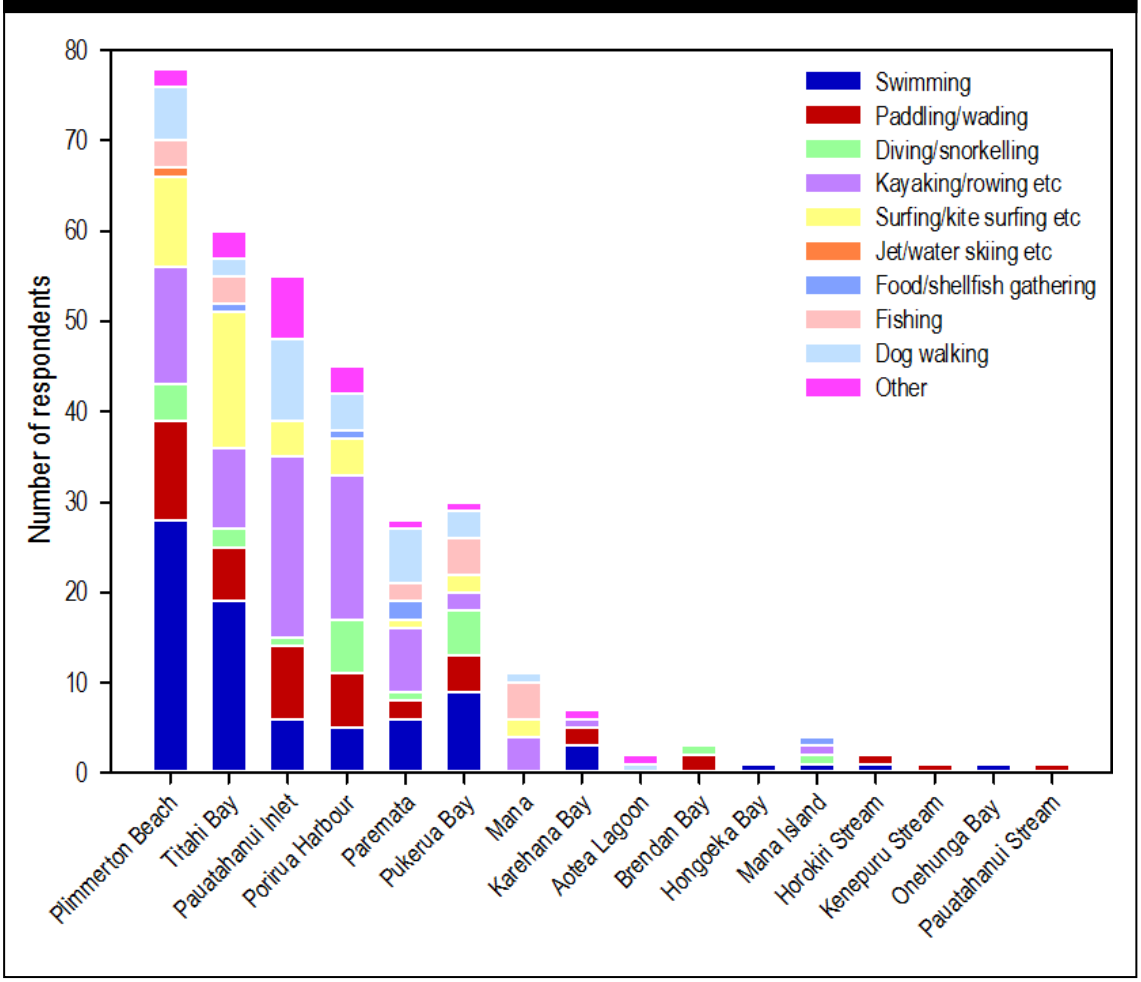
Kalafatelis & Magill (2013) reported the ownership of types of vessel by region, but the levels of response by subgroup was not high and there is limited reliability in the data.

The Greater Wellington Regional Council completed an online, self-selected survey of river and coastal recreational use in the Wellington Region between 7 April and 27 May 2015 (Greenfield & Martin 2016). The focus was on locating and describing recreational activities and reviewing water quality issues. While 423 respondents were recorded, the results can only be considered indicative as there was no attempt at gaining a random sample and there is an unquantified level of sample bias. Relevant results were reported for activities in Porirua, but the sub-sample

[8] In the opinion of the author of this report, these apparent differences need to be treated cautiously due to the data analysis and modelling methods used, especially since the data presentation tool does not illustrate the margins of error at the regional or national level, which may overlap (ie, the differences may lie within the margins of error).

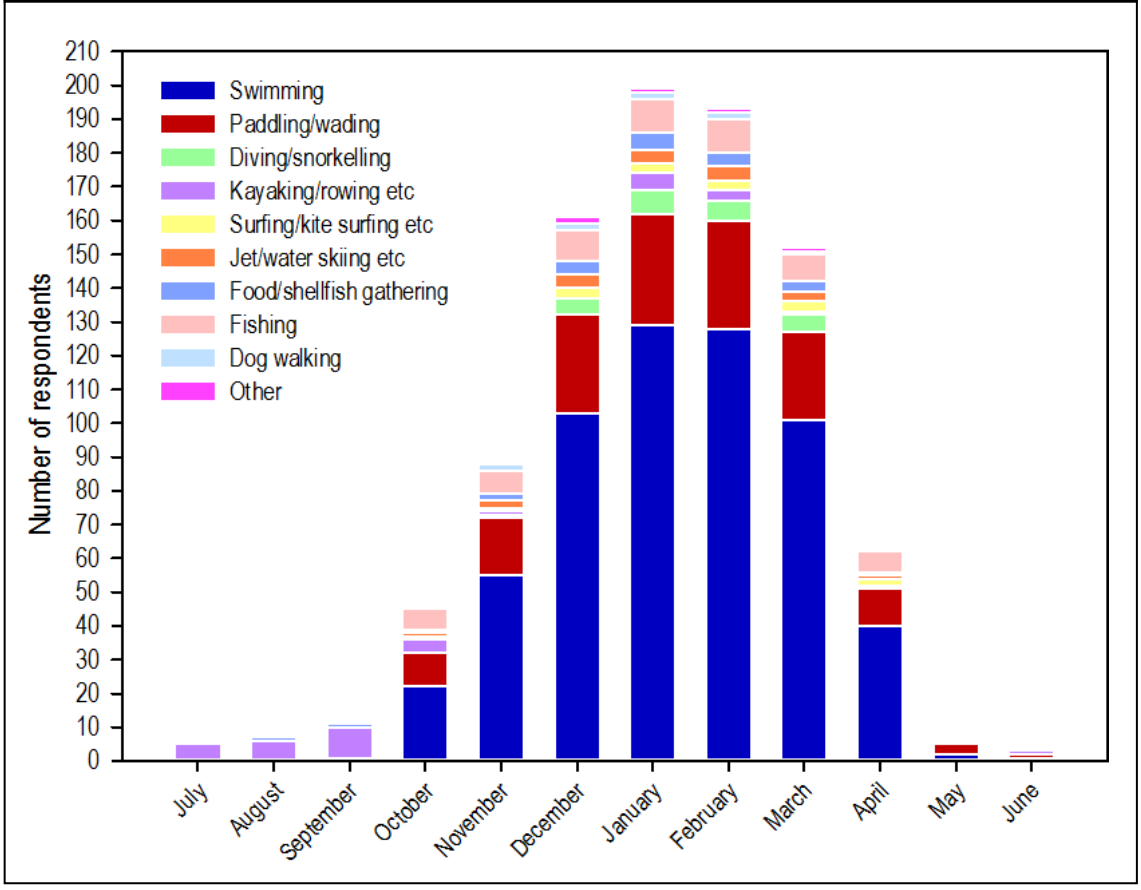
size for these data was 46 and so this output is unlikely to be representative. Figure 6 shows the results for Porirua, with swimming and paddling/wading the most popular activities, and Plimmerton Beach and Tītahi Bay the most popular sites. Food/shellfish gathering was reported at Paremata, Porirua Harbour, Tītahi Bay and Mana Island. Respondents could name more than one activity.

Figure 6: Activities by location (Porirua) (Greenfield & Martin 2016)



Respondents were asked when they undertook their activities. The results shown in Figure 7 are for all respondents (n=423) and are only indicative for Porirua.

Figure 7: Activities by time of year (Region) (Greenfield & Martin 2016)



Wellington Regional Public Health (WRPH 2018) completed an intercept survey of shoppers at the Porirua PAK'nSAVE to help assess communication and management needs associated with water quality and public health in the Te Awarua-o-Porirua Harbour area, with 75 respondents, 35 of whom did no water-based activities. Swimming (33), paddling/wading (13), fishing (12) and rockpooling (12) and collecting kaimoana (8) were the most frequently undertaken activities Other activities included scuba diving/snorkelling, paddleboarding, kayaking, rowing, waka ama, surfing, jet skiing, kite surfing, wind surfing, sailing and swimming the dog. The most popular locations for activity were Tītahi Bay beach (22), Plimmerton Beach (18), Onehunga Bay (10), Paremata Bridge (7) and Dolly Varden Reserve (6). The data collection method means it is not possible to correlate recreation activities with locations and the small sample size and sampling method mean the data are only indicative.

3.2 Regional marine recreation by activity group

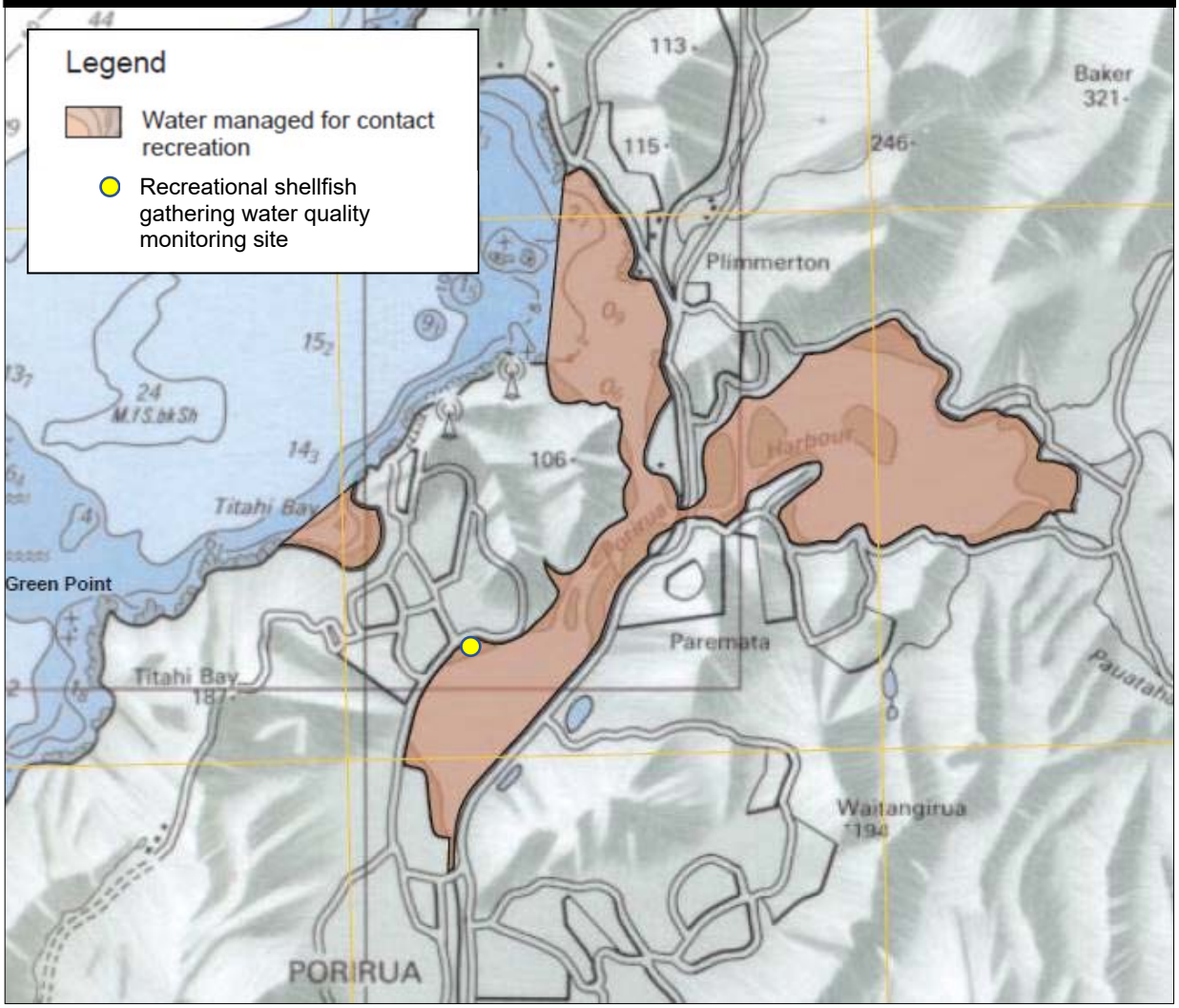
3.2.1 Beach activities, swimming and shellfish gathering

The *Regional Coastal Plan for the Wellington Region* (WRC 2000) states that all of Te Awarua-o-Porirua Harbour, Pāuatahanui Inlet and the Porirua and Plimmerton Coast is to be managed for contact recreation purposes (10.2.2 p127), and that the remainder of the coastal area is to be managed for shellfish gathering purposes (10.2.1, p126). These areas are defined in Planning Map 8C, much of which is shown in Figure 8 – which also shows the location of the one site in Te Awarua-o-Porirua Harbour (at the Porirua Rowing Club) monitored for recreational shellfish gathering water quality (Brasell & Morar 2017). Brasell & Morar note that the Te Awarua-o-Porirua Harbour site has been included in the dataset since July 2007 although it is not recommended for shellfish gathering and is monitored in response to community interest.

The basis for assessing compliance with MoH/MfE guidelines for assessing microbiological contamination in shellfish-gathering waters are (Brasell & Conwell 2019):

- The median faecal coliform content of samples taken over a shellfish-gathering season shall not exceed 14 MPN[9]/100mL; and

Figure 8: GWRC Regional Coastal Plan Coastal Water Classes for Te Awarua-o-Porirua Harbour



[9] Brasell & Conwell 2019 note (p32): "The laboratory results for faecal coliforms were reported in colony forming units (CFU), rather than the most probable number (MPN) units as listed in the guidelines. Although the MfE/MoH (2003) guidelines recommend the fivetube decimal dilution test (known as the Most Probable Number (MPN) statistical

- Not more than 10% of samples collected over a shellfish gathering season should exceed 43 MPN/100mL.

Based on GWRC monitoring data, in 2016/17 the Porirua site had a median cfu/100ml of 56, with 65% of 17 samples exceeding 43 cfu/100mL, and a maximum of 660: meaning it was non-compliant (Brasell & Morar 2017). In the 2017/18 season, the Porirua site had a median cfu/100ml of 16, with 35% of 17 samples exceeding 43 cfu/100mL, and a maximum of 560: meaning it was still non-compliant – as were all seven sites monitored regionally (Brasell & Conwell 2019).

Figure 9: GWRC monitored marine bathing sites in and around Te Awarua-o-Porirua Harbour

method), membrane filtration produces a result in colony forming units (CFU) and is a faster test, providing a result in 24 hours. The MfE/MoH (2003) guidelines states that a validated alternative method (other than the MPN) is acceptable, where an equivalent result for the shellfish gathering waters being tested is achieved. The CFU method is considered an acceptable alternative for the high level risk assessment that this comparison against the guidelines produces."

The GWRC monitored recreational water quality at 36 coastal sites in the 2016/17 summer season and 61 in 2017/18 (Brasell & Morar 2017 and Brasell & Conwell 2019). These are considered to be 'popular' swimming sites[10], although swimming can occur at many sites around the coast. Suitability For Recreation Grades for 12 sites in the Porirua City Council area ranged from 'fair' to 'good', at the end of the 2016/17 swimming season, with the site at the waka ama launching ramp at Wi Neera having with insufficient data to report (Brasell & Morar, 2017) (Figure 9, extracted November 2019).

In 2017/18, three sites in Te Awarua-o-Porirua Harbour were also monitored over winter, the results of which were normally reported within the GWRC Coastal Water Quality and Ecology Programme. "However, monitoring of coastal waters for recreational purposes was deemed necessary beyond the peak summer bathing times, as these coastal sites are used year-round for a variety of contact recreational purposes." (Brasell & Conwell 2019). The Porirua site at Onehunga Bay was not sampled in 2017/18, and grade was based on previous data.

Brasell & Conwell (2019) noted (p26):

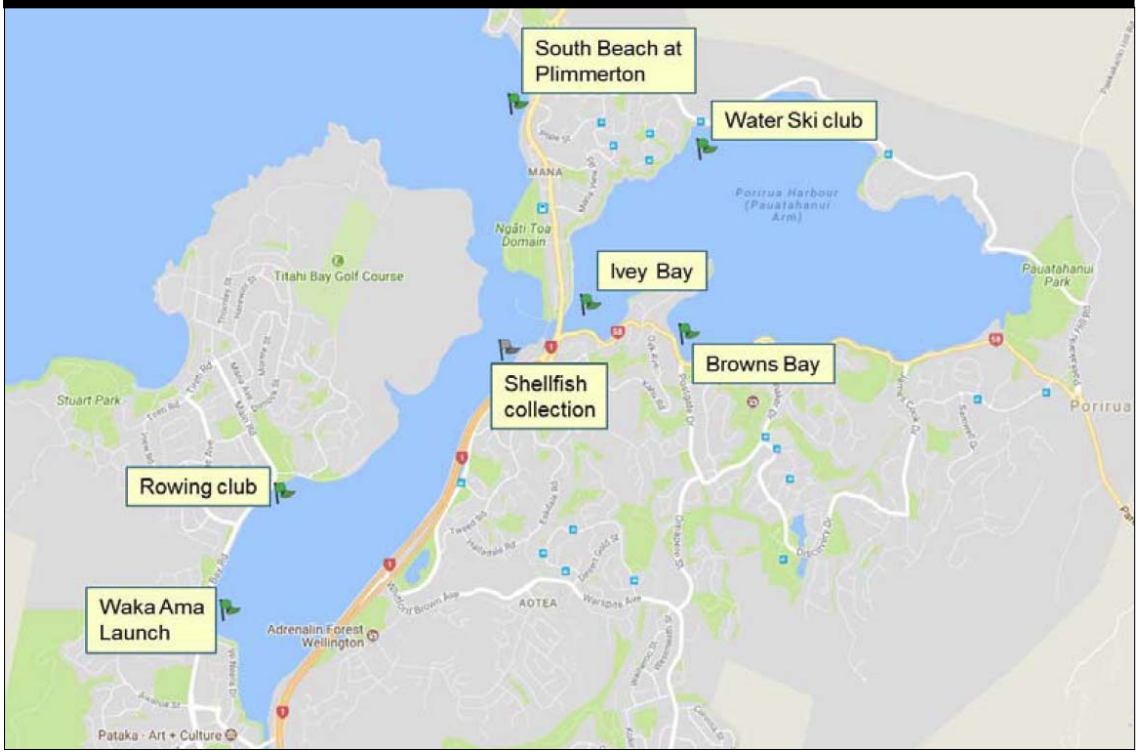
> *Twenty-four action guideline breaches occurred following little or no rainfall prior to sampling – these are regarded as dry weather exceedances. The greatest number of dry weather action guideline breaches occurred at Porirua Harbour at Wi Neera Drive Boat Ramp and South Beach at Plimmerton sites (three occasions each). Two wet weather exceedances were also recorded at South Beach at Plimmerton.*
>
> *Enterococci levels at the South Beach at Plimmerton site were generally within the surveillance guidelines after one or two follow-up samples. However, three follow-up samples were needed at the Wi Neera Drive Boat Ramp site before surveillance guidelines were met again. In the Onepoto arm of the Porirua Harbour, significant sources of contaminants contributing to poor water quality have been identified (DHI 2016, 2017); these include the Onepoto Stream, Takapuwahia Stream, Kenepuru Stream and Porirua Stream. Wind driven currents coupled with potential sediment resuspension mean that some sites, such as the Rowing Club and Wi Neera Drive Boat Ramp, in the harbour can be susceptible to poor water quality in the absence of rain.*
>
> *Across all weather conditions, South Beach at Plimmerton (five exceedances), Porirua Harbour at Wi Neera Drive Boat Ramp (four exceedances) and Paraparaumu Beach at Maclean Park (three exceedances) recorded the lowest level of compliance with the surveillance guideline of all coastal sites monitored during the 2017/18 bathing season. Ten other coastal sites across the region recorded two guideline exceedances.*
>
> *Over the winter recreation period, five of the 11 coastal sites (45.5%) exceeded the MfE/MoH (2003) action guideline during routine monitoring on one occasion. One site in Porirua (Rowing Club) exceeded the action guideline on five occasions…..*
>
> *Most guideline breaches required only one follow-up sample before faecal indicators returned to surveillance levels. On one round, the Tītahi Bay at Toms Road site was re-sampled three times before the site returned to surveillance levels, and the Porirua Harbour (Rowing Club) site required two follow-up samples. Compared with the 2016/17 season, the South Beach at Plimmerton site required only one re-sample on one occasion – a marked improvement from the previous winter season, despite the historical susceptibility of this site to poor water quality associated (DHI 2016, 2017). The Rowing Club site is also susceptible to poor water quality from both the Onepoto Stream following rain, and also can be influenced by poor water quality from the Porirua Stream plume that circulates in the Onepoto Arm of the harbour (DHI 2016, 2017). The Tītahi Bay at*

[10] http://mapping.gw.govt.nz/GW/RecWaterQualityMap/RecWaterQualityMap.htm retrieved November 2019

Toms Road may also be susceptible to the influence of stormwater quality following moderate to heavy rainfall…..

Oliver & Conwell (2017 & 2019) report on the development of a water quality forecast model for Te Awarua-o-Porirua Harbour. This includes two additional sites to those monitored for bathing water quality as shown in Figure 9 – Browns Bay and a 'shellfish collection' site to the west of the Paremata Bridge (Figure 10). The forecast model was undergoing a 'closed public trial' over the 2017/18 season and while it showed promise, Oliver & Conwell (2019) reported that, "The forecast will be put on hold in 2018/19 pending further discussions and recommendations about funding and alignment with other work programmes."

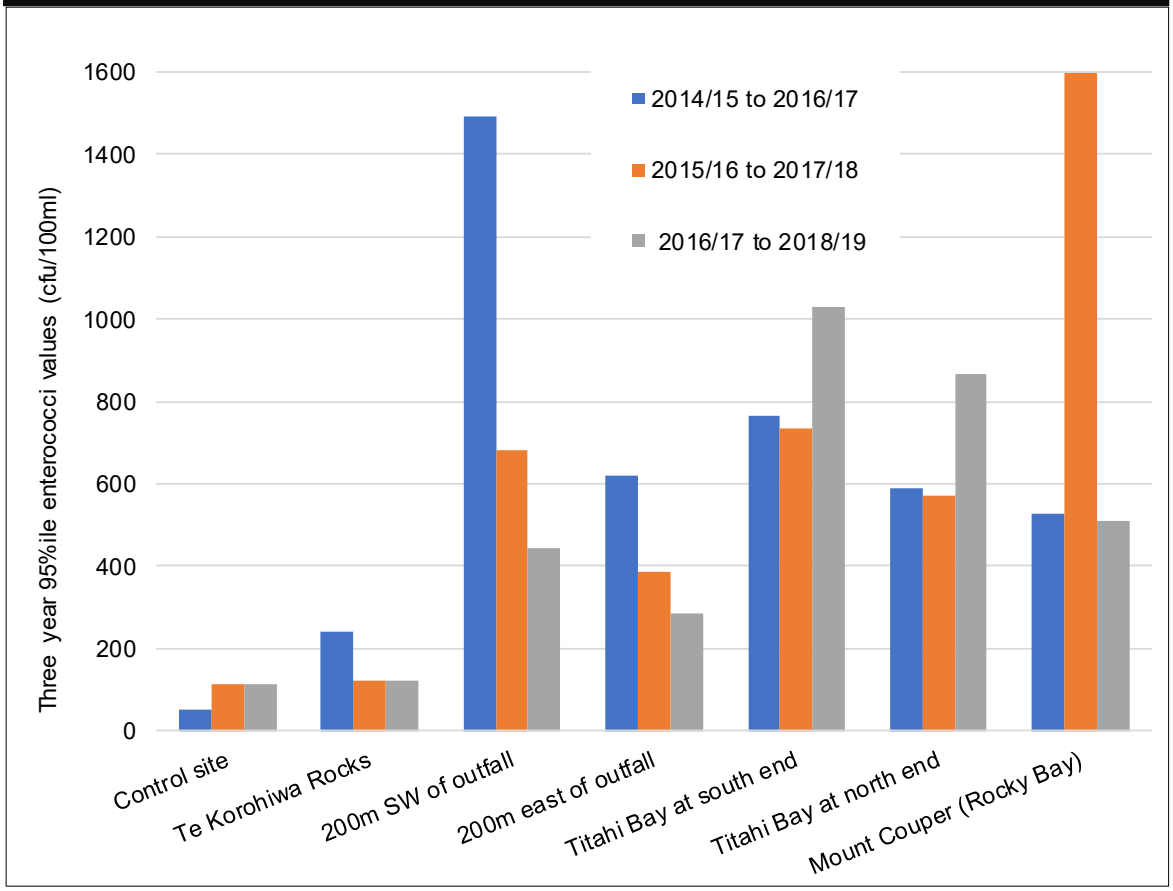
Figure 10: GWRC microbial forecast model sites (Oliver & Conwell 2017)



Section 3.3.1 of the AEE reviews routine recreational water quality monitoring reports carried out by GWRC for Tītahi Bay between 2014 and 2019. This shows annual median enterococci values exceeding the Regional Coastal Plan (RCP) trigger value of ≤35 cfu/100ml at the Bay Drive testing site in the 2017/18 season and at 'South Beach' in 2017/18 and 2018/19. At 'South Beach', the annual median values were 84 cfu/100ml in 2017/18 and 52 cfu/100ml in 2018/19.

All water quality data for enterococci show a general decline in measured concentrations over time. Figure 11 (from Table 3-8 in the AEE) shows the three-year 95-percentile enterococci values for Porirua City Council WWTP bypass event monitoring at sites east and west of the discharge, compared with a control site and those at Tītahi Bay and Rocky Bay, from 2014 to 2019. The data show significantly improving trends in microbiological water quality for coastal sites near the discharge (matching improvements in wastewater treatment), but declining trends in Tītahi Bay. Records at the Mount Couper monitoring site at Rocky Bay appear unrelated to those near the discharge. These indicate other sources of contamination dominating the enterococci measurements in the most popular recreation settings at and north of Tītahi Bay.

Figure 11: Three year 95th-percentile enterococci values west and east of the outfall



Sections 3.3.1 to 3.3.3 of the AEE identify sources additional to the WWTP of local contamination, including:

- stormwater runoff from an urban catchment, and
- wastewater network leaks or wet weather overflows into the stormwater system or direct to coastal waters.

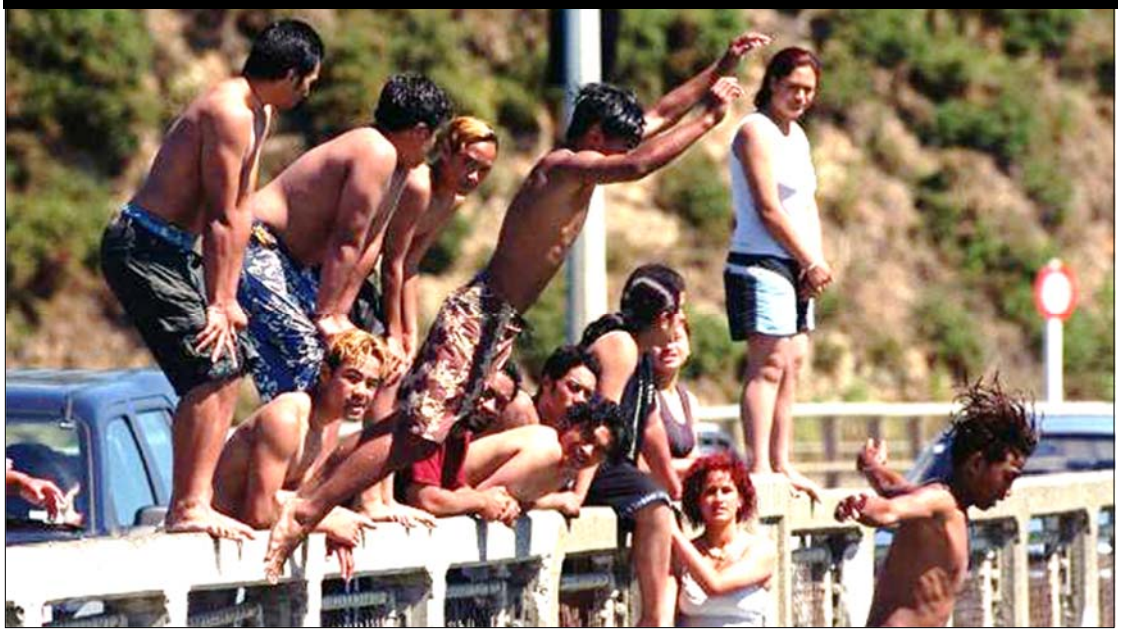
Monitoring of the stormwater outlet which discharges to Tītahi Bay south, near South Beach Access Road, indicates that it has potential to cause significant faecal contamination in near-shore waters during and after rainfall events, with median and 95-percentile *E. coli* concentrations of 2,200 and 12,885 cfu/100ml, respectively, in 2015/16. Browns Stream in Paremata, Taupo Stream in Plimmerton and Onepoto Stream all showed similar results.

The Land Air Water Aotearoa (LAWA) national online water quality reporting site reports the GWRC water quality monitoring data and adds additional details and images of use. Of the Paremata Bridge site (by the Camborne Walkway), LAWA states:

> *This is a sandy beach, popular with locals for swimming. While shallow and always calm, caution should be taken around the bridge as strong currents are present at the outlet. Toilet facilities are located in the parking lot and a boat ramp is located next to the bridge.*[11] (Figure 12).

Figure 12: Dolly Varden Beach – adjacent Camborne Walkway – uncredited LAWA image

Figure 13: Paremata Bridge jumpers – uncredited Stuff image



[11] https://www.lawa.org.nz/explore-data/wellington-region/coastal/Pāuatahanui-inlet-at-paremata-bridge/

Up to '200 young people a day' are reported to use Paremata Bridge over summer, albeit illegally, with a jumping platform proposed (Figure 13).[12]

Of the Camborne Water Ski Club site, the LAWA site states (although the ski club is no longer located here):

> *This popular sandy beach is nestled in the Porirua Harbour. It is very sheltered and has a shallow incline making it a safe spot for swimming. Parking is convenient on the beach front and public toilets are located at the ski club.*[13] (Figure 14)

Figure 14: Adjacent Camborne Ski Club – uncredited LAWA image

For the Porirua Rowing Club site:

> *Porirua Harbour at the Rowing club is a popular launching area for rowers and waka ama. There is also a small sandy beach suitable for bathing. Parking is plentiful and a park can be found across the road with toilets and changing rooms. A boat ramp can be located off the parking lot.*[14]

For Plimmerton South Beach:

> *This sandy beach is popular with swimmers and a great spot for windsurfers, as safety designated windsurfing areas are provided. It is sheltered from northerly swells with a gentle incline and is relatively calm and safe. There is limited parking on Steyne Avenue and South Beach Road, and the site also features a toilet block and changing room.*[15]

For Plimmerton North Beach:

> *This sandy beach is popular with swimmers and a suitable spot for windsurfers with specially designated windsurfing areas at the southern end of the beach. The beach is sheltered from northerly swells and the gentle incline means it is relatively calm and safe. There are no facilities at the northern end of the beach with limited parking, but there are toilets and changing facilities at the southern end.*[16]

[12] https://www.stuff.co.nz/dominion-post/news/wellington/98648912/porirua-swimmers-to-be-without-a-platform-for-another-summer retrieved August 2018
[13] https://www.lawa.org.nz/explore-data/wellington-region/swimming/Pāuatahanui-inlet-at-water-ski-club/swim-site
[14] https://www.lawa.org.nz/explore-data/wellington-region/swimming/porirua-harbour-at-rowing-club/swim-site
[15] https://www.lawa.org.nz/explore-data/wellington-region/swimming/south-beach-at-plimmerton/swim-site
[16] https://www.lawa.org.nz/explore-data/wellington-region/swimming/plimmerton-beach-at-bath-street/swim-site

For Karehana Bay:

> *Karehana Bay is a small flat sandy beach at the northern end of Plimmerton. The beach has a gentle gradient and is protected from swells by the Plimmerton Yacht Club. This popular boating area is also suitable for sunbathing and swimming. Toilet and changing facilities and plenty of parking is conveniently located at the northern end of the beach.*[17]

For Pukerua Bay:

> *This narrow sandy beach features scattered rocky outcrops and provides a great place for beachcombing and rock pooling. The shallow incline makes it a safe spot for swimming and surfing. Three small toilet and changing facilities are on site and limited parking is available.*[18] (Figure 15)

Figure 15: Pukerua Bay – uncredited LAWA image

For Tītahi Bay South Beach:

> *This flat sandy beach located to the west of Porirua City. It is a very popular beach for swimming, snorkelling, windsurfing, fishing, walking and picnicking. Sheltered by Mana Island the beach slopes gently into the ocean allowing swimmers to get a good distance into the water. While usually sheltered from swells it can be dangerous for inexperienced beach users in rougher conditions with strong rips and swells. Surf lifeguards patrol this site during the summer months. Parking can be found along Beach Road and toilets and changing facilities are located at the surf club.*[19]

[17] https://www.lawa.org.nz/explore-data/wellington-region/swimming/karehana-bay-at-cluny-road/swim-site
[18] https://www.lawa.org.nz/explore-data/wellington-region/swimming/pukerua-bay/swim-site
[19] https://www.lawa.org.nz/explore-data/wellington-region/swimming/titahi-bay-at-south-beach-access-road/swim-site

For Tītahi Bay, Toms Road (central bay):

> *This flat sandy beach located to the west of Porirua City. It is a very popular beach for swimming, snorkelling, windsurfing, fishing, walking and picnicking. Sheltered by Mana Island the beach slopes gently into the ocean allowing swimmers to get a good distance into the water. While usually sheltered from swells it can be dangerous for inexperienced beach users in rougher conditions with strong rips and swells. Further up the beach surf lifeguards patrol during the summer months. This site popular with families due to its proximity to Arnold Park which contains a playground, car park, toilets and changing facilities.*[20]

For Tītahi Bay, Bay Drive (north beach):

> *This flat sandy beach located to the west of Porirua City. It is a very popular beach for swimming, snorkelling, windsurfing, fishing, walking and picnicking. Sheltered by Mana Island the beach slopes gently into the ocean allowing swimmers to get a good distance into the water. While usually sheltered from swells, it can be dangerous for inexperienced beach users in rougher conditions with strong rips and swells. Further down the beach surf lifeguards patrol during the summer months. Parking, toilets and changing facilities are available.*[21] (Figure 16)

Many online references can be found describing Tītahi Bay as a popular event venue, including surf, surf lifesaving and community events – the Tītahi Bay Beach Festival is an example of the latter (Figure 17).[22]

Figure 16: Tītahi Bay, Bay Drive – uncredited LAWA image

[20] https://www.lawa.org.nz/explore-data/wellington-region/swimming/titahi-bay-at-toms-road/swim-site
[21] https://www.lawa.org.nz/explore-data/wellington-region/swimming/titahi-bay-at-bay-drive/swim-site
[22] https://www.eventfinda.co.nz/2018/titahi-bay-beach-festival-2018/wellington-region

Figure 17: Tītahi Bay Beach Festival – uncredited event image

Surf Lifesaving New Zealand (SLNZ) identifies 11 swimming beaches in the Wellington Region (Figure 18, not showing Ōtaki Beach to the north). The SLNZ online advisory service for swimming beaches describes Tītahi Bay:

> *Tītahi Beach is a popular location and there is a solid residential base that provides many of the beach's users. It is very common to have large numbers of people swimming during the summer months and there are good numbers of surfers in the water whenever there is a wave breaking. The beach although not commonly having powerful waves or strong rips is still dangerous for inexperienced beach users and patrons should remain in the patrolled area and seek advice from the Lifeguards in doubt.*
>
> *Family friendly (rated 4 out of 5): This beach is well suited for families, make sure your family is prepared for the beach conditions, the beach is patrolled by Surf Lifeguards during the summer months.*
>
> *Swimming (rated 4 out of 5): Swimming at Tītahi Bay is popular during the warmer summer months. The beach is very sheltered and only gets surf during strong onshore winds that form northwest swells. The beach slopes gently into the ocean allowing swimmers to get a good distance into the water. Rips and holes form during swell periods so swimmers should be careful when waves are present and should always swim in the Lifeguard Patrolled area.*
>
> *Surfing (rated 2.5 out of 5): Surfing is a popular activity at Tītahi Bay although the waves are not of a very high quality. They are good for learning surfers and convenient for many Porirua surfers. Tītahi Bay is a beach break that can be surfed on all tides and during periods of onshore winds is generally the time to go there.*
>
> *Fishing (rated 3 out of 5): Surfcasting from the beach is possible but not popular. Fishing from the rocky headland is good but fishermen attempting this need to be cautious as Tītahi Bay is a surf beach. Boats can be launched from the beach allowing fishermen to get to the most productive fishing.*

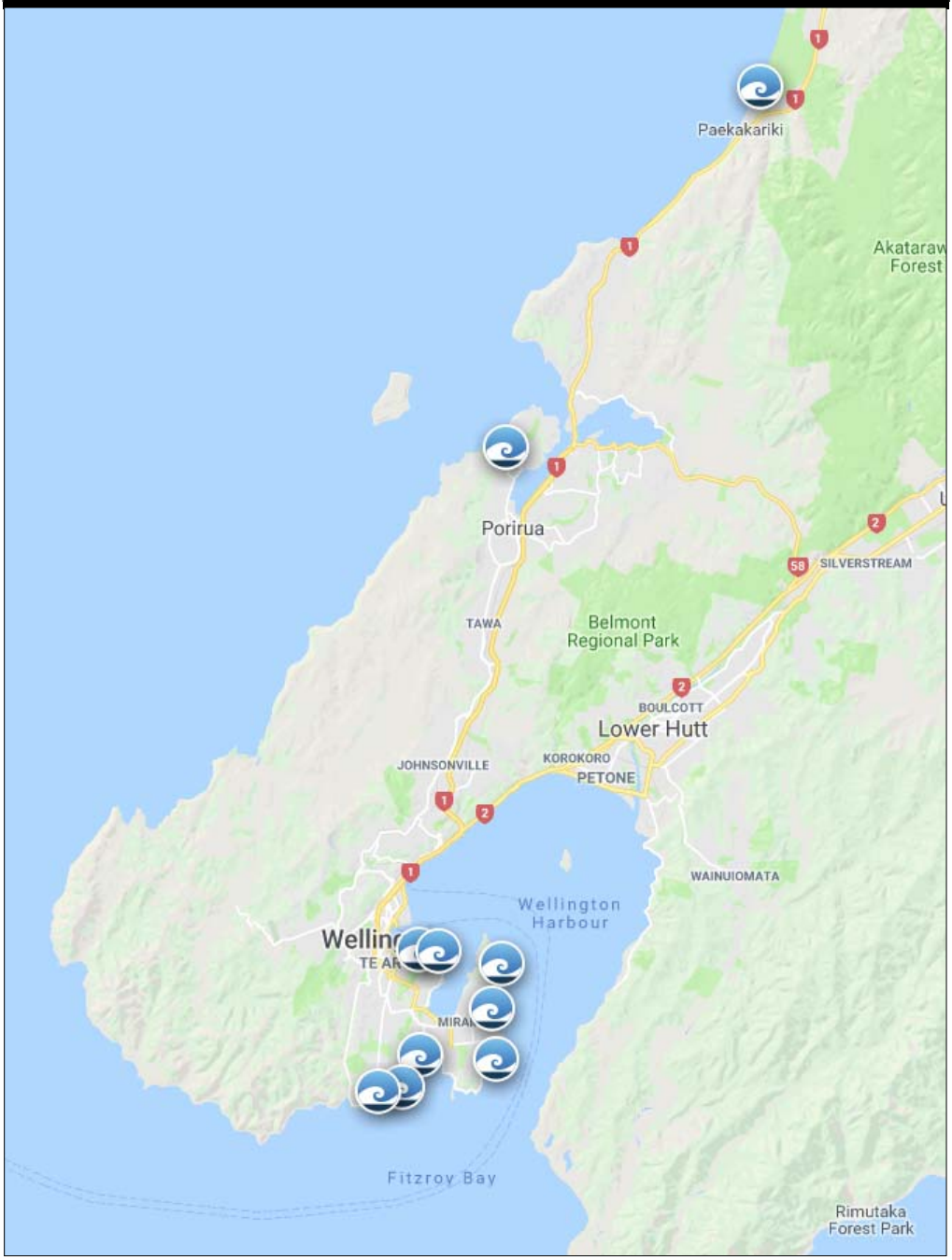
Activities:

- *Canoeing/kayaking*
- *Dog walking*
- *Shellfish gathering*
- *Snorkelling*
- *Wind/kite surfing*

Facilities:

- *Boat launching*
- *Car parking*
- *Changing facilities*
- *Food and beverage kiosk*
- *Public toilets and shower*

Figure 18: SLNZ recommended swimming beaches



There is little information to reference for shellfish gathering activities. Although, as stated in Brasell & Morar (2017) and Lyon & Michael (2015)[23], shellfish gathering in, at least, the Onepoto Arm, is not recommended, it does occur, and is reported as a local activity in surveys carried out in 2018 by Wellington Regional Public Health (WRPH).

The latter included the intercept survey of shoppers at the Porirua PAKnSAVE (discussed above), with 75 respondents, eight of whom collected kaimoana locally. Seven of the eight who collected kaimoana described themselves as Maori, and one as Niuean.

On-site surveys of people gathering kaimoana were also carried out by the WRPH at Karehana Bay, Plimmerton Beach, Ivey Bay, at the Paremata bridge and behind the Paremata Railway Station, with nine respondents.

Of the on-site survey, the sample consisted of four Māori, one Pacific Islander and four Asian participants. Of the six participants living in Porirua, three were from Cannons Creek, two from Tītahi Bay and one from Elsdon. All three from outside Porirua were of Asian ethnicity. The majority of respondents were male (6 out of 9) and aged between 18-34 years old (6 out of 9), they were often with a partner, children, or older parents. Most groups collected in summer (7 out of 9) and two groups collected all year. Table 2 shows the survey results for the types of shellfish collected, and Table 3 shows the collection locations.

Table 2: Types of kaimoana collected – WRPH 2018

Shellfish collected	Count of respondents
Cockles	7
Pipi	6
Mussels	3
Pāua	3
Kina	3
Tuatua	1

Table 3: Where kaimoana are collected – WRPH 2018

Location	Count of respondents
Paremata railway station	7
Ngāti Toa domain	1
Plimmerton Beach	1
Karehana Bay	1
Paremata Bridge	1
Onehunga Bay	1
Tītahi Bay Beach	1
Whitireia Park	1
Ivey Bay	1

[23] The latter states, p34: "Contaminant levels in cockles from Te Awarua-o-Porirua Harbour Onepoto Arm were measured in 2006 (Milne 2006). Cockles at Mana sandbank and Takapūwāhia (sites with the highest densities of cockles) had levels of faecal contamination just above detection levels and well below Ministry of Health and New Zealand Food Safety Authority recommended guidelines for edible tissue (Milne 2006). The heavy metals cadmium, mercury, and lead were also recorded in cockle samples from Mana Sandbank and Takapūwāhia but not at concentrations that exceeded the New Zealand Food Standards for edible tissue (Milne 2006). There were additional contaminants found in Onepoto Arm cockles (chromium, copper, nickel, and zinc) but no standards governing their effect on people. Because of this, the current advice from the Greater Wellington Regional Council and Regional Public Health is to avoid eating shellfish from Te Awarua-o-Porirua Harbour."

Most interviews were conducted with people behind the Paremata Railway Station where cockles were the main type of kaimoana collected. The majority of participants reported that they would be put off by a warning sign for water quality (7 out of 9).

The availability of relevant shellfish (cockles, mussels and pipi) are reported in Lyon & Michael (2015) for the Onepoto Arm and Michael & Wells (2017) for the Pāuatahanui Inlet for cockles.

Lyon & Michael (2015) based their assessment of shellfish populations in the Onepoto Arm on between 9 and 27 quadrat samples taken from each of 24 randomly selected transects on the tidal flats. The densities and size of 13 shellfish species was recorded, including pipi, cockles and mussels. Cockles were by far the most abundant, with 7465 counted (and a population estimate of 190.8 million), compared with 37 pipi (1.1 million) and 108 mussels (5.2 million). Figure 19 to Figure 21 show the relative densities for these three food species (although other shellfish, such as whelks and cats eyes will also be gathered).

Figure 19: Cockle distribution, mean number per quadrat per transect (Lyon & Michael 2015)

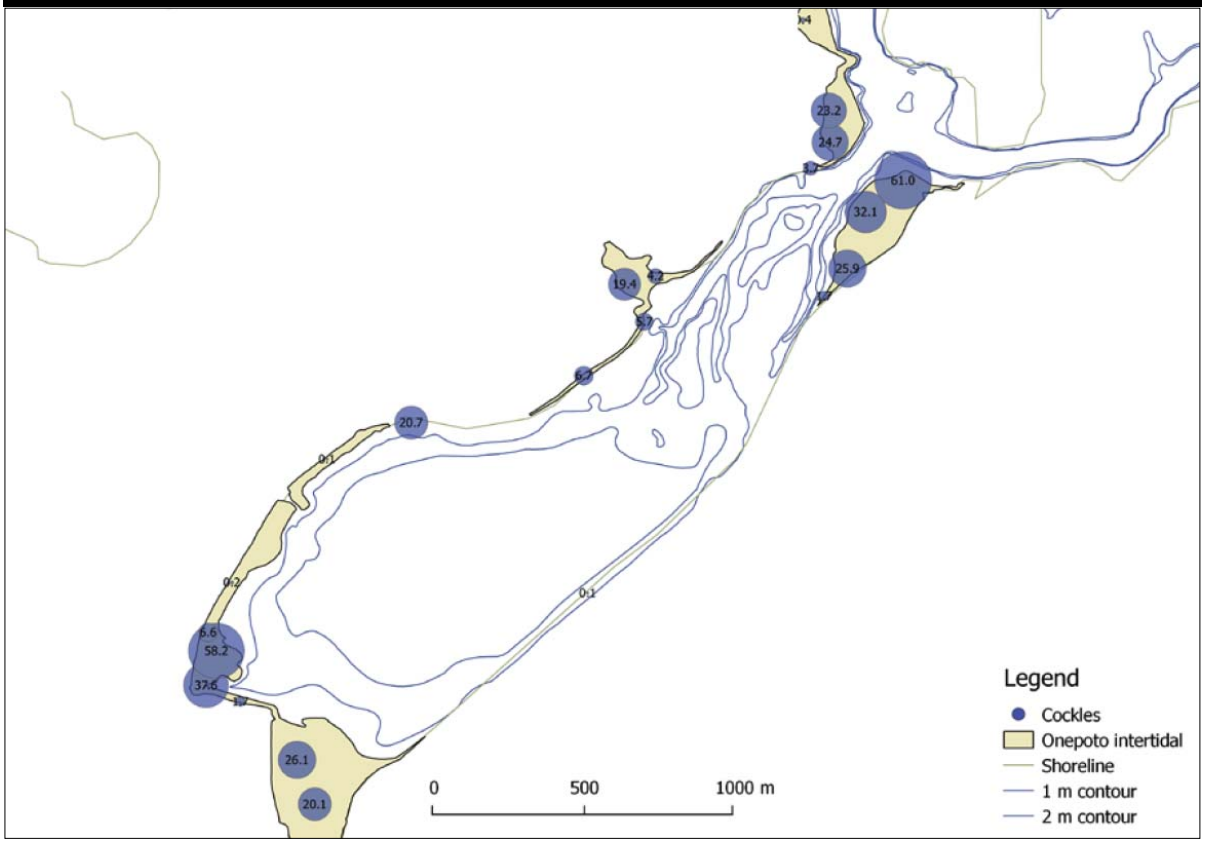


Figure 20: Pipi distribution, mean number per quadrat per transect (Lyon & Michael 2015)

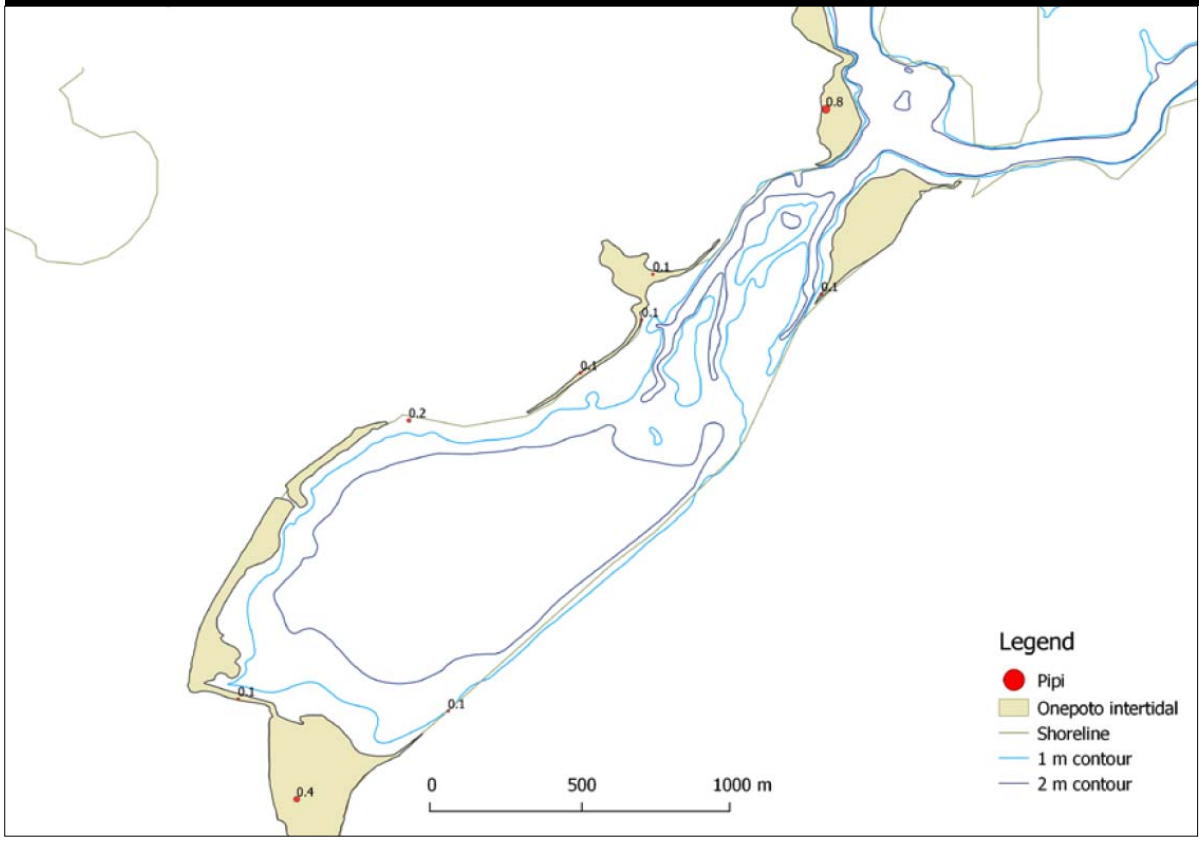
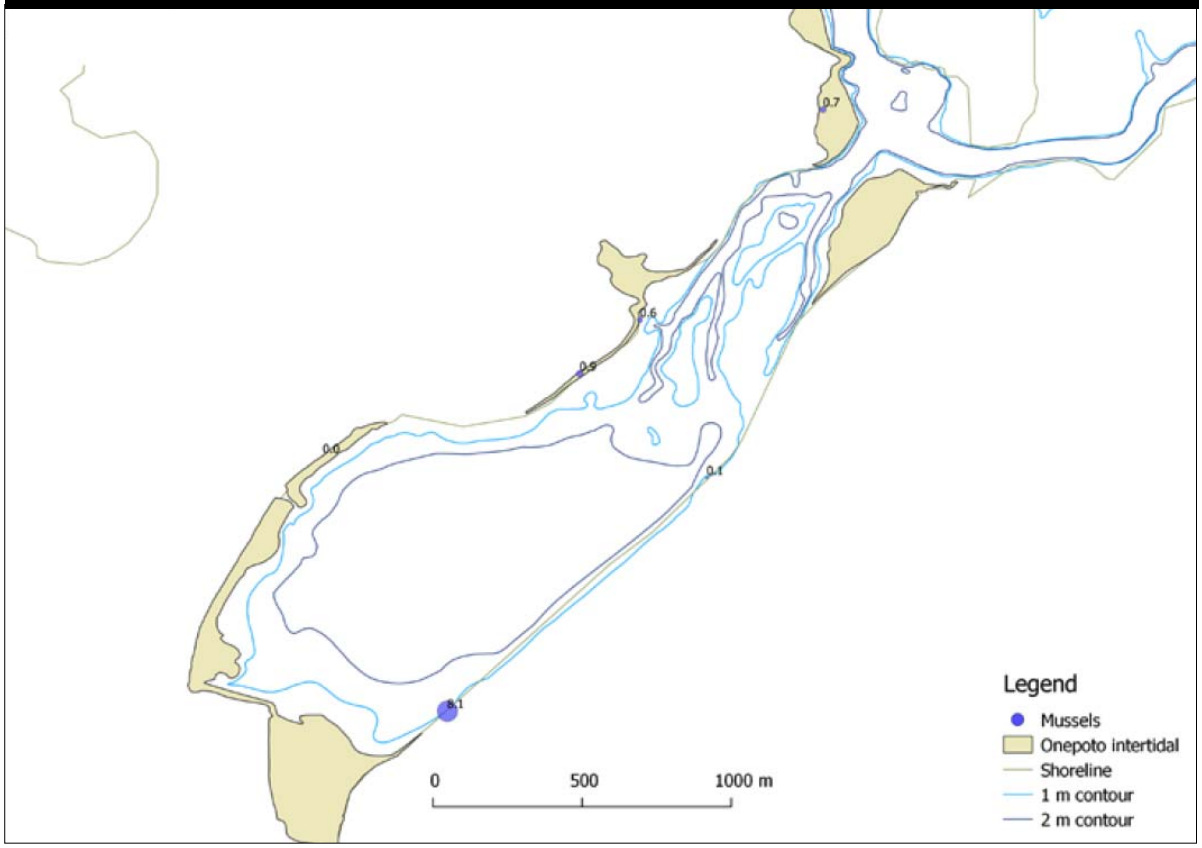


Figure 21: Mussel distribution, mean number per quadrat per transect (Lyon & Michael 2015)



Michael & Wells (2017) relied on volunteers from The Guardians of Pāuatahanui Inlet and the local community to count cockles across 30 transects in the Pāuatahanui Inlet in 2016 (Figure 22). Previous surveys have allowed some trend analysis. Total cockle population size in the Inlet increased 87% between 1995 (180 million cockles) and 2013 (336 million cockles) and declined 14% between 2013 and 2016 (288 million cockles). In 2016, cockle counts per quadrat ranged from zero to a maximum of 176 per 0.1 m^2 (higher than in any of the previous surveys) but were mostly lower than in 2013. Figure 23 shows cockle density by transect, attributed to each of the bays described in Figure 22 (transect 3a was not sampled). All bays featured some cockles, with the lowest count at Camborne. Harvesting is not permitted in the Pāuatahanui Wildlife Reserve (the Bromley transects).

Figure 22: Cockle transects Pāuatahanui Inlet (Michael & Wells 2017)

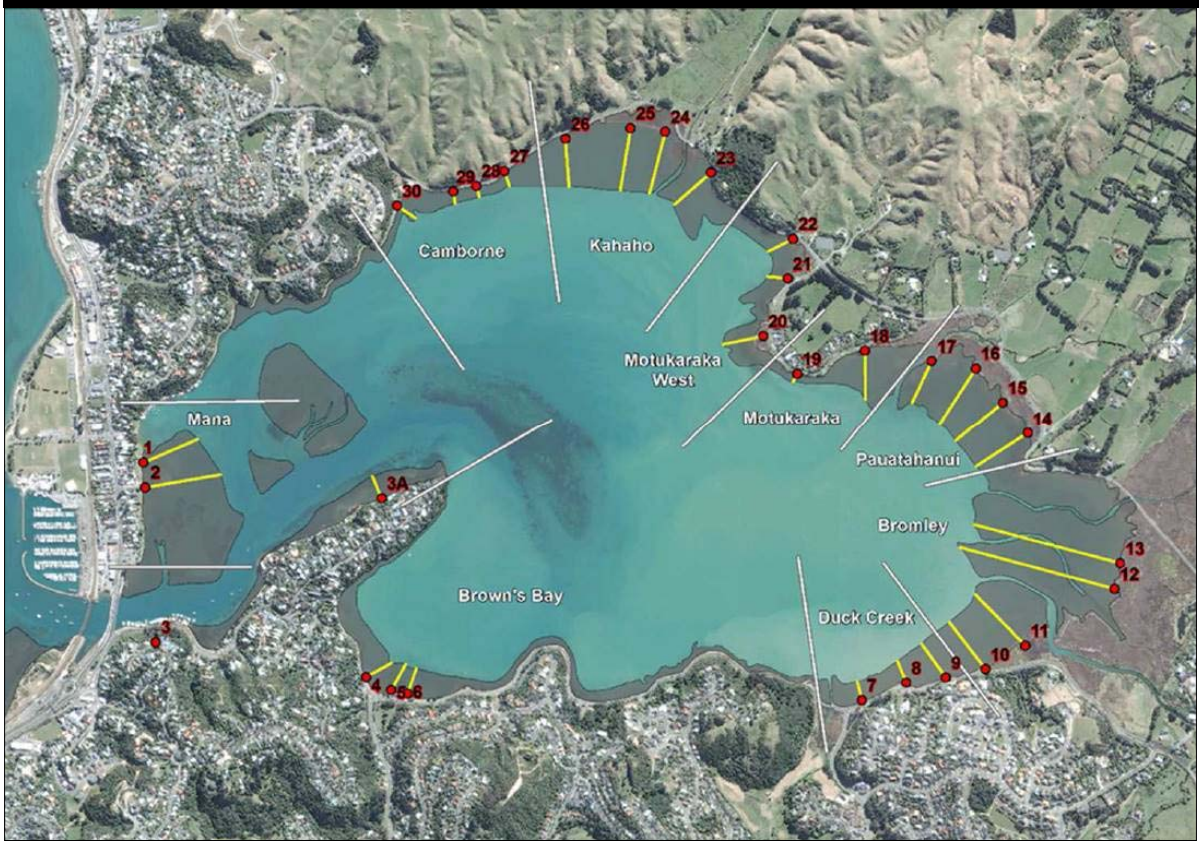
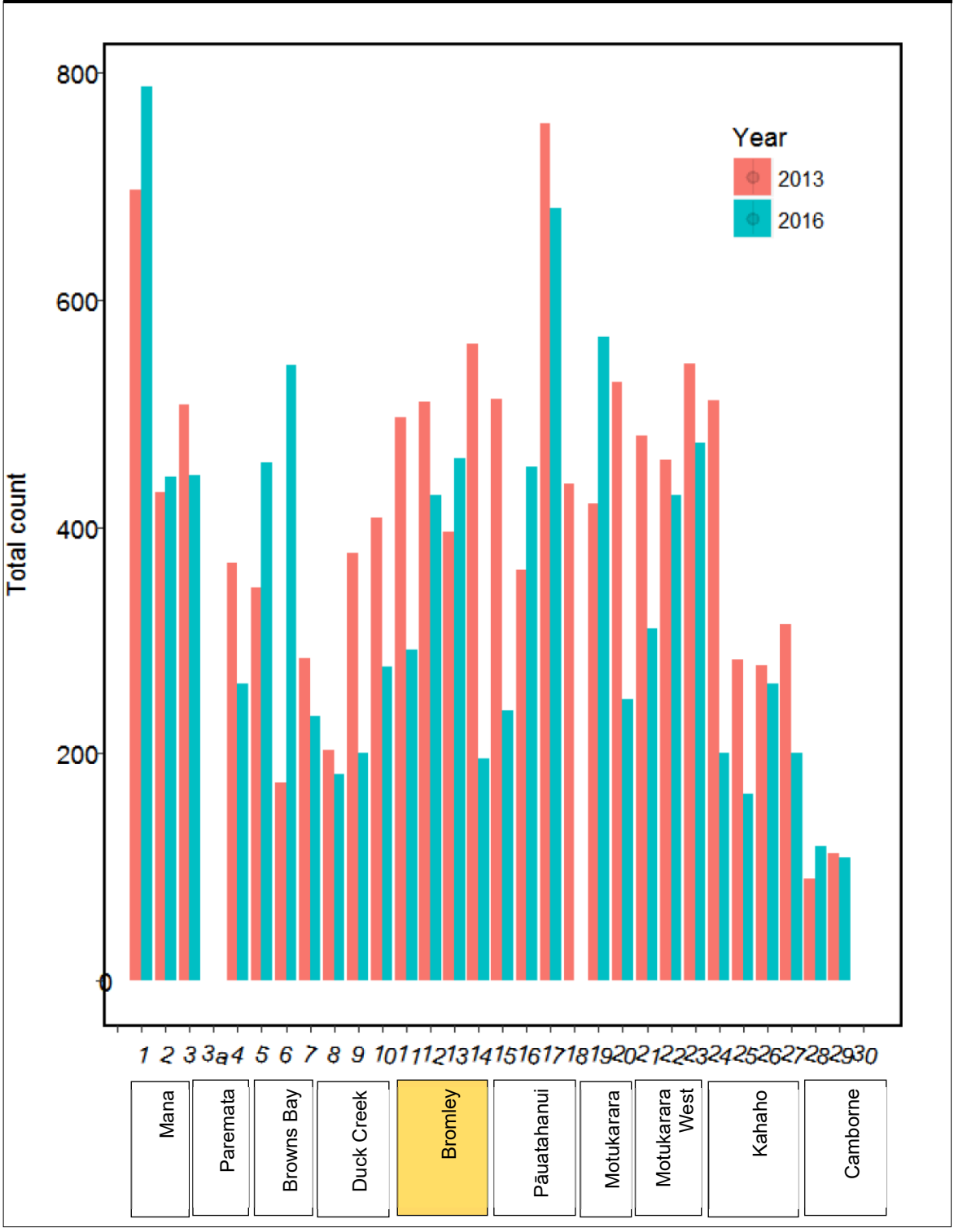


Figure 23: Cockle density by transect, Pāuatahanui Inlet (Michael & Wells 2017)



3.2.2 *Fishing and diving*

The Spot X national surfcasting (Draper & Airey 2012) and boat fishing (Airey 2012) guides identify various fishing opportunities in and around the study area.

Four surfcasting sites are identified in the study area (Figure 24). Pukerua Bay is identified as an all-tides beginner surfcasting site targeting snapper and stingrays, with the advice:

> *Looking north there is a point to your right. Fish on the eastern side of this point. Fishing Tips: The bottom here is pretty rough, but not as bad as the rest of this coast. Thread a 75g ball sinker onto your line and tie on a hook. Don't move your bait once you have cast out or you will catch the bottom. Retrieve quickly.*

Wairaka Point is identified as a low-tide rock fishing site suited to anglers with intermediate skill in autumn and summer, targeting snapper, kahawai, kingfish and trevally, with the advice:

> *There are two rocks to fish off; the larger of the two can only be accessed when the tide is out a bit. A great little fishing spot that has produced some outstanding snapper over the years. Strayline with large baits, or hang baits under a sliding float. Kingfish can make an appearance at times, so it pays to be prepared for them.*

Karehana Bay is identified as an all-year beginner's all-tide surfcasting site, targeting gurnard, kahawai, red cod, snapper and trevally, with the advice:

> *Immediately around the point, the bottom is quite rocky and weedy. You will need a cast of at least 50m to get out onto the sandy bottom. Snapper are caught here from time to time and it's also well worth staying into darkness. Sometimes a lot of red cod in the winter.*

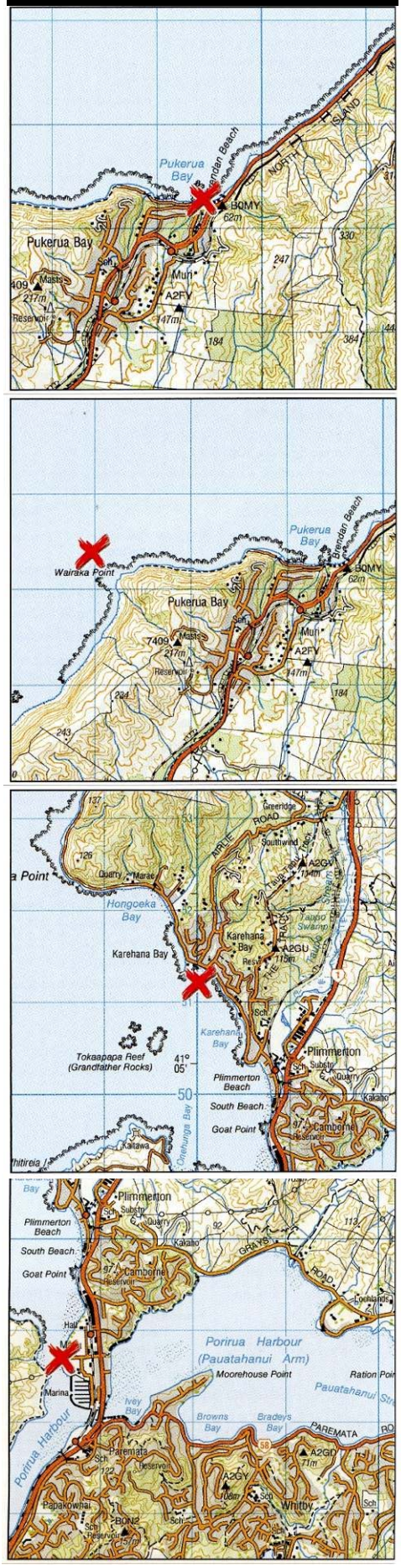
Ngāti Toa Domain is identified as an all-year beginners incoming-tide surfcasting site, targeting kahawai, red cod, stingrays and trevally, with the advice:

> *Park and fish from the water's edge. The southern end of the domain has deeper water closer to shore. A very easy place to fish. Mainly a sandy bottom with small rocky patches. Only cast around 50 metres. Use half pilchards for bait. A strong current, so use a breakaway sinker. Look out for boats as they come and go from the marina.*

Airey (2012) identifies several boat fishing sites in the study area (Figure 25). The sites are, from north to south:

5: Pukerua Bay, fishing November to April, targeting snapper: *Find the edge of the kelp-covered reef and*

Figure 24: Spot X shore fishing sites



anchor. Drift your lines back over the reef amongst the berley. Often trevally, John dory and blue cod as well as snapper. Try over the sand for gurnard if the reefs aren't producing.

7. Wairaka Point, an advanced crayfish and photographic dive site in 15 to 40+m: *Very exposed and only diveable in calm conditions. Often a current. Awesome dive, with sharks, kingfish, schools of warehou, blue moki and tarakihi. Colourful sponges, including long finger sponges on the walls. Large numbers of reef fish and even the odd hapuku. Crayfish in the cracks and nudibranchs amongst the colourful invertebrates.*

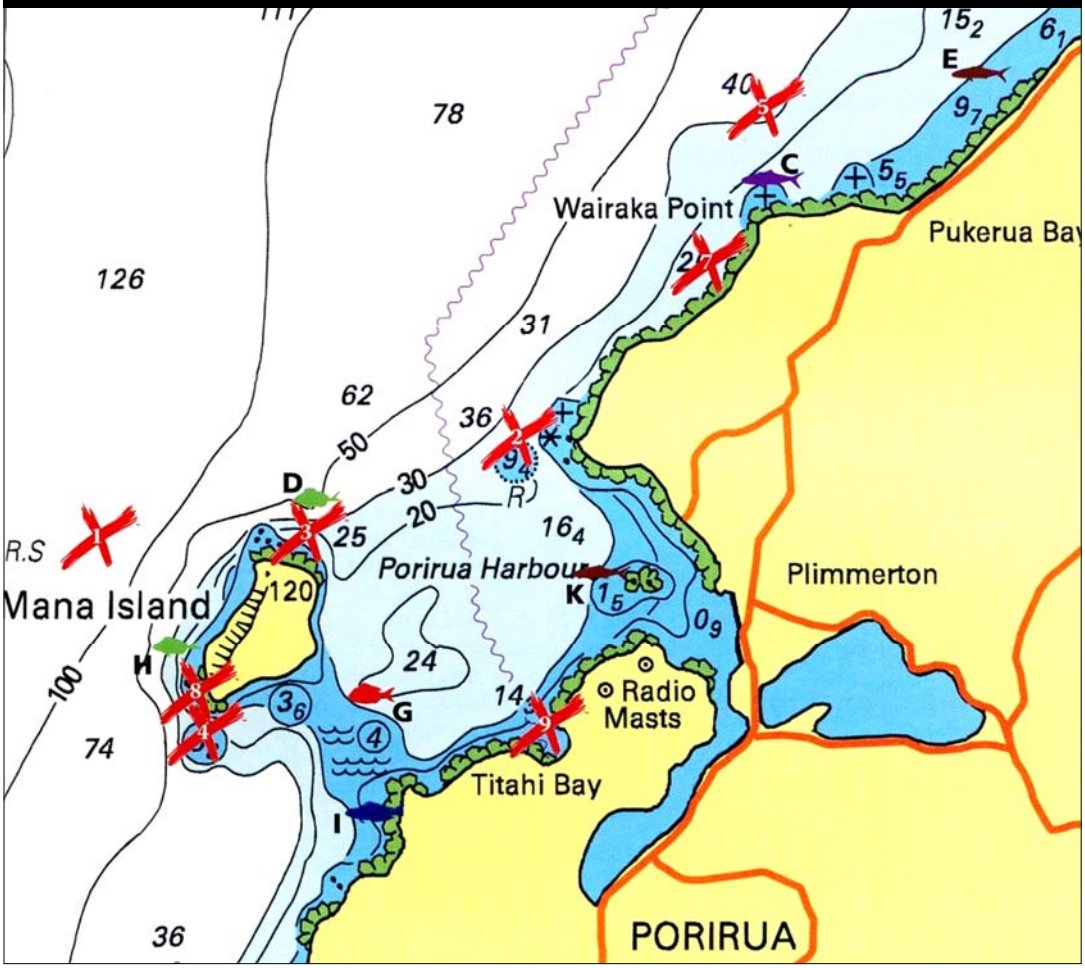
2: Te Rewarewa Pinnacle, fishing all year targeting tarakihi: *Good place for some really nice tarakihi. Not a huge area of foul ground and doesn't always show fish on the sounder. Some small groper here, as well as tarakihi and occasional very large blue cod.*

3. North Mana, fishing October to April for kingfish: *Lots of patches of rough ground here. Anchor with a quick-release danbuoy on your grapnel. Berley up and cast into the trail. Quite a few kahawai too. Try straylining for snapper over summer.*

8. South Point, an intermediate crayfish and photographic dive site in 5 to 15m: *Best with no wind or a light southerly. Some current. Visibility can reach 10 metres after a week with no rain. Kelp-covered reefs with gutters and sandy patches. Crayfish under the larger boulders and juvenile reef fish. Some rocks have a coating of anemones with nudibranchs amongst them.*

4. South Pin, fishing November to March for snapper: *Good patches of rough ground here. Use your sounder and anchor the drift back over the fish. This spot also produces blue cod, trevally and some good tarakihi. Kingfish appear over summer*.

Figure 25: Spot X boat fishing sites (Airey 2012)



9. Tītahi Bay Boatsheds, a beginner photographic and snorkelling site in 0 to 8m (Figure 26): *Sheltered from all but westerly winds. Large kelp forests around the shore, which are a haven for juvenile fish. Spotties dominate, but there are sweep, banded wrasses and leatherjackets around the weed stacks. Seahorses attached to the bases of fronds and shrimps and decorator crabs for macro photography.*

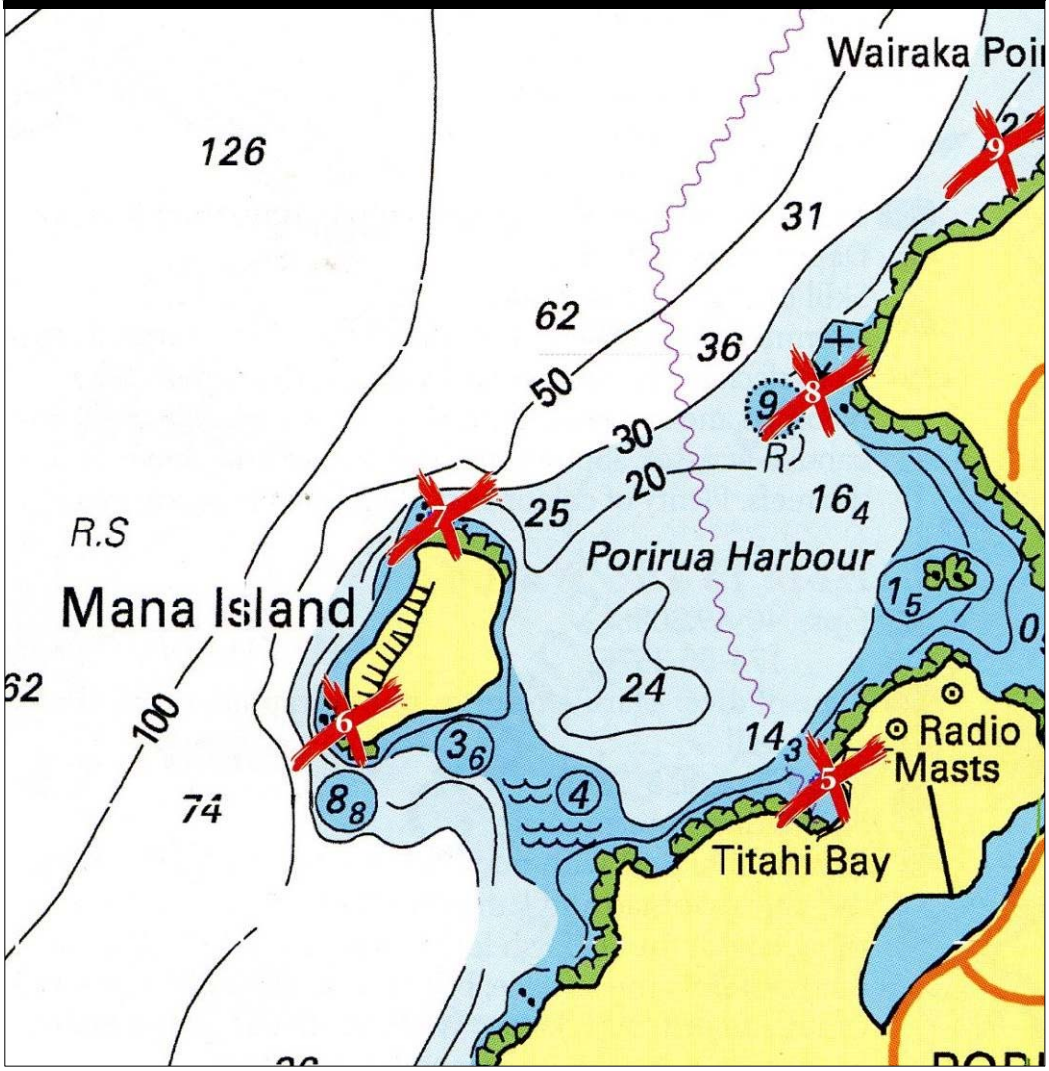
Snapper are also identified as a target species between Mana Island and the coast (The Bridge), blue cod around Rock Point, and kingfish around Toka-a-Papa Reef east of Karehana Bay and north of Wairaka Point.

Enderby and Enderby (2007) (a national Spot X diving and snorkelling guide) indicates three dive sites in the study area (those by Mana Island are just outside). These are, from north to south:

9. Wairaka Point, a beginner crayfish, photographic and snorkelling site in 10 to 25m: *No wind or light from south or east makes best conditions. Watch for fishing line in the kelp. Rocky reef easily reached from shore with gutters and some deep cracks and underhangs. Crayfish aren't common. Small spotties, leatherjackets and banded wrasse. Large sea stars, decorator crabs, sea hares and patches of anemones on the larger rocks.*

8. Te Rewarewa Point, a beginner photographic and snorkelling site in 10 to 25m: *Best with light wind from the south or east and no swell. Any heavy rain will drop visibility to zero. Watch for abandoned fishing line in the kelp. Heavy kelp with some bare patches of kina. Mainly*

Figure 26: Spot X shore fishing sites (Airey 2012)



spotties among the kelp, but a few other juvenile fish. Sea hares, nudibranchs, hermit crabs and seashells for macro photography. Also a shore dive.

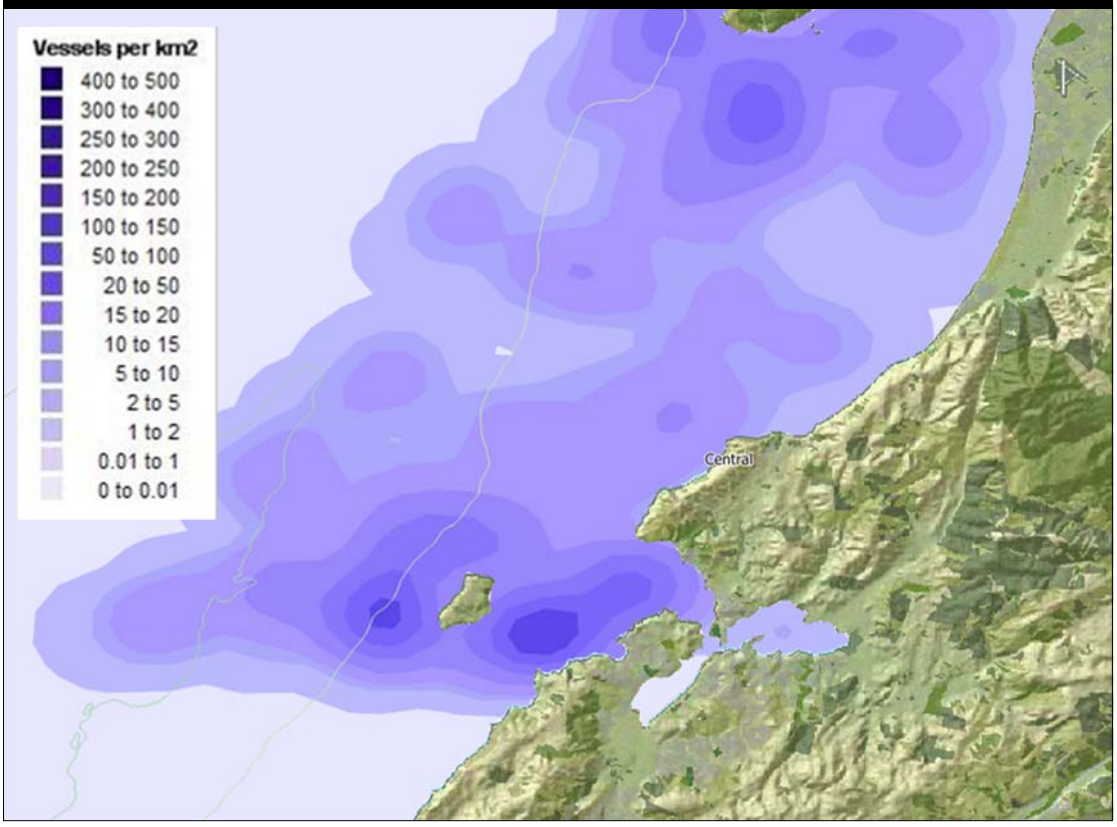
5. Tītahi Bay Boatsheds, a beginner photographic and snorkelling site in 0 to 8m: *Shore dive sheltered from all but westerly winds. Large kelp forests around the shore, which are a haven for juvenile fish. Spotties dominate, but there are sweep, banded wrasses and leatherjackets around the weed stacks. Seahorses attach to the bases of fronds and shrimps and decorator crabs are present for macro photography.*

The National Aquatic Biodiversity Information System (NABIS) provided by the Ministry for Primary Industry provides results from aerial surveys of recreational fishing effort undertaken over 2006 and 2007 (Hartnell *et al* 2008, as represented in the NABIS system)[24] (Figure 27). Boats recorded include those scuba diving and so show 'fishing' effort within, for example, marine reserves. The data show the Mana Island Bridge to be a relatively heavily fished setting – 20 to 50 vessels per km^2.[25] The survey area ended south of Mana Island and so does not suggest zero fishing south of Rock Point.

Fish & Game NZ describe fishing options on Wellington's 'small streams' including Pāuatahanui:[26]

> *Small streams abound in the rugged Wellington landscape. Waters such as the Makara (access is either through Karori to the middle reaches at Makara or Ohariu to the lower reaches). Korokoro (off SH2 opposite Petone), and Pāuatahanui (access off SH2 over Haywards Hill or via Paremata to Pāuatahanui) provide interesting fishing attracting a*

Figure 27: NABIS output for recreation fishing activity 2006/07. MPI data.



[24] http://www.nabis.govt.nz/map.aspx?topic=Fish
[25] A kernel density function was used to contour the data. The density of boats is given as vessels per kilometre squared. The value at each point is determined by calculating the average density over a shifting 2500km^2 window centred at that point. This window size was deemed to give the best trade-off between representing the scatter of vessel locations while providing a smoothed synoptic picture of fishing intensity.
[26] https://fishandgame.org.nz/wellington/freshwater-fishing-in-new-zealand/fishing-locations-and-access/

small number of anglers. Don't expect large fish and numbers can vary from year to year. Early season is better as the warmer conditions of summer tend to make fish sluggish and angling difficult. A small nymph, dry or even a worm drifted through the small pools will usually bring an enthusiastic take if conditions are right.

3.2.3 Boating and sailing

The *New Zealand Cruising Guide Central Area* (Murray and Von Kohorn 2002) describes the 'Paremata/Porirua Inlet' as "the only sheltered natural harbour on the lower west coast of the North Island," and notes, as guidance to cruising craft:

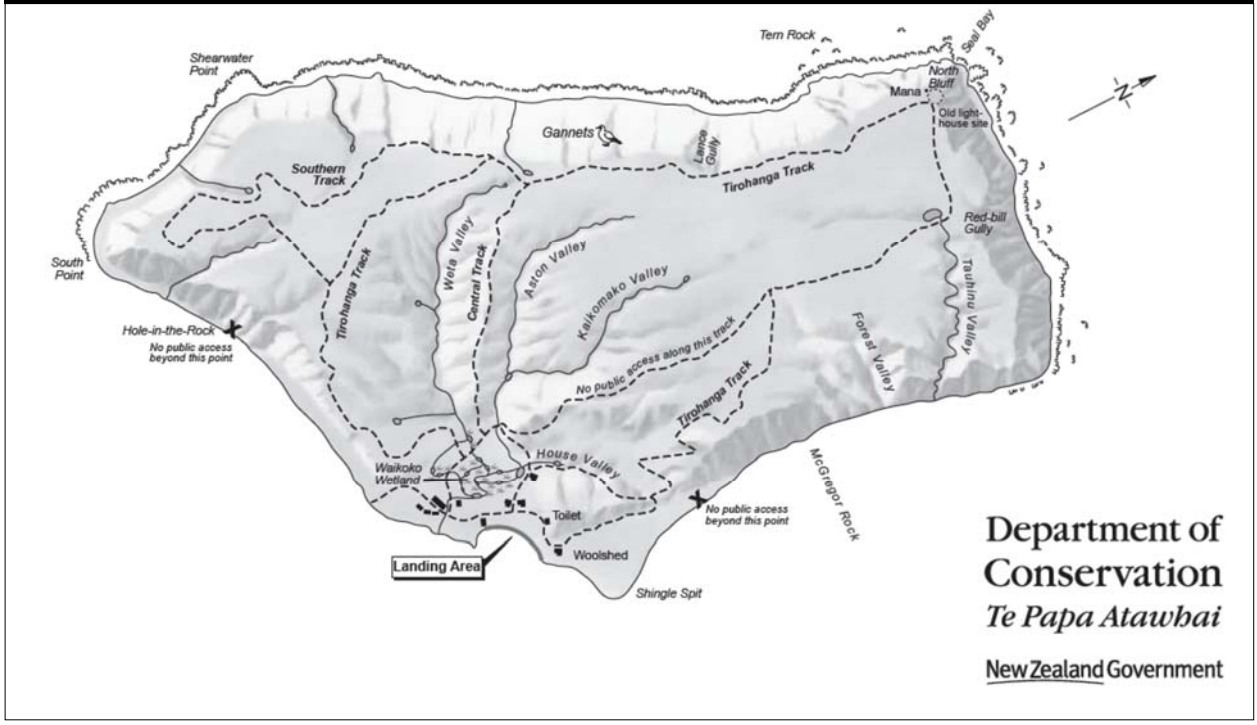
Strong W to NW winds can make the bar dangerous particularly if accompanied by a heavy swell from the same direction and an outgoing tide. In such conditions it may be prudent to wait until approximately one hour before high tide before attempting to enter or leave the harbour. The southern coast pf Mana Island makes a convenient and sheltered place to wait for the rising tide. Boats drawing over two metres will have difficulty with depth of water over the bar…

Most of the navigable area outside the railway bridges is taken up with moorings. Visitor should approach to [Mana Cruising] Club for overnight berthage… The harbour continues south from the area immediately adjacent to the Manan Cruising Club via a channel close to the western shore. This shallows to less than one metre and is of little use to other than trailer boats.

Access to Paremata Inlet is restricted by the railway and road bridges. There is a clearance under these of about three metres at HWS… There is deep water past the boat sheds and Ivey Bay but from there onwards depth shallows in the channels to about 1.7 metres.

Mana Island, at its southern end, is recommended as a picnic site (Figure 28), albeit with rock hazards close to shore and strong rips. Tītahi Bay is not recommended as an anchorage and the guide notes that "At Round Point to the west of Tītahi Bay is the sewerage outlet for the northern Wellington suburbs. This unfortunately mars the area." Pukerua Bay is described as

Figure 28: Mana Island access map, DOC



offering shelter in east to south and south west winds with 'acceptable holding' (an OK anchorage in those wind conditions).

Mana Island is a local boating destination, administered by the Department of Conservation, with restrictions on the timing and location of access – limited to between 8am and 5pm, all year, with access only permitted via the eastern landing area where two daytime-only boat moorings are provided.[27]

Mooring areas within the study area are defined by the GWRC Regional Coastal Plan 2000 (Appendix 5 and Planning Map 3) (Figure 29, Figure 30 and Figure 31).

Figure 29: Onepoto mooring area - GWRC Regional Coastal Plan 2000, Map 3A detail

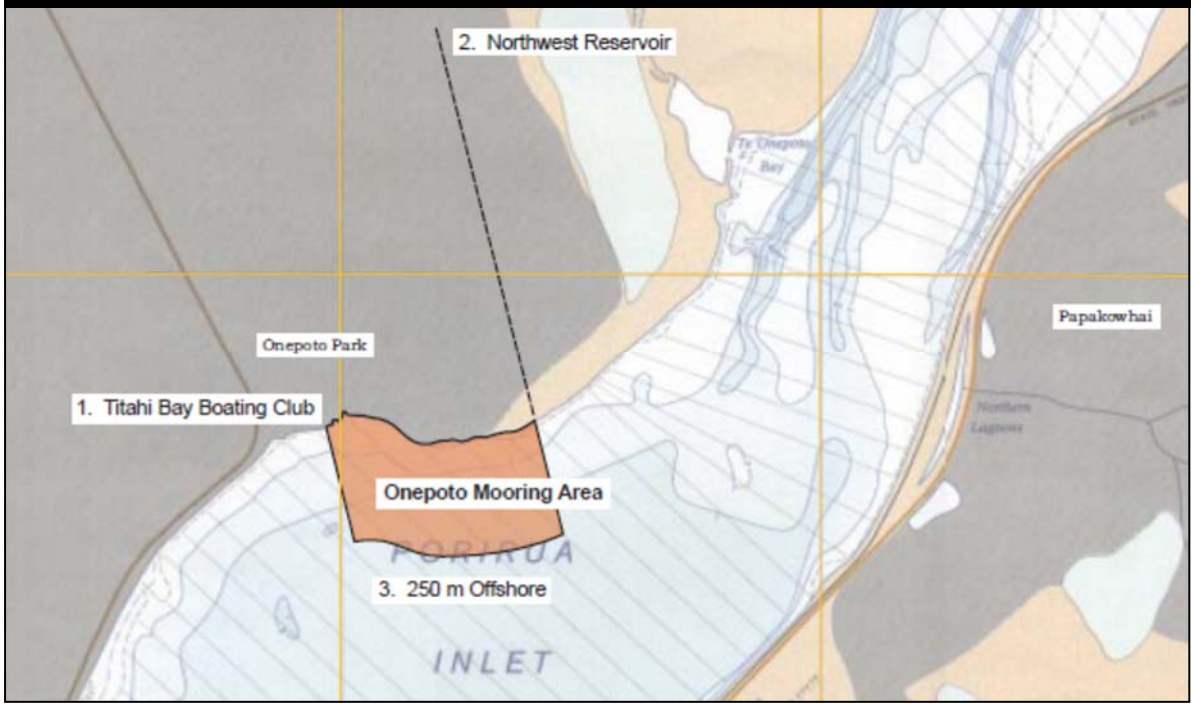
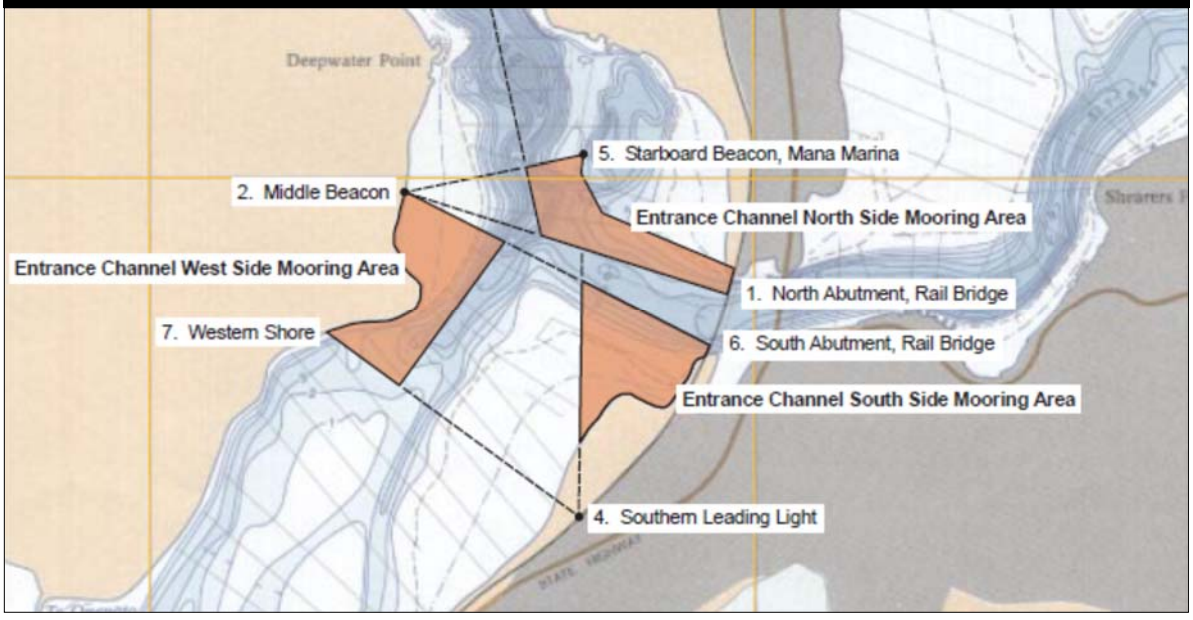
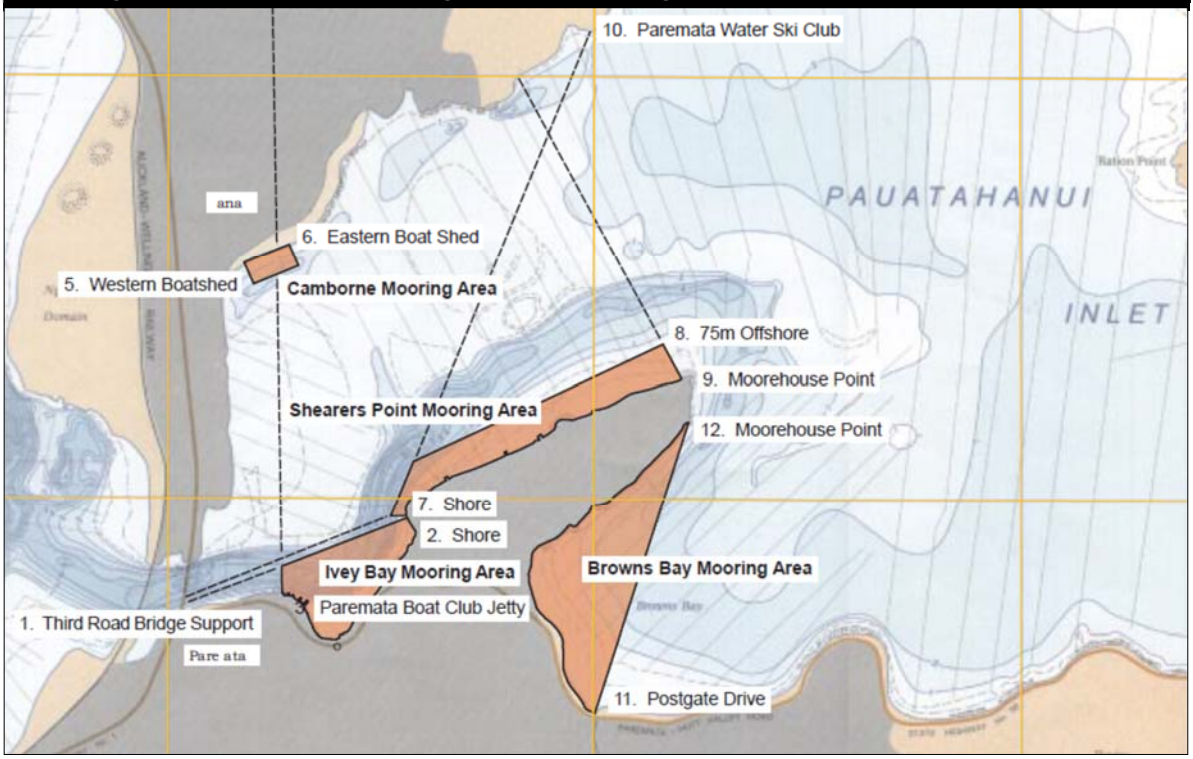


Figure 30: Porirua Inlet mooring areas - GWRC Regional Coastal Plan 2000, Map 3B detail



[27] https://www.doc.govt.nz/Documents/parks-and-recreation/places-to-visit/wellington/mana-island-factsheet.pdf

Figure 31: Pāuatahanui mooring areas - GWRC Regional Coastal Plan 2000, Map 3C detail



Boat sheds are a significant feature of Tītahi Bay and the Onepoto Arm (at Onepoto) and Pāuatahanui Inlet (mostly at Paremata and Camborne) – the latter three groups shown as black squares in Figure 32 (other individual sheds are located around the Inlet). The GWRC notes in relation to controlling the use of these:[28]

> *Boat sheds are normally used to store boats and their associated paraphernalia. But in the Wellington Region, many people have set up home in their sheds to better enjoy coastal life. In the past this practice was low key and councils tended to turn a blind eye to it. But there are not a lot of coastal areas around Wellington and Porirua that are suitable to launch boats from so, by the 1990s, residential use of boat sheds had started to squeeze out the number of boat sheds available for storing boats.*
>
> *Any sort of building on the foreshore restricts public access to and along that piece of coast. This is contrary to the principles of the Resource Management Act. On top of that, most boat sheds don't have toilets connected to a sewer. The Council now requires resource consents from people wanting to stay in their boat sheds, and is taking enforcement action against those people who break the rules.*

[28] http://www.gw.govt.nz/Boat-sheds/

Figure 32: LINZ Chart 4632 detail showing main boat shed areas and moorings

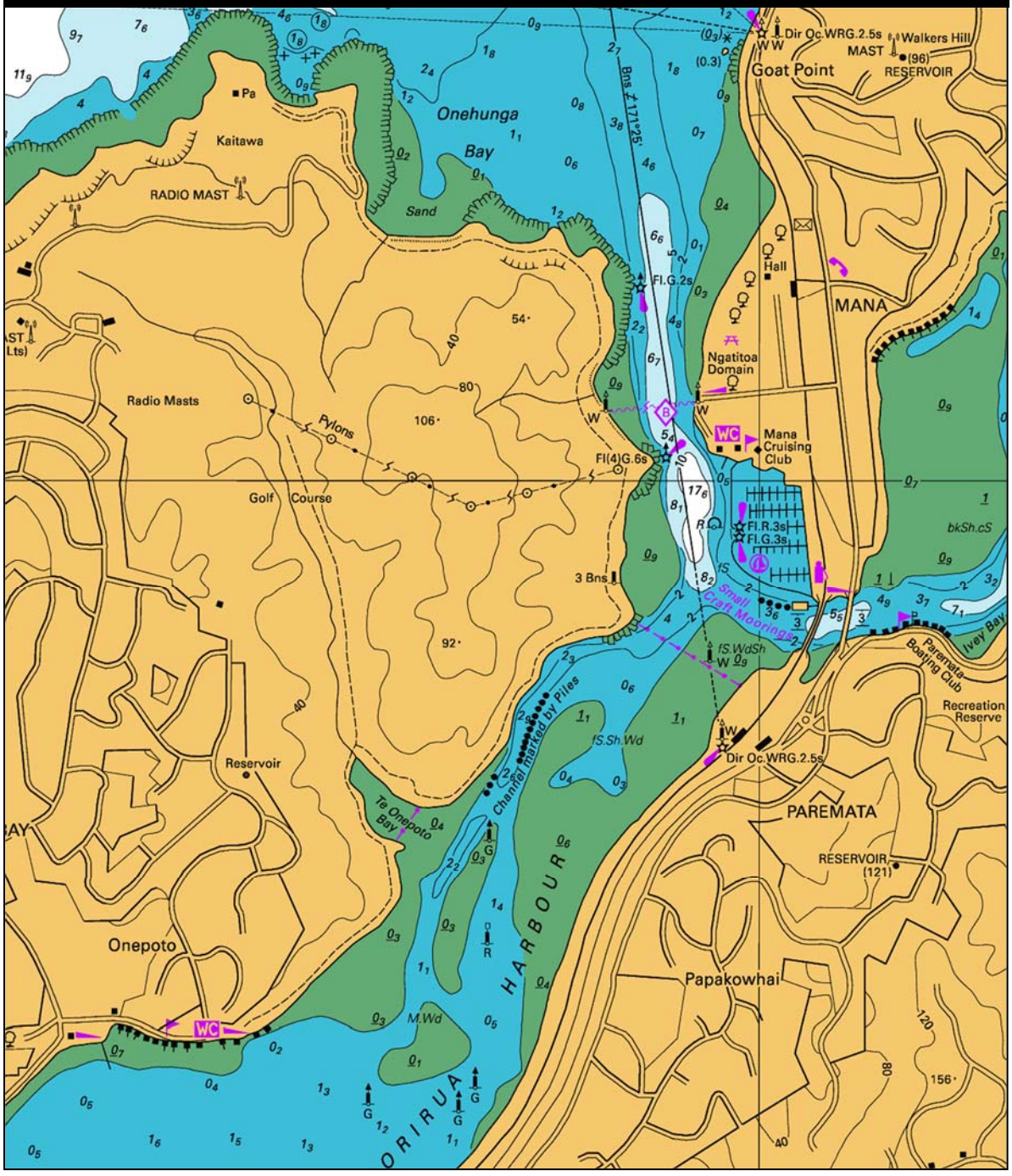
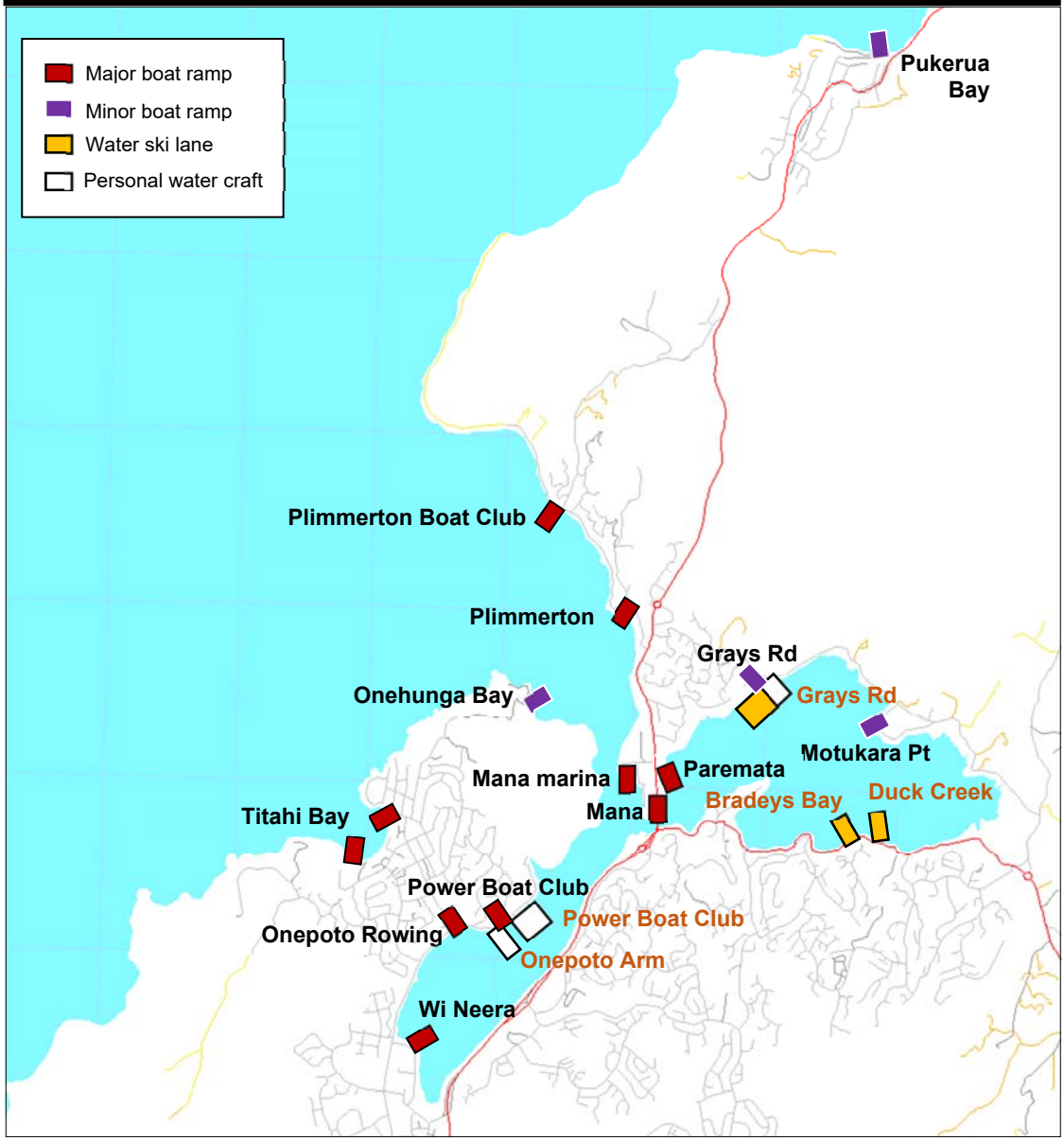


Figure 33 shows the locations of boat launching ramps in the study area, as well as reserved areas for water ski lanes and personal watercraft. Reserved areas are defined by the GWRC *Navigation and Safety Bylaws Wellington Region* (2009) and permit water skiers and those on jet skis or similar (personal watercraft) to exceed 5 knots within 200m of the shore. In all other inshore areas, all watercraft (apart from windsurfers, and yachts, rowers and kayakers when racing or training with a recognised group), must not exceed 5 knots within 200m of the shore or a structure. Browns Bay is described as a public ramp[29], but is no different to any beach access point suitable for small craft such as dinghies and kayaks.

Figure 33: Boat launching ramps and waterski lane and personal water craft areas



[29] http://www.gw.govt.nz/Porirua-launching-ramps/

Figure 34 shows the locations of boating and surf clubs. Clubs generally host training and racing activities in their immediate areas.

Figure 34: Boat and surf club locations

Windsurfing New Zealand identifies three launching sites in the Harbour (Figure 35).[30] Advice about the use of these sites indicates that the entire near-coast study area is used for the activity.

The three sites are:

1: Pāuatahanui Inlet. *Turn right at Whitby. Parking, grass rigging and BBQ areas. Toilets etc*

Suits: Slalom, longboarding, beginners

Wind: Most directions except N which is gusty and common in summer. Strength is slightly less here than other places.

Water: Flat.

Watch: Rocks and shells on bottom – shoes are essential. Some banks exposed at low tide only.

Figure 35: Windsurf launch sites

This is a large tidal inlet, ideal for learning in just about any conditions/ directions as it's just about touch-the-bottom all the way across and is essentially landlocked so drifters can be rescued by car. Launching site is halfway round north side. Wear sandshoes as there are some

[30] http://www.winzurf.co.nz/windsurf/wgtnz/wgtnz28.htm retrieved August 2018

sharp stones near the shore. Bit shallow at low tide in places. Good place for beginners and learning gybes, water starting etc.

2 Plimmerton. *Access: From the Plimmerton Yacht Club. For wavesailing, there is limited access by the railway crossing at the main highway. From the Tītahi Bay side there is plenty of access.*

Suits: Slalom, wavesailing. Intermediate.

Wind: NNW = cross/cross onshore winds

Water: Waves are not too powerful and form good ramps. A good place to learn to wavesail.

Watch: Other windsurfers – it's a very popular place. Boats which are navigating in/out over the bar. The other wavesailing spot near Wellington other than Lyall Bay, Plimmerton is best in a north-westerly. Waves form over bar about 200m out. Launching from South Beach, just over the railway lines, further round near the fire station or alternatively on the other side of the bay below the radio masts (turn off at Porirua and head for Tītahi Bay). Plimmerton has variety and space for the type of sailing you want, but can get busy on a good day.

3 Porirua Harbour*. Access: From Tītahi Bay turnoff.*

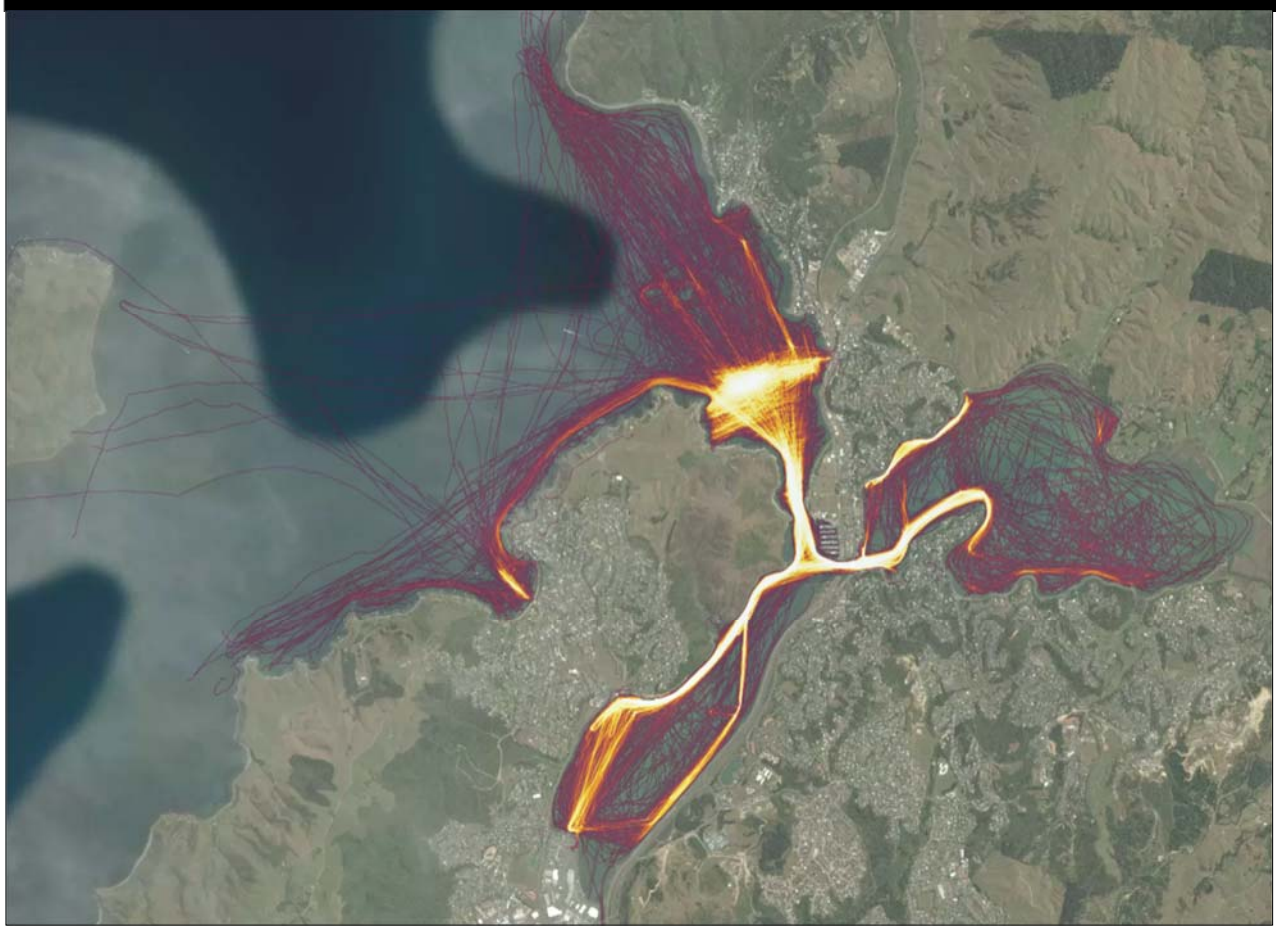
Suits: Slalom, longboarding. Beginners...

Wind: S.

Water: Flat and shallow. Watch out for the swans.

Figure 36 shows the Strava heatmap for water sports for the 24 months to November 2019. Strava uses GPS records from subscribers' smartphones uploaded to a central database,

Figure 36: Strava heatmap data for water sports, 24 months to November 2019



allowing speed and time comparisons with other cyclists, runners, kayakers and swimmers (for example), and the monitoring of individual activity or training targets. While the service is popular with professional athletes, its membership is dominated by casual recreation participants. Strava does not state its membership numbers, but 42 million international users were reported in 2019 (80% outside the US) with an additional million per month. It is now very popular amongst regular cyclists and runners, and is also used by the likes of rowers, kayakers, waka ama and swimmers. The Strava heatmap shows an accumulation of GPS tracks over a rolling 24-month period.

International comparisons between different forms of data-gathering show a degree of reliability for Strava data with a range of 1% to 12% of users recorded on-site that are connected to the service; and this is growing (Herroro 2016 and [31]). The author of this report has completed several analyses recently in Nelson and Wellington comparing Strava use with reliable cycle counters, and where the routes are heavily used by cyclists on training rides, Strava participation can be very high – up to 67% at Third House on the Coppermine Trail in Nelson (a recreational mountain bike ride). Such response rates would compare favourably to (or better than) an on-site intercept survey of users in an outdoor setting, particularly since the Strava data are collected over all seasons and all day (an intercept survey would normally only cover relatively short time periods and be confined to specific interception points). Nevertheless, caution needs to be applied to the use of Strava data as they show participation by only Strava members, and there is no estimate available for the scale of uptake within the water sports community. There will be an inherent bias to the more competitive and tech-savvy, and some data accumulate from users staying logged in when they are doing other activities, such as driving. Some records are also offset by tens of metres due to either poor GPS reception or map projection errors. However, most records appear in their correct locations.

Strava is therefore a little like a tag and release programme, but unlike, for example, tagging 10 longfin eels with GPS devices and seeing where they head to breed[32] Strava essentially tags several thousand active people in an area and monitors where and how they recreate. Its greatest strength is therefore in showing the relative value of settings for different forms of recreation.

Water sports include canoeing (such as waka ama), kayaking, rowing, wind surfing, kite surfing, stand-up paddles boarding (SUP), surfing or swimming (using a waterproof pouch). Although a participant could record any activity (such as dinghy sailing recorded as kayaking), sailing is not a category that can be selected in the application.

The heatmap is likely to be showing:

- Wind and kite surfing from Plimmerton Beach,
- Waka ama and kayaking from the Wi Neera ramp,
- Rowing from the Porirua Rowing Club,
- Swimming in Tītahi Bay,
- Sea kayaking or flat-water kayaking around the Pāuatahanui Inlet and out the harbour entrance, with a lot of launching from the Paremata ramp at the Dolly Varden Reserve,
- Some sailing in the Pāuatahanui Inlet, evidenced by tacking courses,

[31] https://medium.com/strava-metro/cdc-finds-strava-metro-data-correlates-strongly-with-census-active-commuting-data-8ab1be0fe130
[32] As NIWA did in 2019 and earlier in the century. See: https://www.rnz.co.nz/national/programmes/ourchangingworld/audio/2018695044/mystery-of-the-longfin-eel-s-breeding-ground

- SUP in many settings.

There was only a handful of Strava routes based out of Pukerua Bay showing, most likely, local sea kayaking trips.

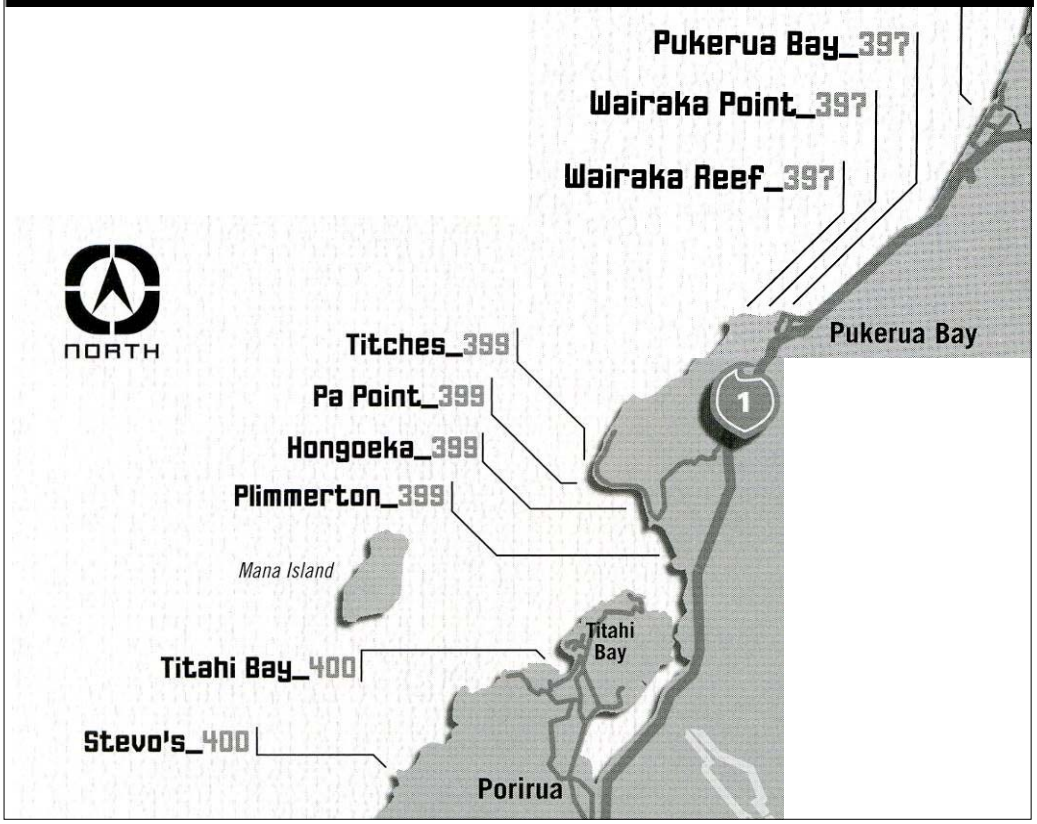
3.2.4 Surfing

The NZ Coastal Policy Statement (DOC 2010) does not identify any surf breaks of national significance in the Wellington Region. Lyall Bay and Tītahi Bay are commonly identified as the top regional sites,[33] as well as a number of breaks along the Wairarapa Coast (such as Ning Nongs, The Spit and Tora).[34]

The *Wavetrack New Zealand Surfing Guide* (Morse & Brunskill 2004) identifies a number of surfing sites between Pukerua Bay (Figure 37 to Figure 38) and Rock Point. Of Tītahi Bay Morse & Brunskill state:

> *Covering nearly 50 kilometres of coastline, the area offers a range of surfing options with beaches, points and reefs that can create great waves. But for most of the time this coast is missing that magic ingredient called swell. Although it's part of the West Coast it is shielded from the Southern Ocean swells by the South Island to the west.*

Figure 37: 'Kāpiti area' surf breaks (Morse & Brunskill 2004)



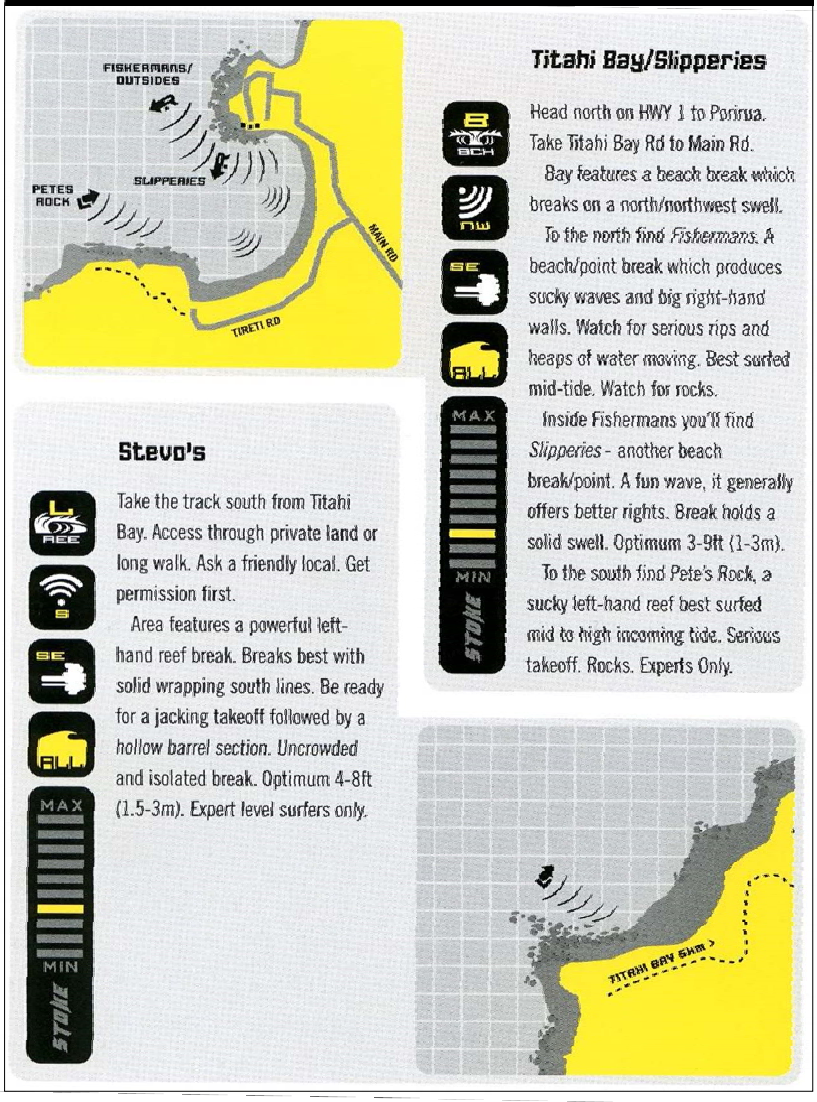
[33] For example, see: http://www.jasons.co.nz/surf-cities-in-new-zealand; http://www.surf2surf.com/reports/wellington; http://surf.co.nz/reports/north-tasman/wellington/; http://www.wellingtonnz.com/discover/things-to-do/sights-activities/beaches-and-bays/

[34] http://www.swellmap.co.nz

Occasionally a southwest swell will wrap round into the Kāpiti Coast but it generally relies on a very narrow northwest swell window. During certain weather patterns Tasman storms and equinoxial gales pound the coast. If the wind drops all the reefs and points can provide a welcome escape valve for Wellington suffers.

Tītahi Bay is the centre of surfing on the coast and is known as the onshore capital of New Zealand. But it's not all bad: even in a howling north-westerly it's still very surfable with a surf-friendly rip and semi-clean wave faces. Many of Wellington's true surf chargers started surfing at the Bay.

Figure 38: Titahi and south surf breaks (Morse & Brunskill 2004)



Atkin *et al* (2015), when identifying significant surf breaks for GWRC, identify all breaks listed by Morse & Brunskill (2004) as regionally significant, but note that Morse & Brunskill have mis-located Stevo's at Boom Rock and have omitted two breaks at Open Bay and Tirau Bay. These are best shown in a figure taken from Gunson *et al* (2014) (another report on regionally significant surf breaks) in Figure 41. Open Bay is also referred to as Little Tītahi, and Gunson *et al* report it is also a swimming beach (clothes optional). The green break south of Stevo's in Figure 41 is un-named. Kaumanga Point is described as Green Point by the NZ Geographic Board (as it appears on NZ Topo maps).

The following surf breaks were identified as 'significant' in the Draft GWRC Proposed Natural Resources Plan, but were deleted in the Decision Version:

- Tītahi Bay – Fishermans, Tītahi Bay (nth)
- Tītahi Bay – Main Beach,
- Tītahi Bay BeachTītahi Bay – Pete's Rock, Tītahi Bay (sth)
- Tītahi Bay – Slipperies, Tītahi Bay Beach
- Stevos Wairere, Porirua
- Plimmerton, Plimmerton Beach
- Brendans, Pukerua Bay

- Wairaka Point, Pukerua Bay
- Wairaka Reef, Pukerua Bay
- Titches, Te Rewarewa Point, Hongoeka Bay

Figure 39: Pukerua surf breaks (Morse & Brunskill 2004)

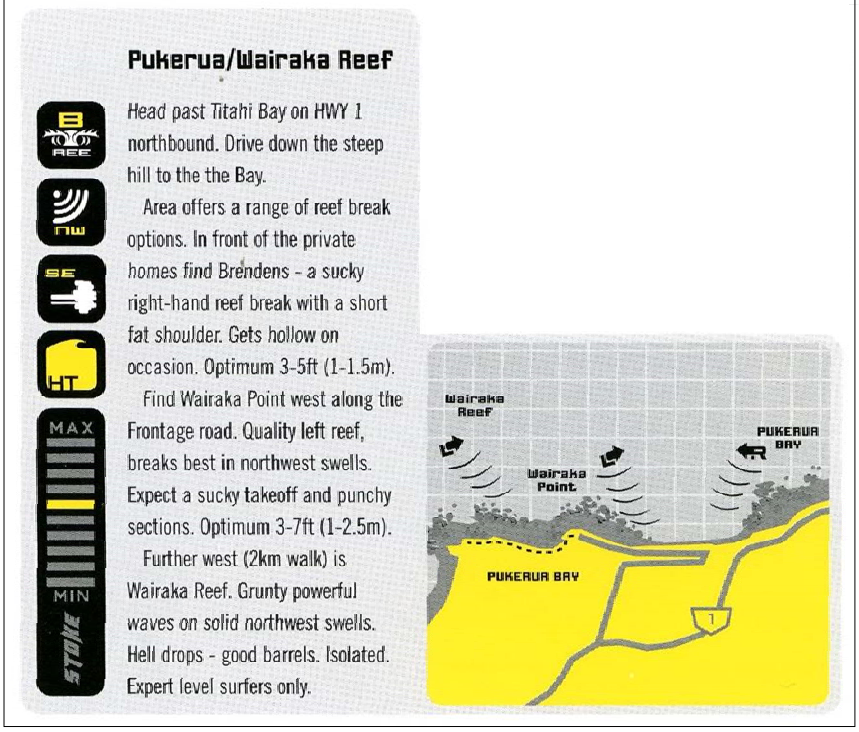


Figure 40: Plimmerton surf breaks (Morse & Brunskill 2004)

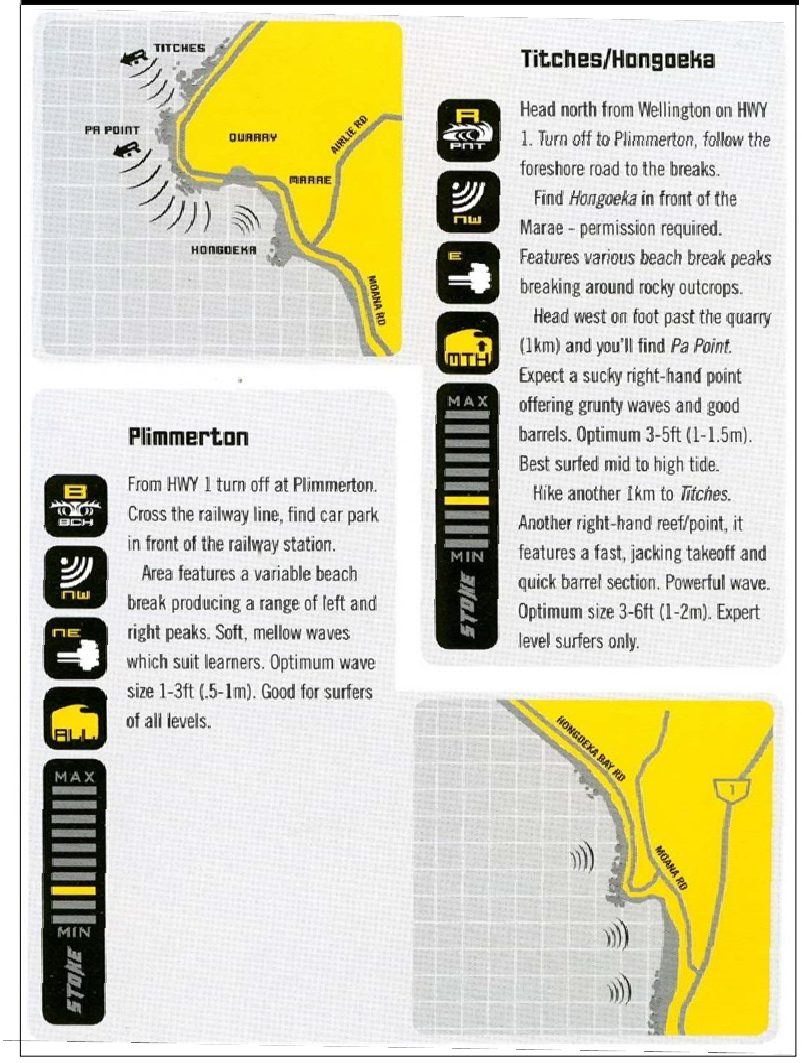


Figure 41: Stevo's, Open Bay and Tirau Bay surf sites (Gunson *et al* 2014)

3.3 Terrestrial recreation

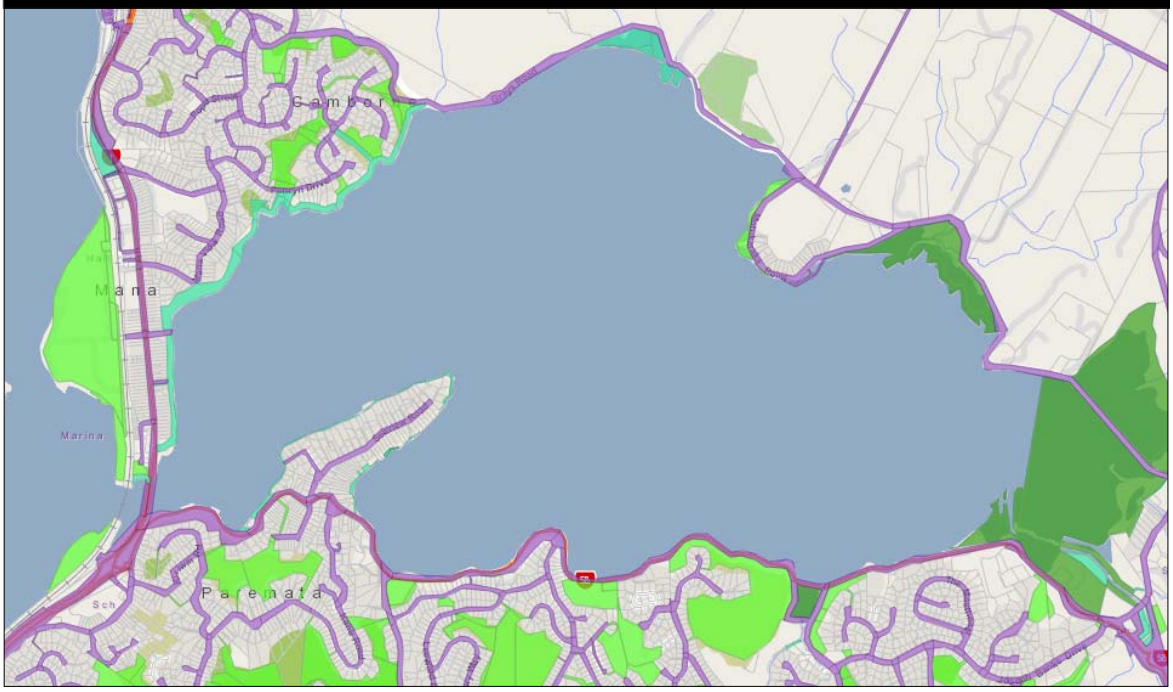
The coastal and riparian margins of the study area are generally all very accessible. This section aims to only indicate the scale of access and not to define every form, as this would take an extensive analysis.

It is a challenge to show public access via reference to one mapping system. Figure 42 shows the public amenities layer from Porirua City Council's online GIS system for the Pāuatahanui Inlet indicating reserves in green, walking tracks in red and dog exercise areas in blue. Figure 43 shows the Walking Access Commission's walking access map for the same area, showing

Figure 42: Public access areas, Pāuatahanui Inlet, Porirua City Council public amenities GIS

in addition, legal roads in purple, Council and DOC reserves in green and dark green respectively, and esplanade reserves in cyan. The Walking Access Commission maps often omit areas of reserve or other forms of public access, as is more evident in later figures.

Figure 43: Public access areas Pāuatahanui Inlet, Walking Access Commission



The entire edge of the Inlet is bounded by road, walkway and / or reserve. The eastern end of the Inlet is a Government Purpose Reserve (the Pāuatahanui Wildlife Reserve) (Figure 44), with four tracks, including on both sides of the Pāuatahanui Stream (partially only on the true left), and several bird watching hides.

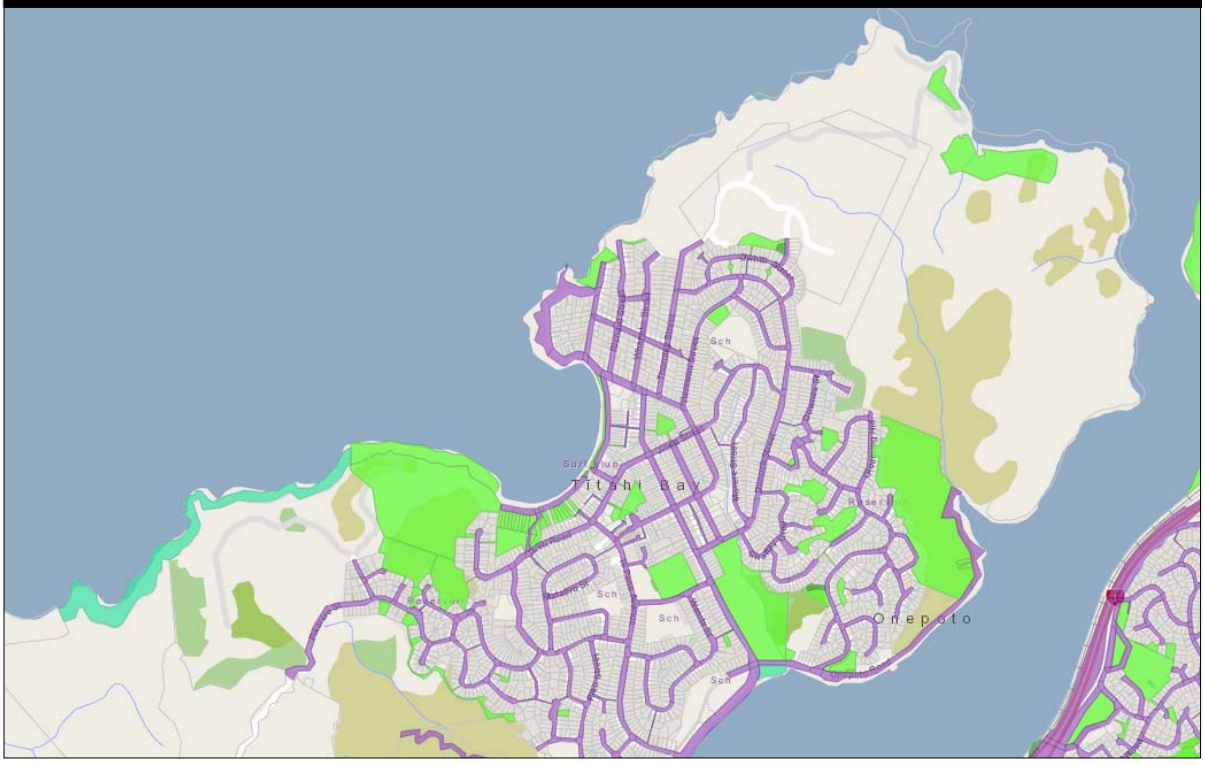
Figure 44: Pāuatahanui Wildlife Reserve DOC / Forest & Bird

Figure 45 and Figure 46 show the same information for the Tītahi Bay area (and omissions in the Walking Access Commission data). Public access along the coast ceases just south of Tirau Bay at the end of a section of Esplanade Reserve administered by the Porirua City Council. Surfer access to Tirau Bay is described in Gunson *et al* (2014) as via a 5 or 6 km walk from the treatment plant carpark via 'rough terrain' and a 'climb down the cliff follow the track and follow the foreshore in a southwest direction.'

The Porirua City Council Reserve Management Plan (2013, Volume 3 Reserve Maps) also provide details of all Council, GRWC and DOC reserves in the study area (at 2013).[35]

Figure 45: Public access areas, Titahi Bay area public amenities GIS

Figure 46: Public access areas Titahi Bay area, Walking Access Commission



[35] See https://poriruacity.govt.nz/your-council/city-planning-and-reporting/reserves-management/

Figure 47 and Figure 48 show access around and north of Plimmerton. The Wairaka Walkway (in red) extends north from Plimmerton to Pukerua Bay.

Figure 47: Public access Plimmerton, Porirua City

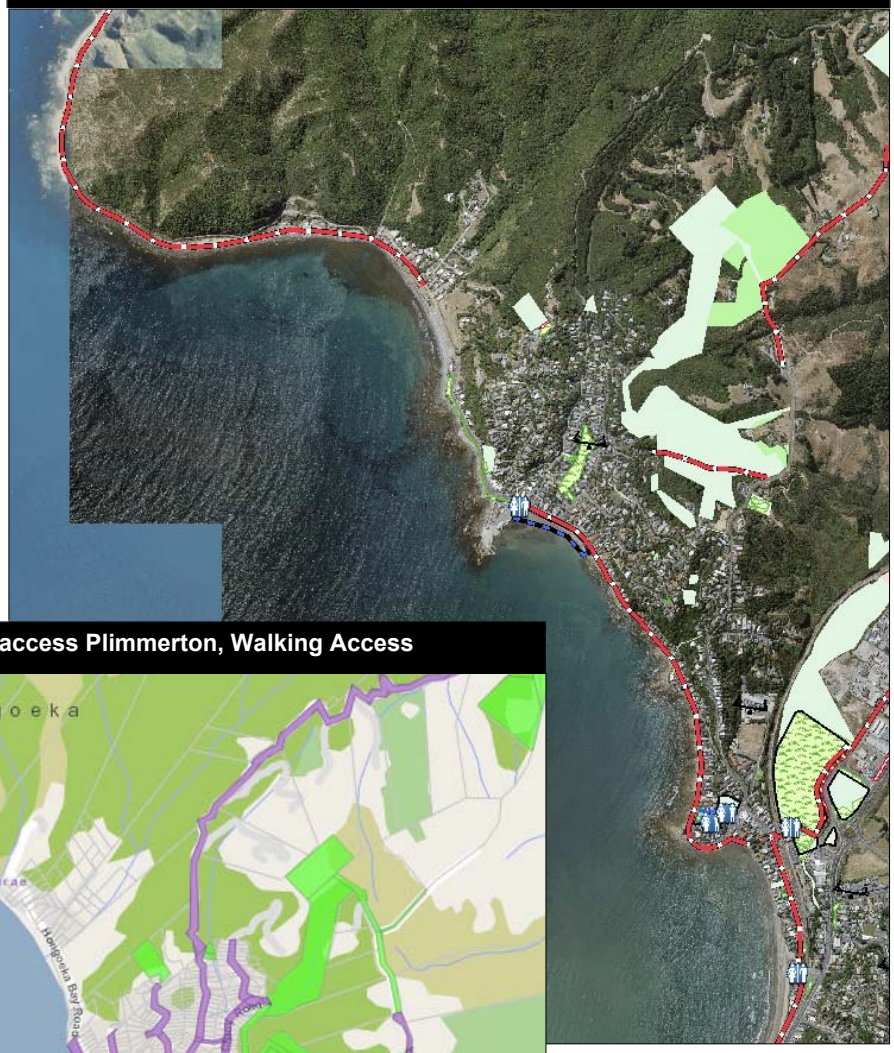


Figure 48: Public access Plimmerton, Walking Access

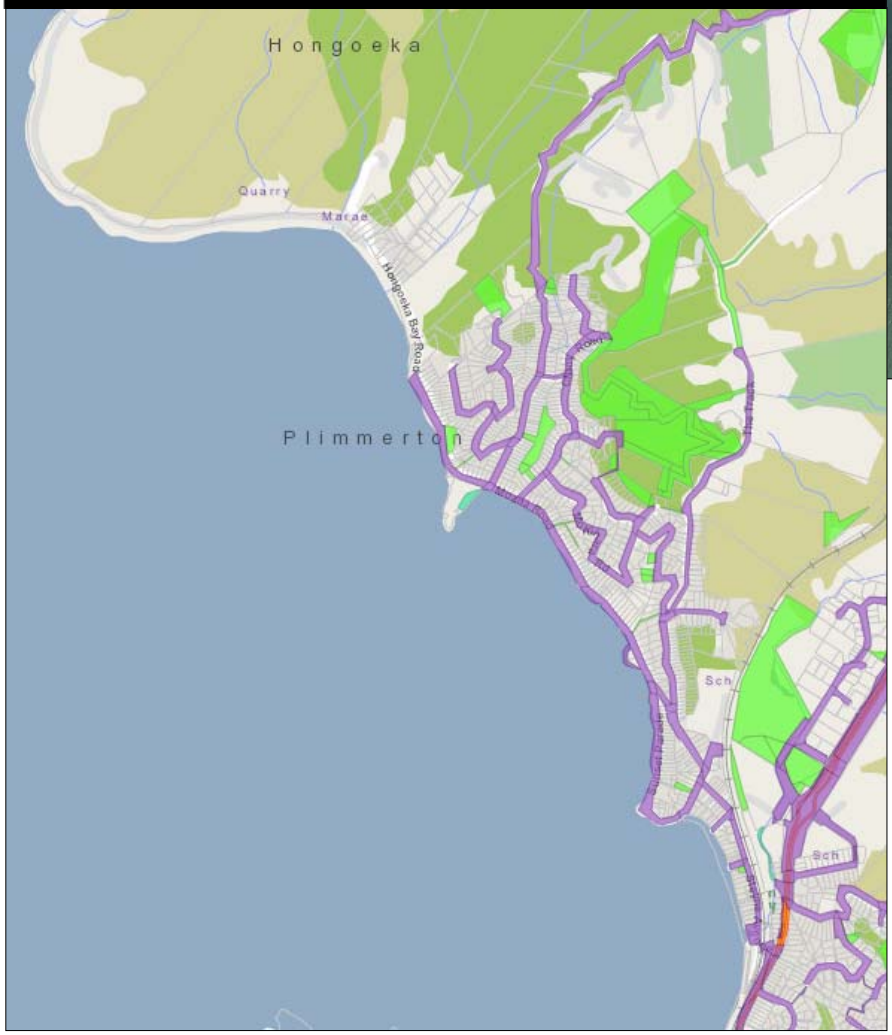
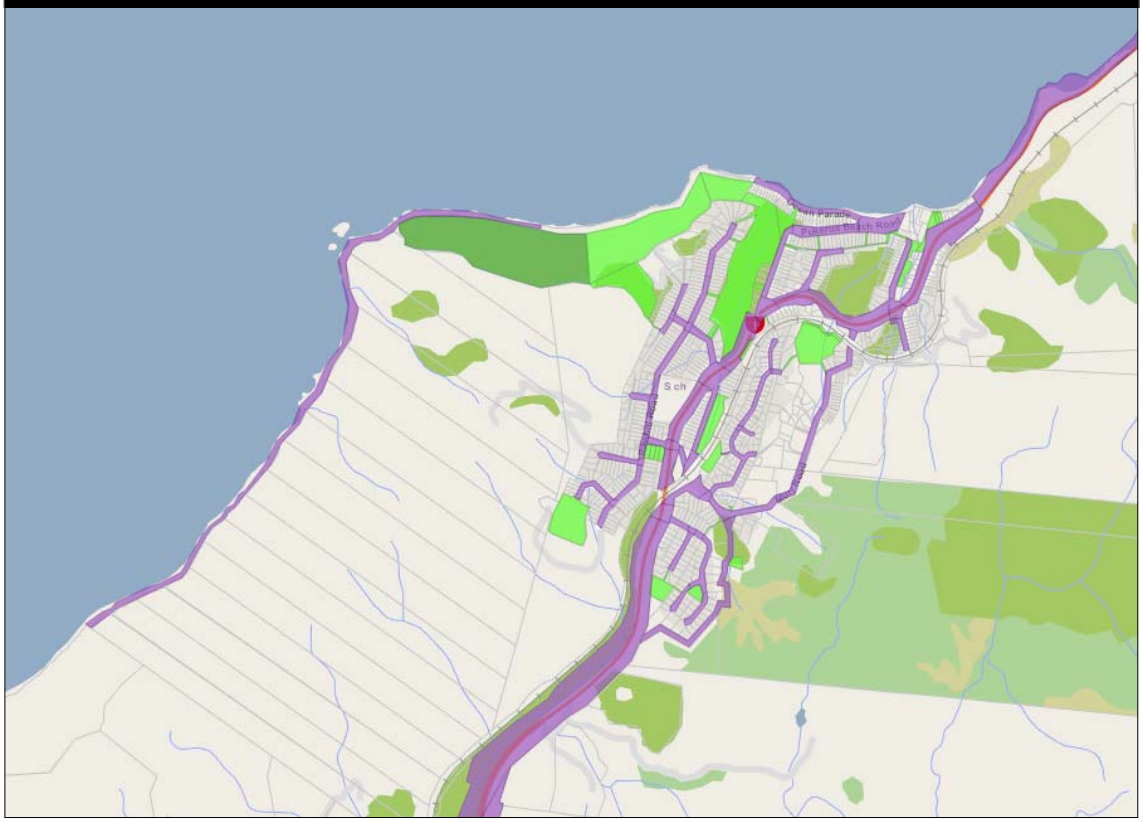


Figure 49 and Figure 50 show access data for Pukerua Bay, including the northern end of the Wairaka Walkway leading from Plimmerton. Pink areas shown in Figure 49 are QE2 Covenant areas.

Figure 49: Public access Pukerua Bay, Porirua City Council

Figure 50: Public access Pukerua Bay, Walking Access Commission



3.4 Perceptions of water quality

Three surveys have been located to describe perceptions of water quality, with reference to recreation.

Key Research (2014) completed a survey of 600 residents across the Te Awarua-o-Porirua Harbour catchment area to identify perceptions about the environmental quality of the Harbour and local streams. Eighty-nine percent stated that it was 'very important' or 'important' that they could enjoy recreation activities in the Harbour. Twenty-six percent stated that the overall condition of Te Awarua-o-Porirua Harbour and the streams draining into it had deteriorated over the previous three years. The remainder stated that it had stayed the same over the past three years (56% of all respondents), or had improved (18% of all respondents). When asked about the streams running into the harbour, 45% of respondents did not know if they were unhealthy and 44% felt they were unhealthy. The most harmful issue facing the harbour, when respondents were prompted, was perceived to be sewer and stormwater outfalls with 76% of respondents stating the outfalls were 'harmful 'or 'very harmful'. Unprompted, the most common response by residents when asked what they believe is harming the health of Te Awarua-o-Porirua Harbour and the streams running into it was 'dumping of rubbish and litter' (33% of all respondents).

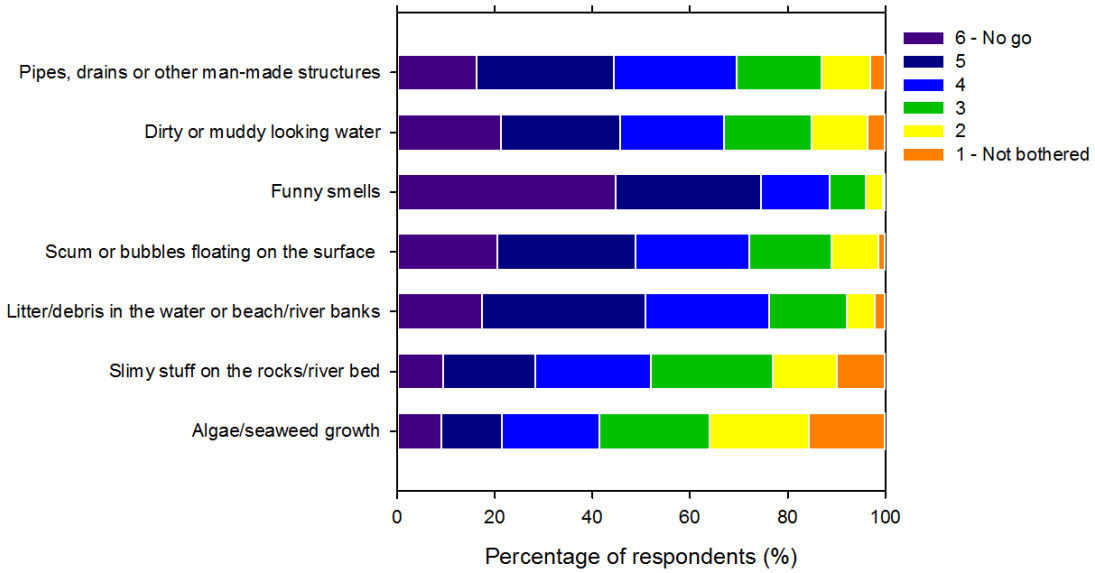
Respondents to the Wellington Regional Public Health PAK'nSAVE intercept survey (see Section 3.1, n=75 with 35 not participating in water-based activities) were asked what put them off carrying out their water-based activities. The most common responses were 'funny smell' and 'litter' (Table 4).

Table 4: Water quality effects on recreation – WRPH 2018

Issue	Count of respondents
Funny smell	29
Litter	23
A sign	22
Algae	19
Bubbles/scum	19
Pipes or drains	19
Muddy water	18
Slimy stuff	16
Rahui	13
Recent heavy rainfall	8
Dog poo	1
Jellyfish	1

Respondents to Greenfield & Martin's (2015) survey of 423 Wellington Region residents (see Section 3.1) identified the factors that would put them off accessing water-based activities from a pre-defined list (Figure 51). 'Funny smells' was the most significant issue and algae or seaweed growth the least. Respondents were also asked what 'other things' would influence their choice to get in the water. The most frequently mentioned factors were weather and water conditions, presence of farmland and cattle in streams, health warnings, presence of sewage overflows or outfalls, recent rainfall and the presence of jellyfish.

Figure 51: Deterrents to accessing water (Greenfield & Martin 2016)



4 Interview summary

Thirty telephone interviews were carried out over the first half of August 2018 with a variety of groups and individuals with an interest in recreation participation or resources in the study area (see Appendix 1). The intent of the interviews was to help identify the scale and type of recreational use and value of all parts of the study area, and to identify whether there are any differences which could influence decisions about wastewater treatment options. However, as with the literature review, it is clear that almost all parts of the study area are used for recreation, and while some may be used less intensely, there is no area which can be described as low value – although there was little reported in-river use of the rivers and freshwater courses. Key findings were:

Activities: These include: boat launching, bird watching, canoeing, diving, ecological restoration programmes, fishing (net, surf-casting, boat), floundering, jet skiing, kayaking, kite surfing, motor boating, power boat racing, radio controlled yachts, rowing, sail training (including for people with disabilities), sailing, sea scouts and cadets, shellfish gathering, snorkelling, stand-up paddleboards (SUP), surf lifesaving, surfing, swimming, waka ama, water safety and environmental education, whitebaiting and wind surfing.

Marine locations: There are no parts of the study area not used. While some areas are more popular for specific activities – such as small-dinghy sailing in the Onepoto Arm and Pāuatahanui Inlet (particularly around club facilities), wind surfing off Plimmerton Beach, surfing in Tītahi Bay and jumping off the Paremata Bridge – there is no area where water-contact recreation does not occur via multiple forms of recreation. Shellfish gathering was widely reported in the inner harbour area, although many interviewees would not do so themselves due to water quality issues.

Special attributes: The core value of the study area was, mostly, that it exists and is readily accessible, with many relevant club facilities conveniently located. The harbour setting is the only recreation setting of its type in the region, with large areas of shallow and relatively warm water that – due to its scale – is relatively safe. The surf lifesaving club at Tītahi Bay adds to the safety of the most popular beach in the study area. Paddlers, wind surfers, kite surfers, sailors and the like, when using the Inlet or Onepoto Arm, are never far from a shore and shallows, which means it is an ideal setting for training and education – although some sailing activities are limited by low tides. There is always some shelter from wind within the enclosed arms. The outer harbour areas and Tītahi Bay offer more excitement and advancement as skills improve. Many interviewees lived locally and treasured the ability to immediately access a natural setting with good beaches, good walking options and excellent fishing, including out to Mana Island. Walking tracks were considered to be extensive with many quality settings.

The Toa Waka Ama Club has a particular relationship with the Harbour based on the intertwined nature of their recreational use and cultural association with the study area; considering Porirua is the awa of the Takapuwahia Marae, and Ngāti Toa paddlers have a multigenerational relationship with the setting and their waka ama activities.

Tidal and weather effects on activity: There are some low tide restrictions on sailing in Pāuatahanui Inlet and Onepoto Arm, otherwise there were no important effects from tides – although some fishing preferences. Access for waka ama is preferred at high tide to avoid walking through mud, but since training must often coincide with after-work and after-school times, low tides must often be endured. Sailing preferences for wind conditions vary depending on location (shelter) and bravery, but most interviewees reported few restrictions on their activities from tide and weather.

Things which prevent recreation: Seven interviewees mentioned occasional poor water quality as a limiting factor for recreation, without prompting. All other unprompted responses

about access limitations related to weather and tides. Two interviewees referred to gathering mussels when water quality was good (based on GWRC website data or personal observation). Several referred to gathering shellfish in the past but had ceased due to perceptions of poor water quality. Several noted other people still harvesting locally (in Ivey Bay, Dolly Varden Beach ('Mana'), Onepoto Arm, Browns Bay). Example comments included (the only ones to directly reference wastewater discharges):

Sailing: Water quality prevents activity – because children often end up in the water. High rainfall leads to local sewerage overflows. An issue with the pumping station. Guidelines from Regional Council tell us when to stay out of the water. Farm effluent also comes down the streams to the sea.

Swimming and boating: We can't swim when pollutants are in the water. Metal levels are too high. Plimmerton Beach has too many events with heavy rain stormwater and sewerage leaks and high E. coli counts. Pāuatahanui less likely to be affected by sewerage – more like green algae and metals. Always careful on mussel collecting. We look at NIWA site and Greater Wellington websites. Pukerua Bay is not polluted but sometimes jellyfish stop us from going into the water.

Swimming: Effluent has closed Tītahi beach a couple of times in the last few years.

Waka ama: Health warnings generally stop activity. Rahui also, and if participants see obvious contamination - not just pollen - they're put off - but not often.

Awareness of outfall south of Tītahi Bay: Two interviewees were not aware of the outfall.

Awareness of poor water quality issues: Interviewees were asked, "Are you aware of any issues to do with poor water quality in Porirua Harbour (Onepoto Arm), Porirua Stream, Pāuatahanui Inlet, Tītahi Bay or Pukerua Bay?" Almost all interviewees were aware, particularly in Porirua Stream and the Onepoto Arm – which most referred to as Porirua Harbour. One interviewee (from Pukerua Bay) noted a concern about poor water quality at Pukerua Bay due to 'runoff from SH1 and railway into streams'. An experienced diver noted significant improvement in local diver health after the installation of the Porirua Wastewater Treatment Plant. Typical responses were:

Aware of poor water at Porirua Harbour and Porirua Stream (poor clarity, run-off and high coliform counts). Pāuatahanui Inlet monitoring shows that quality is compromised – mostly due to sewerage infrastructure and stormwater drains. Aware of poor quality of Tītahi Bay. Don't know about Pukerua Bay.

Aware of poor water at Porirua Harbour and Porirua Stream – know that if they get cut the wound festers. Aware of poor water at Tītahi Bay many years ago but understand it has been cleaned up. Pāuatahanui Inlet it is cleaner than Porirua. Don't know anything about Pukerua Bay - seems OK.

Water quality appears to have improved - was not unusual for paddlers to have infections after paddling and some used Vaseline as a precaution to prevent water contact. But sea horses have been seen in the Harbour recently and this gives a perception that things are improving. Pukerua Bay perceived as being quite clean - although not sure how the local houses deal with their sewage. Tītahi Bay perceived as being cleaner now than in the past - recall being able to see a brown plume when standing on the hills above, but not so much now. Pāuatahanui not perceived as being any cleaner than any other part of the harbour - considering houses and roads nearby - assume cadmium and other heavy metals, but would be good to get some real data about actual levels of contamination.

5 Assessment of effects

This section describes the wastewater discharge activity and its modelled effects on water contact recreation, shellfish consumption and terrestrial coastal activities. Most recreation activities identified in the study area include some form of accidental water contact – from boarding and falling out of, or off various small vessels (waka ama, sailing dinghies, SUP, rowing skiffs, etc), or direct water contact via swimming, paddling and surfing. Shellfish gathering has been identified as occurring at low levels throughout much of the study area. The assessment also includes the effects of aerosolisation of potentially contaminated water via wave and wind action, and the inhalation of water droplets by people either on the water or nearby ashore.

5.1 The WWTP activity and human health effects

The WWTP treats wastewater collected from Porirua City and the northern catchments of Wellington City and has been upgraded over the last six years to improve the quality of the discharge at Rukutane Point less than 1000m west of the Tītahi Bay beach. However, during peak wet weather events, over-capacity flows currently bypass the secondary treatment process (the aeration basin and clarifiers) and are only treated to a primary level (screening) before being combined with secondary-treated wastewater. This 'combined' wastewater is then UV irradiated and discharged. Normal inflows (that is, most of the inflows) are fully treated before discharge.

Further improvements are scheduled for completion over two stages: by July 2021, an upgrade of the UV system will allow disinfection of flows to a capacity of 1,500 L/s; and by July 2023 an upgrade of WWTP inlet works will increase the flow capacity from 1,000 L/s to 1,500 L/s and the capacity of the secondary treatment processes to 1,500 L/s. The outcome will be all flows received at the WWTP being secondary treated and UV irradiated. The application seeks resource consent for:

- A maximum average discharge flow of 38,016 cubic metres per day (up from 24,000 m^3 under the current consent); and
- A peak discharge flow of 129,600 cubic metres per day (up from 92,800 m^3 under the current consent).

A new 20-year consent is being sought, and during this time the discharge quality is expected to show an initial sharp improvement because of the capacity and treatment upgrades, followed by a gradual decline due to population growth, which will progressively increase wastewater inflows and contaminant loads. This process is reviewed in the AEE.

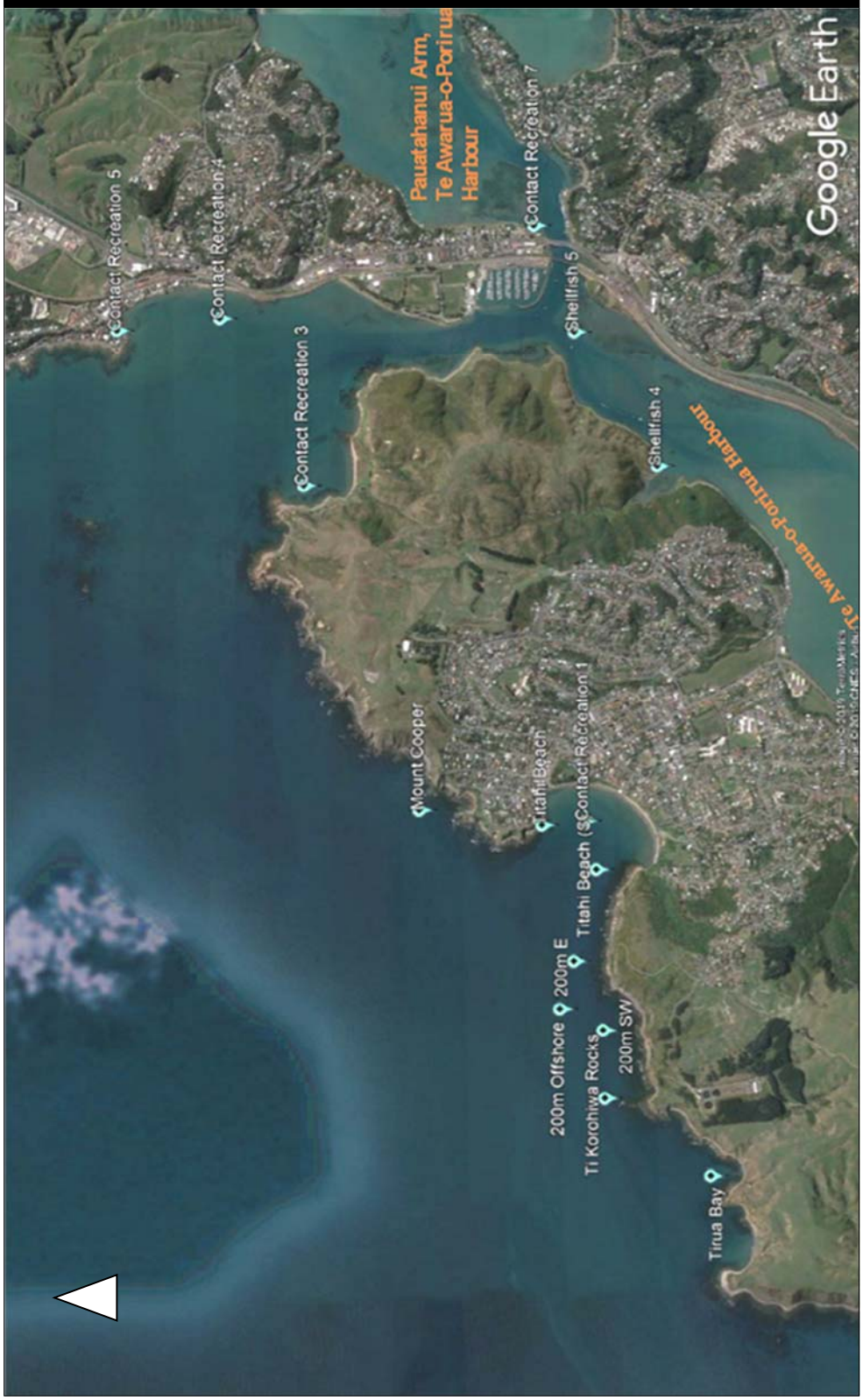
This review assumes the implementation of the proposed improved treatment options described above and as assessed for their effects on contact recreation, shellfish consumption and aerosolisation by Oldman & Dada (2020). Considering the modelling of treated wastewater dispersal from the discharge point in DHI (2018), these two assessments base their conclusions on further modelling of human health risks at 15 representative exposure sites (Figure 52). These exposure sites were chosen based on a 2018 version of this recreation report which reviewed recreation and shellfish gathering activities within the study area.

In summary, the modelling[36] shows that – based on the results of current discharge monitoring for faecal coliforms and enterococci and the proposed upgrading of the WWTP UV disinfection system – it is expected that an enterococci discharge limit of <500 cfu/100mls (95%ile) will be met at all 15 exposure sites under current and future wastewater flows – which meets the

[36] Based on DHI dilution and dispersion modelling

targets of the Proposed Natural Resources Plan (PNRP). However, modelling (using QMRA[37]) of the concentrations of several varieties of virus in the receiving water after discharge was considered a more effective measure of describing the expected impact on primary and secondary contact recreation and shellfish gathering, and this is described below.

Figure 52: Fifteen exposure sites (Oldman & Dada 2020)



[37] Using Quantitative Microbial Risk Assessment (or QMRA) carried out by Streamlined Environmental Ltd (Oldman & Dada 2020)

5.2 Effects assessment

This assessment compares the effects of the treated discharge, including proposed system upgrades, against the 'existing environment' which, for the purposes of the consent application:

- Includes the past effects of the activity (that is, the extent to which the environment may have already been altered by the operation of the WWTP up until now);
- Includes any structures which it would be fanciful or unrealistic to assume would be removed if the consent renewal was declined; but
- Does not include the ongoing effects of the activity which is the subject of the resource consent application.

If the ongoing effects of the existing discharge are not considered (that is, if the existing environment is assumed to not include an operating WWTP), the activity as a new proposal would have no adverse effect on contact recreation and shellfish gathering at any of the exposure sites. However, improvements to the discharge are highly unlikely to reduce the number of human health warnings issued for contact recreation in the study area, and warnings for the consumption of shellfish are likely to remain in place due to the many other sources of contamination in the area (see Section 3.2.1 of this report and Section 3.3.2 of the AEE).

In terms of effects on marine biota, Morrisey et al (2019) found that there were no clear differences between the fauna and flora around the existing outfall and those at Round Point or the reference location, suggesting that the existing discharge has not had a marked ecological effect. However, the potential for more than minor adverse effects over time on the biota of the subtidal rocky reef was identified due to ammonia and EOC[38] toxicity and nutrients, based on a conservative review. In response, a mitigation regime is proposed relying on a 'monitoring, review and response' approach to ensure that potential persistent effects do not occur. This is reviewed in Section 5.8 of the AEE.

The degree to which the WWTP discharge would represent an unacceptable cumulative effect in association with other sources of contamination will depend on the scale of effect of each of those individual contamination sources, and how that might change over time. There is no existing improvement programme for those other contamination sources to refer to, so it is not possible to identify if there is a point in time when the WWTP discharge would become a specifically measurable influence on, for example, contact recreation standards for Tītahi Bay. However, the WWTP is modelled to account for less than 20% of the PNRP 95-percentile target for enterococci at 2018 at Tītahi Bay south, and 80% of the target 200m from the outfall (see Section 5.6.1 of the AEE). There are no other sources of contamination at the outfall, and so it is unlikely that the WWTP discharge would compound over time to exceed the standard. Conversely, the WWTP would only ever contribute a minor portion of any cumulative discharge effects which would result in an exceedance in Tītahi Bay.

Calculating the stand-alone effects of the WWTP on recreation over time is based on comparing the disinfection performance of the upgraded plant with the resulting reductions in viral pathogen concentrations in the discharge. The disinfection performance for the upgraded plant, including combined secondary and UV treatment, is reported in Loughran, Jenner & Haverland (2020) (Appendix N to the AEE) and is summarised in Sections 2.7.4 and 5.6.2 of the AEE. This indicates different levels of deactivation for each major viral pathogen identified by the QMRA (where dose-response data are available), for a flow of 440 L/s with combined secondary and UV treatment:

[38] Emerging organic contaminants - EOCs include chemicals such as those used in industrial and domestic cleaning products, paints, inks and surface treatments, kitchen and laundry detergents, personal care products, cosmetics, pharmaceuticals and medicines.

- a minimum log 5.0 removal for norovirus;
- a minimum log 7.0 removal for enterovirus; and
- a minimum log 3.0 removal for adenovirus.

Deactivation rates for a flow of 440 L/s are used for the assessment rather than the peak flow of 1,500 L/s. Flows at the higher rate are uncommon (see Section 2.6 of the AEE), are not associated with increased viral loads in the incoming wastewater at the WWTP (they are diluted by stormwater intrusion), and coincide with rainfall events which are associated with high background levels of contamination in inshore waters.

Based on the results of the QMRA, the AEE reports on what these reductions in viral load mean in terms of the health risk for contact recreation by children, and for shellfish consumption. Children are used in the assessment as they are the most susceptible to infection; and so for adults the assessment is conservative. The risk assessment also assumes that all enterovirus infections result in an illness (due to a lack of dose-response data) while illness/infection ratios of 0.6 and 0.5 are applied for noroviruses and adenoviruses respectively (where dose-response data are available). Norovirus and enterovirus are associated with gastrointestinal illness ('enteric') caused by ingesting contaminated water or food, while adenoviruses cause respiratory infections and febrile illness (marked by a fever).

The illness risk thresholds are defined in Table 5.

Table 5: Human health risks from viruses for 15 exposure sites (from Table 5-5 of the AEE)

Swimming or shellfish consumption	Inhalation of pathogens in spray/aerosols
High illness risk (>10% gastrointestinal illness)	High illness risk (>3.9% acute febrile illness[39])
Moderate illness risk (5-10% gastrointestinal illness)	Moderate illness risk (1.9% - 3.9% acute febrile illness)
Low illness risk (1-5% gastrointestinal illness)	Low illness risk (0.3 – 1.9% acute febrile illness)
No observable adverse effects level (<1% gastrointestinal illness)	No observable adverse effects level (<0.3 acute febrile illness

The QMRA indicates, at the modelled log reduction levels for all three viral pathogens, that the illness risk at all sites is at the "no observable adverse effects level" (NOAEL) for all contact recreation and shellfish gathering at all exposure sites, including those at 200m of the discharge. The human health risk assessment also finds that the discharge will meet PNRP standards for enterococci at and beyond the 200m mixing zone.

Table 6 summarises the results for viral pathogens by the type of recreation.

Table 6: Human health risks from viruses for 15 exposure sites

Activity	Risk
Primary contact (swimming, surfing) – enteric illness.	The **norovirus** illness risk at all sites, for current and future flows, are assessed as NOAEL. The **enterovirus** illness risks at all exposure sites for current and future flows are assessed as NOAEL.
Secondary contact (inhalation of spray – walking, paddling etc) – febrile illness.	The **adenovirus** illness risk under current and future flows is assessed as NOAEL for all exposure sites.

[39] Acute febrile illness is the medical term used to describe a sudden fever or elevation in body temperature typically in response to a bacterial or viral respiratory infection.

Table 6: Human health risks from viruses for 15 exposure sites	
Activity	**Risk**
Raw shellfish consumption - enteric illness.	The risk of gastrointestinal illness from **enteroviruses** at the three representative shellfish gathering sites in the inner harbour are at NOAEL for current and future flows.

The scale of effects on recreation values are assessed according to the matrix in Table 7. This considers the magnitude of the effect and the value of the setting for recreation. The magnitude of the effect on recreation is usually identified by other specialists for water quality and ecological values, considering, for example:

- The spatial scale and duration of the effect;
- The magnitude or consequences of the effect occurring;
- The value of the organism or habitat affected for recreationally harvested species; and
- The likelihood of the effect occurring.

Recreation value in this assessment correlates to the different levels of use of the setting identified in Figure 1 on page 6.

Table 7: Scale of impact on recreation values considering magnitude of effect					
		Recreation value			
		Very High	High	Moderate	Low
Magnitude of effect	High or severe	Significant	Significant	Moderate	Minor
	Moderate or medium	Significant	Moderate	Minor	Minor
	Low or minor	Moderate	Moderate	Minor	Minor
	Negligible	Negligible	Negligible	Negligible	Negligible

A 'significant' adverse effect is likely to displace[40] many or most users from a setting for prolonged periods, but not necessarily for all activities which occur there; although it is likely that amenity for all activities will be degraded. A 'moderate' adverse effect will periodically displace some activities and users, but amenity will not be degraded for all activities. A 'minor' adverse effect will displace a small number of users for short periods, but amenity will almost always be preserved for the majority of activities and users. The scale of effect may be reduced if the area affected is confined and there are ample suitable alternative opportunities for relevant activities. There is no 'minor' scale of impact for 'high' or 'very high' use recreation settings. This reflects community expectations that very popular settings are managed for extremely small or negligible human health risk (as expressed through interviews for this assessment and the experience of the report author).

In summary, the discharge activity has negligible adverse effects on coastal and marine recreation within the study area, when compared to a scenario where the current discharge is discontinued, and based on the conservative health risk assessment. However, as discussed, beyond the immediate outfall area, there are unlikely to be any changes to real health risks from recreation or shellfish-gathering due to the many other sources of contamination which affect the most heavily used parts of the study area (compared with both a 'no discharge' scenario and for the life of the proposed consent).

[40] Force people to recreate in other settings or not at all.

6 Conclusion

This report assesses the impacts on recreation of the continued operation of the Porirua Wastewater Treatment Plant outfall discharge at Rukutane Point.

Rukutane Point is accessible from Tītahi Bay via a walking track, but has only moderate levels of recreational activity, which are mostly shore-based considering the presence of the discharge outlet. Pāua are the only potential source of kaimoana at and near the site, and although in low numbers, are more common there than nearby, probably due to a community reluctance to harvest near the discharge. The wastewater plume is rapidly diluted beyond the 200m mixing zone, but ultimately enters Tītahi Bay and Te Awarua-o-Porirua Harbour (Onepoto Arm) and Pāuatahanui Inlet, albeit at much lower concentrations. These waterbodies have high regional recreation value, with a wide variety of uses suitable for all age groups and abilities, and are of major significance to Porirua residents. While harvesting of pipi and cockles is not recommended by the DHB, particularly after rain, it is commonly observed within the Harbour.

These waterbodies are also affected by multiple other sources of pollution, and the WWTP discharge appears to be only a minor contributor to the overall health risk from recreation and shellfish harvesting in either Tītahi Bay or the Harbour.

The WWTP is to be upgraded to treat all peak inflows and to better cope with future population growth. Modelling indicates that – based on the results of current discharge monitoring for faecal coliforms and enterococci and the proposed upgrading of the WWTP UV disinfection system – it is expected that an enterococci discharge limit of <500 cfu/100mls (95 percentile) will be met at the 15 representative exposure sites under current and future wastewater flows – which meets the targets of the Proposed Natural Resources Plan.

Viral pathogens will also be present in the improved discharge, although at much lower concentrations than prior to upgrading. The human health risk assessment used to support this assessment has focused on the persistence of specific viruses which are known to cause health risks in receiving waters where human contact through ingestion or inhalation is possible. The presence of these viruses is not routinely tested for in wastewaters or receiving waters due to cost and laboratory availability, but are considered better gauges of health risk than indicator bacteria like enterococci.

The QMRA process, from which the human health risks were derived, was based on inherently conservative assumptions. The risk to children – the most susceptible to enteric and febrile illnesses – was assessed. It was also assumed that there is no natural disinfection – such as from solar radiation – in the environment. For shellfish, it was assumed that all are eaten raw. The QMRA relied on a high level of disinfection of viruses at the WWTP and accordingly resulted in an assessment of ‘no observable adverse effects’ on illness risks for primary and secondary contact recreation and for shellfish consumption. Accordingly, considering the WWTP as a new activity, the scale of adverse effect on recreation and shellfish gathering within the study area will be negligible over the period of the consent.

7 References

Airey, M. 2012. *Spot X Boat Fishing New Zealand*. Spot X Publications, Auckland.

Allen, W. Elmetri, I. Clarke, S. Gibbons. J. Clark, K., Sinner, J., Jiang, W. and Taylor, M. 2009. *Mapping the Values of New Zealand's Coastal Waters. 3. Social Values*. Biosecurity New Zealand

Atkin, Ed. Gunson, M. & Mead S. 2015. *Regionally Significant Surf breaks in the Greater Wellington Region*. 22 May 2015 version. eCoast Ltd client Report prepared for Wellington Regional Council

Booth, K.L. and Lynch, P.M. 2010. *Outdoor Recreation Research Stocktake: Synthesis*. Prepared for Sport and Recreation New Zealand by Lindis Consulting, Christchurch.

Booth, K.L., Lynch, P.M. and Lizamore, C.A. 2010. *Outdoor Recreation Research Stocktake: Bibliography*. Prepared for Sport and Recreation New Zealand by Lindis Consulting, Christchurch.

Brasell, K.A. and Conwell, C. 2019. *Is it safe to swim? Recreational water quality monitoring results for 2017/18.* Greater Wellington Regional Council, Publication No. GW/ESCI-T-19/9, Wellington.

Brasell, K.A. and Morar, S.R. 2017. *Is it safe to swim? Recreational water quality monitoring results for 2016/17.* Greater Wellington Regional Council, Publication No. GW/ESCI-T-17/98, Wellington.

Davey, N.K. Hartill, B. Cairney, D.G. Cole, R.G. 2007. *Characterisation of the Marlborough Sounds recreational fishery and associated blue cod and snapper harvest estimates*. Final Research Report for Ministry of Fisheries research project REC200502 62 p. (Unpublished report held by Mfish, Wellington and reported within the MPI NABIS mapping system).

Department of Conservation. 1996. *Conservation Management Strategy for Wellington 1996–2005.* DOC, Wellington Conservancy.

Department of Conservation. 2010. *New Zealand Coastal Policy Statement 2010*. DOC, Wellington.

Department of Conservation. 2012. Wellington Harbour Islands Kaitiaki Plan 2012–2017. DOC, Wellington Conservancy.

DHI. 2018. *Porirua Outfall Options.* Report 44801313 prepared for Wellington Water.

DHI. 2016. *Porirua Harbour Water Quality Forecast Annual Quality Status Report.* Technical memo prepared for Greater Wellington Regional Council. 22 August 2016.

DHI. 2017. *Porirua Harbour Water Quality Forecast Annual Quality Status Report.* Technical memo prepared for Greater Wellington Regional Council. 19 June 2017.

Draper, M. 2012. *Sport X Surfcasting New Zealand*. Spot X Publications, Auckland.

Draper, M. Enderby, T. Enderby J. (eds) 2008. *Sport X Fishing New Zealand*. Spot X Publications, Auckland.

Enderby, T. Enderby J. 2007. *Sport X Diving New Zealand*. Spot X Publications, Auckland.

Gemba Group, 2013. Sports Data Tables April 2012 – March 2013. Data prepared for Sport NZ, Wellington.

Greater Wellington Regional Council, 2009. *Navigation and Safety Bylaws Wellington region*. GWRC

Greater Wellington Regional Council, 2019. *Proposed Natural Resources Plan for the Wellington Region Decision Version (31.07.2019)*. GWRC

Greenfield, S. Martin, E. 2015. *Survey results for river and coastal recreational use in the Wellington Region*. Greater Wellington Regional Council document WMGT-8-14

Herrero, J. 2016. U*sing big data to understand trail use: three Strava tools.* TRAFx Insights Series 2016. Available at: https://www.trafx.net/img/insights/Using-big-data-to-understand-trail-use-three-strava-tools.pdf

Kalafatelis, E. & Magill, K. 2013. *Rates of participation in recreation boating*. Research New Zealand client report prepared for Paul Vance, Maritime NZ.

Key Research, 2014. *Porirua Harbour and Catchment Environmental Perceptions Study 2014*. Client report for Porirua City Council, Wellington City Council and Greater Wellington Regional Council.

Loughran, P., Jenner, G. & Haverland, R. 2020. *Porirua WWTP - Technical Memo - Disinfection Performance;* Connect Water

Marine Industry of New Zealand, 2007. *Marine Industry of New Zealand Annual Report for period to 31 December 2007*. MIA, Auckland.

Maritime New Zealand, 2007. *Boating Safety Strategy – 2007 Review of the New Zealand Pleasure Boat Safety Strategy*. MNZ, Auckland.

Maritime New Zealand, 2015. *Maritime Rules Part 22: Collision Prevention.* MNZ, Auckland.

Morrisey D, Berthelsen A, Clark, D, Cunningham S, Edhouse S, Floerl L, Sneddon, R, D'Archino R, 2019 *Porirua wastewater treatment plant outfall: assessment of effects of different outfall options on the marine environment*. Prepared for Wellington Water Ltd. Cawthron Report No. 3380

Morse, P.B Brunskill, P. 2004. *Wavetrack New Zealand Surfing Guide*. Greenroom Surf Media, NZ.

Murray, K, von Kohorn. R. 1999. *The New Zealand Cruising Guide Central Area.* Steven William Publications

Oldman, J.W. & Dada A.C. 2020. *A Quantitative Microbial Risk Assessment of the Porirua WWTP discharge and receiving environment*. DHI1901, Streamlined Environmental.

Oliver, M.D. & Conwell, C. 2017. *Coastal Water Quality and Ecology monitoring programme Annual data report, 2016/17*. Greater Wellington Regional Council report GW/ESCI-T-17/97

Oliver, M.D. & Conwell, C. 2019. *Coastal Water Quality and Ecology monitoring programme Annual data report, 2017/18*. Greater Wellington Regional Council report GW/ESCI-T-18/144

Sport New Zealand, 2013. *Sport and Recreation Participation Trends (1997 to 2007)*. Sport NZ, Wellington

Sport New Zealand, 2015a. *Sport and Active Recreation in the Lives of New Zealand Adults. 2013/14 Active New Zealand Survey Results*. Sport NZ, Wellington

Sport New Zealand, 2015b. *Sport & Active Recreation Regional Profile Wellington Region Findings from the 2013/14 Active New Zealand Survey*. Sport NZ, Wellington

Unwin. M.J. 2009. Angler usage of lake and river fisheries managed by Fish and Game New Zealand: results from the 2007/08 National Angling Survey. NIWA Christchurch.

Vance, P. 2014. *Synthesis of research conducted in recreational boating*. Maritime NZ internal report.

Wellington Regional Public Health. 2018. *Te Awarua-o-Porirua Harbour Public Health Communication Plan Background Document.* Wellington Regional Public Health.

World Health Organization. 2003. *Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters.* WHO, Geneva

Appendix 1: Contact list

Organisation	Contact name
Boatshed owner	Paul McVicar
Boatshed owner	Robyn Moore
Friends of Mana Island	John McKoy
Guardians of Pāuatahanui Inlet	Tony Shaw
Harbour Master GWRC	John Tattersal
Hawaikinui Tuarua Waka ama	Ray Underhill
Mana Cruising Club	Allan Davidson
Mana Marina	Neil Cornwell
New Zealand Sea Adventures	Tony Howell
Paremata Boating Club	Chris McCarthy
Paremata Residents Association	Russell Morrison
Pāuatahanui Residents Association	Diane Strugnell
Plimmerton Boating Club	Gail Carmichael
Plimmerton Residents Association	Tm Shepperd
Porirua Canoe Kayak Club (waka ama)	John Hodges
Pukerua Bay Residents Association	Iain MacLean
Sailability	Don Manning
Te Ara Moana Trust	Jenny Bedford/ Heidi
Tītahi Bay Boating Club	John Goodman
Tītahi Bay Fishermans Club and boatshed owner	Steve Warren
Tītahi Bay Residents Association	Graeme Ebbertt
Tītahi Bay Surf Lifesaving club	Margaret McDowell
Toa Waka Ama Club	Jeanette Grace
Wellington Jet Sport Club	Carl Lampe
Wellington Power Boat Club	Raewyn Palmer
Wellington Radio Yacht Club Porirua	Ed Schmidt
Wellington Recreational Marine Fishers Association	Jim Mikoz
Whitby Residents Association	Gavin Mclaughlin
Whitebaiter	Ian Laing
Windsurfer (ex-president Windsurf NZ)	Bruce Spedding