



Te Awarua o Porirua Harbour Scorecard - 2016

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Background

The two water systems of the harbour (the Pauatahanui Inlet and the Onepoto Arm) once supported a bountiful supply of fish and shellfish. In addition to the marine species, rich forests surrounded the harbour and provided valuable habitat for birds. Flax was abundant in the swamps.

From the 1820s Europeans began to settle in Porirua. From the 1850s onwards, major impacts on the harbour system were caused by forest clearance propelled initially by an increasing demand for timber. Forest clearance proceeded rapidly so that within some 40 years lowland Porirua was transformed from a mostly forested into a mostly pastoral landscape. Interestingly, there is more vegetation around the harbour system now than there was at the end of the 19th Century.

The progressive clearance for pasture resulted in a massive increase in sediment, which started filling the harbours at a rate of 2 – 4mm/year from a pre-European background inflow of 1mm/yr.

The next big effect was urban development. This increased sediment inputs to the harbour and subsequent deposition and, together with the effects of roads, railways and reclamations, dramatically altered the shoreline and the tidal prism (the amount of tidal water that could move in and out of the harbour system). Sedimentation rates increased substantially so that by the mid 1970s the average rate was estimated to be between 6 and 9mm/yr. In parts of the Pauatahanui Inlet it may have been as high as 10-15mm/yr at some sites. If continued, these rates would result in the Inlet being in-filled and becoming a swamp in 145 - 195 years and the Onepoto Arm in 290 – 390 years. (Gibb, 2009, 2011).

In addition to sediment, urban development added chemical and biological contaminants and nutrients, together with toxins from urban run-off. Agricultural chemicals and industrial run off in the post Second World War era added further pollution which is now embedded in harbour sediments and affects its shellfish and fish stocks.

Fortunately, this legacy of contamination is now being addressed by the three authorities responsible for the harbour and its catchments – Porirua City Council (PCC), Wellington City Council (WCC), and Greater Wellington Regional Council (GWRC). Together with Ngati Toa and other organisations and agencies, these authorities have drawn up a Porirua Harbour and Catchment Strategy and Action Plan. This sets out directions, actions and targets designed to arrest the decline in harbour condition and return it to a healthy and resilient state. The Action Plan is the touchstone and guide towards a brighter future for the harbour.

On a further positive note, scientific surveys and research tell us that the harbour still has a solid foundation for a healthy ecosystem. Among these indicators are continuing large numbers of cockles; it is the southern-most nursery for rig

(sand shark); resident and migratory birdlife use both arms of the harbour; apart from pathogens, no other harbour contaminants are occurring in fish or shellfish; spotless crane have re-established in the Pauatahanui Wildlife Reserve; and there are a host of other common fish and birdlife species that live in or use the harbour.

Te Awarua O Porirua Harbour and its catchment are significant to the people of Porirua City as well as those across the Wellington region.

- It is the focal point and defining feature of Porirua City
- It is a gateway to Wellington City from the Kapiti Coast and points north.
- It is a much-valued recreational playground for the city and the region
- It is a regionally significant bird and fish habitat and includes a wildlife reserve of national importance
- It is a significant resource for local iwi, Ngati Toa.

This scorecard serves to raise awareness and report on long term progress in meeting the objective of the Porirua Harbour and Catchment Strategy for “a healthy catchment, waterways and harbour”.

The Porirua Harbour Trust

The Trust (*Porirua Harbour and Catchment Community Trust* but marketed as the *Porirua Harbour Trust*) was established in 2011 with representation from the three councils, Ngati Toa and community members. Two of our key objectives are to:

- Advocate for the sustainable management of the harbour and its catchment; and
- Foster an understanding of ecological and environmental issues within the harbour and its catchment through research, education and community awareness.

The Trust has undertaken to report annually with reference to a set of “State of the Harbour” indicators with the aim of tracking progress towards a healthy harbour. To this end a review panel of two Trust members and two independent observers has been established. The panel considers data available from the Councils as well as the Trust’s own surveys and projects and uses this to report on five key indicators of the health of the harbour.

The review panel comprises:

Grant Baker, Chairperson of the Porirua Harbour Trust
Lindsay Gow, Trustee of the Porirua Harbour Trust
Dr John McKoy, Marine Scientist
Clive Anstey, Landscape and Resource Planner.

The annual scorecard on the health of the Porirua Harbour will be available at the start of each calendar year.

Executive Summary for 2016

The 2016 “State of the Harbour” scorecard is the fourth for the Trust and reports against the baseline established for each of the five indicators being measured in our first report in 2013. While it is still too early to report on trends appearing across the five indicators our major concerns are the ecological health of the harbour, the increase of mud in the Pauatahanui Arm, and the quality of our streams and water quality at our swimming beaches.

Our key findings are:

Agency Action:

We are seeing a strong, coordinated and increasing commitment from councils and agencies for the harbour strategy programme and this indicator continues to receive a **Good** rating.

Sedimentation:

Sedimentation rates for 2016 are good within the harbour overall; the Onepoto Arm (subtidal) and Pauatahanui Inlet (intertidal) both receive a rating of **Excellent**. However, and as discussed in the comments section below, there is a growing concern about the deposition of fine mud in parts of the harbour and particularly in the Pauatahanui Inlet subtidal areas.

Education and Recreational Usage:

Recreational Water Quality at all of our major swimming sites in the harbour continue to be of concern with three of our top beaches at Plimmerton given a **Poor** rating - *water quality is not always suitable for swimming*.

Only the Karehana Bay beach which is outside the Harbour and Pauatahanui Inlet at the Paremata Bridge get a **Good** - *being suitable for swimming for most of the time*. There has been no improvement in the ratings at any of the sites in recent times, with most continuing to be rated “poor” even though considerable work has been carried out on the storm water and sewerage systems. This is a key concern over our summer months.

The Education programme provided by the Trust and the councils which targets schools across the catchment has received a **Good** rating having increased the number of schools using the resources from 26 schools out of the 51 schools in the catchment in 2015 to 39 in 2016. The wider education programme within the catchment run by the Trust and GWRC continues to achieve increases in school children engaged in catchment programmes.

Ecological Health of the harbour:

All of the streams monitored in the catchment show that the macroinvertebrate health is lower in the streams measured with only one of the four measuring points receiving a **Good** rating over the last three year period. Three of the four measuring points received only a **Fair** in this year’s result and a decline in ecological health over time. Our streams continue to languish toward the bottom

of the list for water quality compared against all streams in the Greater Wellington region.

The ecological health of the harbour is **Fair** to **Good** and while there continues to be an increase in mud, particularly in the upper Pauatahanui Inlet, the sand-dominated habitats appeared to be in good (healthy) ecological condition. The concentrations of metals, particularly lead, copper and zinc, found in the soft muds of the Onepoto Arm of the harbour remain elevated.

Waste:

The result for Waste, large rubbish items collected from the Porirua Stream area of the Onepoto Arm, continues to be rated as **Fair** with little change in the last three years on the number of large items, predominantly tyres still getting into the harbour. PCC needs to provide an incentive to users to take tyres to the landfill rather than dump these in our harbour.

Reported below are the full results and the commentary for the five indicators.

The Scorecard for 2016

This scorecard for the 2016 year is the fourth in an annual series that PHT will produce. The scorecard assesses five indicators related to the harbour and catchment using a five-point scale for each one. (5 being excellent and 1 being poor).

The scores highlight changes in key aspects of harbour and catchment quality, and give an indication each year of progress on the *Strategy and Action Plan*.

The five indicators are:

- 1 **Agency Action** – a review of local authority and agency progress with implementing the *Strategy and Action Plan*;
- 2 **Sedimentation** – a summary of data from the GWRC’s sedimentation records from 18 recording plates in the Onepoto Arm and Pauatahanui Inlet;
- 3 **Education and Recreational Usage** – feedback from recreational groups using the harbour waters, water quality records from key beaches and the number of schools involved in the catchment education programme;
- 4 **Ecological Health** – a summary of data from GWRC’s records on the quality of major streams entering both arms of the harbour and on harbour quality;
- 5 **Waste** – assessment of the changing volumes of large rubbish items collected from the harbour at the Porirua Stream mouth by the Trust.

An education component was added to the third indicator (Education and Recreational Usage) in our 2015 report which now also measures the uptake of the Porirua Harbour Trust catchment education programme across the 51 schools in the catchment.

The review panel recognizes that data collection in the harbour and catchment has been underway for many years, but only recently has a more comprehensive set of data been collected. The review panel has taken the approach of only reporting on matters with at least three years of comparable data available. This is because data gathered for just one or two years might result in one off events overly influencing the longer-term average.

The review team acknowledges the strong and helpful support received from the environmental science team at GWRC in making the data available.

The criteria for each indicator being measured, the five-point scale explanation and the full results are included in Appendix 1.

1. AGENCY ACTION

What is being measured:

An Annual Review of progress by all agencies against the Porirua Harbour Strategy and Detailed Action Plan

This includes a comparison of what was stated in the Detailed Action Plan with what was funded and planned and achieved through outputs and outcomes.

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Comment
3	3	4	4	In the 2016 year, the Trust notes there continues to be a generally strong and coordinated commitment from councils, and agencies for harbour strategy programme projects and activities

Comment:

The *Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan* has been in place since March 2012 and councils and agencies have continued to include in their annual and long term planning the funding required to carry out the work identified in the plan. The long term, 10 year plans were reviewed in 2015/16 and we are now in the second of the three year cycles.

The Trust was pleased to see affirmative actions by Porirua City and Greater Wellington Regional Councils in their recent 10 year plans and related activities.

Wellington Water is an increasingly important agency in achieving harbour and catchment outcomes. It manages water treatment and supply, storm water and wastewater service delivery in the Wellington region. It says, on its website wellingtonwater.co.nz that “*an important part of our work is promoting water conservation and sustainability.*” The Harbour and Catchment Action Plan includes a number of specific projects for which Wellington water is responsible.

The catchment based “Whaitua Committee” has been in place for two years. This committee is working to collate community, scientific, economic and geographical information to gain an understanding of the current state of water in their catchment area. The Whaitu process will end up modelling the entire catchment and harbour, and setting limits for water *quality* and *quantity* in the streams and harbour.

The purpose of the Whaitua Committee is to develop a set of environmental goals or a vision for their catchment area which might include setting targets or limits for water as suggested by the National Policy Statement for Freshwater. Some of these recommendations might be included in the Natural Resources Plan for the Wellington Region.

The Te Awarua-o-Porirua Joint Harbour Committee has overseen the first three year review of the Harbour Strategy. The Committee has affirmed the original objectives, priorities, targets and timeframes. It is also responsible for directing a coordinated cross agency strategy and work plan that sets out harbour and catchment related activities, responsibilities, priorities and budgetary commitments for the next two years

Over the 2015-16 year, the Harbour Committee chair notes that there is “*a much greater prominence of our harbour in decision making for the Porirua and Greater Wellington Regional Councils.*”

In its Annual Report, the Harbour Committee sets out some highlights, as follows:

- *Completion of a catchment-wide Sediment Reduction Plan*
- *Completion of consents, planning and preparation for the Porirua Stream Mouth Estuary Enhancement Plan Project*
- *Porirua City Council adoption of a Stormwater Bylaw*
- *Greater Wellington Regional Council’s appointment of the harbour-catchment’s first dedicated Land Management Officer*
- *Commencement of a Drains to Harbour street drain labelling and education programme*
- *Porirua City Council’s reorganisation to give greater emphasis and support to strategic priorities, including the harbour programme.*

While these and other deliverables mentioned in the Annual Report show commitment and consistent activity by all agencies, there is no available reporting on the status of each of the projects set out in the Action Plan.

The Trust considers that, as part of its Annual Report, the Harbour Committee should produce an itemised status report against each of its project-activity areas. The absence of such information makes it impossible to meet our intentions of reporting on “*a comparison of what was stated in the Detailed Action Plan with what was funded and planned and achieved through outputs and outcomes*”.

The Trust is seeing a generally strong, coordinated commitment from councils and agencies for the Harbour Strategy programme. But, as mentioned above, we want to see more specific project-activity reporting with a particular emphasis on priority deliverables and outcome-based results. For these reasons, we have kept the overall rating for the 2016 year at **4**.

The Trust will continue to engage with the councils, the Joint Harbour Committee, Ngati Toa and agencies to ensure work is planned, implemented and delivered as set out in the *Strategy and Action Plan*.

2. SEDIMENTATION

What is being measured:

2.1 Harbour Sedimentation. Indicates the Mean Annual sedimentation rate from the 18 sedimentation plates, (9 in the intertidal and 9 in the sub tidal) in the Onepoto Arm and Pauatahanui Inlet. A separate rating is shown for subtidal and intertidal in each inlet and for the harbour as a whole.

Results for each year: Our rating

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Comment
5	5	5	5	Onepoto Arm subtidal
1	5	3	3	Onepoto Arm intertidal
3	4	5	3	Pautahanui Inlet subtidal
3	5	5	5	Pauatahanui Inlet intertidal
-	4	5	4	Harbour Overall

Data used:

To measure sedimentation rates, GWRChas buried concrete plates at 18 sites throughout Porirua Harbour over which annual measurement of sediment deposition are taken, (Subtidal means harbour areas always covered with water; intertidal means areas that are exposed at low tide but covered with water at high tide)

It is important to note that the sedimentation rate in any single year does not necessarily reflect the overall pattern of sedimentation in the harbour. For this reason, the review panel has taken the approach of only using data where a minimum of three years is available to ensure that one off events do not overly influence our reporting.

For example, the sedimentation rate on the intertidal flats of Onepoto Arm near the Paremata Railway Station (Site no. 1) was 14.3 mm in 2012/13 (Table 1), -4.3mm in 2013/14, 1.5mm in 2014/15 and 0.5mm in 2015/16, indicating that there can be large inter-annual variation.

Table 1: Mean annual sedimentation rates for selected locations in Porirua Harbour

(Source: Oliver MD. 2016. *Coastal state of the environment monitoring programme: Annual data report 2015/16.*)

Indicator	Onepoto Arm								Pauatahanui Arm									
	Intertidal			Subtidal					Intertidal					Subtidal				
Site no.	1	2	3	S6	S7	S8	S9	6	7	8	9	10	11	S1	S2	S3	S4	S5
Sedimentation rate (mm) (2012/13)	14.3	12.3	4.3	-	-	-	-14	3.5	9.3	2.0	-0.8	-3.0	-	-	-	-	-	-
Sedimentation rate (mm) (2013/14)	-4.3	-0.3	1.8	0.0	-6.0	-8.0	0.0	-2.0	-4.0	-2.5	4.5	14.8	-30.0	6.6	26.4	8.0	11.0	9.2
Sedimentation rate (mm) (2014/15)	1.5	2.3	2.3	5.0	-92.0	-93.0	4.0	-3.0	-2.0	1.3	-2.5	-5.5	4.0	2.0	18.0	-12.0	-4.0	-10.0
Sedimentation rate (mm) (2015/16)	0.5	7.8	5.0	-16	-2.0	10.0	7.0	-3.5	-5.8	0.0	-5.0	1.8	1.0	8.0	10.0	-	-5.0	-2.0

From the data, the review team has taken the measurements for the intertidal and subtidal areas of each harbour arm and averaged these each year to arrive at a mean sedimentation rate to indicate what is happening in each part of the harbour on an annual basis. This is then rated using the criteria as defined in Appendix One to provide an index of risk/condition. The overall target is to have sedimentation at a mean annual rate of less than 1mm per year.

Table2: Sedimentation Index for each part of the Porirua Harbour

Rolling mean of 3yrs for sedimentation data

Indicator	Onepoto Arm		Pauatahanui Arm		Total Harbour
	<i>Intertidal</i>	<i>Subtidal</i>	<i>Intertidal</i>	<i>Subtidal</i>	
Sedimentation Index rate (mm) (2010/13)	10.3	-14.0	2.2	-	-
Sedimentation Index rate (mm) (2011/14)	-0.9	-3.5	-3.2	12.2	1.2
Sedimentation Index rate (mm) (2012/15)	2.0	-4.4	-1.3	-1.2	-11.3
Sedimentation Index rate (mm) (2013/16)	4.4	-0.25	-2.0	2.2	1.1

Our Comment:

The sedimentation rates vary considerably on a year to year basis but in the main the news is good with the mean sedimentation rate for the 2013/16 year being 1.1mm for all sites monitored, with slight reductions in the Onepoto Arm subtidal and Pauatahanui Arm Intertidal and increases in the Onepoto Intertidal and Pauatahanui Subtidal.

The sedimentation rate for the Onepoto Arm (subtidal), and Pauatahanui Inlet (intertidal) are rated as Excellent, and are below the desired sedimentation rate of 1mm per year.

The measurements in the subtidal areas of the Pauatahanui Arm show both increases and decreases across the measuring points and it will be interesting to see how these continue to change as we move further into the Transmission Gully project construction period. However, with only three year's data collected, it is too early to say how deposition rates will vary. The predicted land disturbance, particularly from Transmission Gully construction, forest harvesting and urban development is likely to have further impacts on the harbour in the years ahead. The flood which arrived in November is not included in these results so it will be interesting to see what impact this and other weather events have on future measurements.

There is a large increase in mud in the Pauatahanui Arm with the mean mud content of subtidal sediments increasing from 40%, to 49%, to 59% and now 62% in the last four years.

Mud causes problems for harbour life as it creates conditions where oxygen and nutrients are reduced. The result is a smelly, unhealthy sediment layer that reduces diversity of plants and sea life. Soft mud also gets moved around the harbour and causes noticeable reductions in water clarity and quality.

Strategy partners have produced a Sediment Management Plan outlining how they will address ways to reduce the sediment inflows and to work on achieving the long term target set in the Harbour Strategy of less than 1mm/year on average. Reducing the fine-grained mud component from catchment run-off is important, and this will be a particular challenge given the potential impact of the predicted land disturbances that will occur in the immediate years ahead.

3. EDUCATION AND RECREATIONAL USAGE

What is being measured:

3.1 Recreational usage of the Harbour.

Feedback from recreational groups on the quality of the harbour in satisfying their recreational expectations.

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Comment
4	4	NA	3	

Comment:

A survey was carried out across recreational users of the Porirua Harbour. This survey was sent to the yachting, boating, rowing, outrigger canoeing and kayak clubs.

The survey provides a rating for their overall experience in the past year and their experience on the water quality. Recreational groups rated their experience on the water as good, however water quality received a lower rating of fair. Overall we have rated the recreational usage as **Fair**.

The main concerns from recreational users is; the increase in sedimentation and the shifting and growth of sand banks which means they have to be alert in respect of the areas they use in the harbour; the water quality especially after storm events; and the amount of debris around the shoreline.

What is being measured:

3.2 Recreational Water Quality

Recreational water quality results from weekly summer monitoring of six sites in Porirua Harbour

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Sites	Comment
4	4	3	4	Pauatahanui Inlet at Paremata Bridge	suitable for swimming most of the time
3	3	4	4	Karehana Bay at Cluny Rd	suitable for swimming most of the time
3	3	3	3	Pauatahanui Inlet at Water ski club;	generally suitable for swimming with care
3	3	3	2	Plimmerton Beach at Bath Street	water quality is not always suitable for swimming
2	2	2	2	South Beach at Plimmerton	water quality is not always suitable for swimming
2	2	2	2	Porirua Harbour at Rowing Club	water quality is not always suitable for swimming

Data Used:

GWRC and PCC jointly monitor microbiological water quality at 10 coastal sites in Porirua, six of which are located either within the harbour or on its outer margins. The monitoring programme comprises weekly water sampling for 20

weeks between mid-November and the end of March (monthly sampling also occurs outside of this period).

Table 3 below lists a summary of compliance with the surveillance, alert and action levels of the national microbiological water quality guidelines for recreational waters (MfE/MoH 2003) for data collected over summer 2015/16, as reported by Morar and Greenfield (2016). It also lists the current Suitability for Recreation Grade (SFRG) assigned to each site. This grade describes the general condition of the water at any given time from a public health perspective.

Table 3: Summary of microbiological water quality data for the 2015/16 summer at selected coastal monitoring sites in Porirua

(Source: Morar & Greenfield 2016 Is it safe to swim? Recreational water quality monitoring results for the 2015/16 summer.)

Bathing site	n	No. sample results (Enterococci cfu/100mL)			Beach grading (2008/09–2014/15 data)		
		Surveillance (≤ 140)	Alert (141–280)	Action (>280)	SIC Grade	MAC Grade (95 th -ile value)	SFRG
Karehana Bay at Cluny Rd	20	20	0	0	Moderate	B (125)	Good
Plimmerton Beach at Bath St	20	17	1	2	Moderate	C (530)	Poor
South Beach at Plimmerton	20	18	2	0	Moderate	D (825)	Poor
Pauatahanui Inlet at Water Ski Club	20	20	0	0	Moderate	C (205)	Fair
Pauatahanui Inlet at Paremata Bridge	20	20	0	0	Moderate	C (175)	Good
Porirua Harbour at Rowing Club	20	19	1	0	Moderate	D (820)	Poor

Comment:

The results from the sampling leave much to be desired and there is little to no improvement since the first report in 2013. As is shown in the table above, most sites sampled rate only a “poor”. One of those rated “poor” is South Beach at Plimmerton – which is popular as a swimming beach. Effectively, this rating means it is not always suitable for swimming. Water quality at South Beach was expected to show significant improvement following work by Porirua City Council during 2015 to find and repair broken sewer pipes in the Taupo Stream, however this year’s results show the problem still exists.

The only “good” rating is for Karehana Bay at Cluny Road which is in the outer harbour and the Paremata Bridge area near the entrance to the Pauatahanui Inlet.

What is being measured:

3.3 Education Resource Usage

Engagement with schools in the catchment through the PHT Education programme

Rating 2015	Rating 2016	Number of Schools in the catchment engaged in the PHT programme
3	4	39 of 51 schools in the catchment engaged in the programme after two years.

Comment:

The PHT has produced a curriculum based resource for teachers based on the *Living Waters* series of short documentaries.

The programme commenced in November 2014 and is now well supported by schools in the catchment. The resource is presented in three themes, each with a specific curriculum focus including ecology of the harbour with a science focus; the harbour as a taonga with a social studies focus, and the human impact on the harbour with a focus on both science and social studies.

Each theme includes a field trip that focuses on aspects of the harbour and catchment. While the "*Living Waters*" documentaries bring learning to life for students, experiencing the harbour first hand will add enormous value to their understanding and appreciation.

During 2016 at least 39 schools in the catchment (out of total of 51 schools) are aware of the education resource and Living Waters documentaries and further workshops are planned to cover the other schools in the catchment. A significant number of these schools are actively using the resources as part of their learning programme, or planning to use them during the year.

The Trust has also released a 25 minute DVD "*Maota I le Talafatai - Home to Harbour*" in the Samoan language and this has been made available to schools in the catchment.

Further education programmes provided during the year included a puppet show *Nan and Tuna – a story about long finned eels* which was presented to over 1200 students at various schools in the catchment and a very successful art competition across schools in the programme culminating in a Porirua Children's Art exhibition held in the in the Porirua CBD at the end of Term 4 with over 300 students participating.

Over 1900 students across 80 different classes have taken part in *The Whitebait Connection*, *Experiencing Marine Reserves* and *Healthy Harbour Porirua* programmes in 2016.

The Trust is keen to see additional school involvement in this programme and its educational benefits.

4. ECOLOGICAL HEALTH

What is being measured:

4.1 Ecological health of streams

Uses the Macroinvertebrate Community Index (MCI) for the three main streams with the mean score for the last three years.

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Sites
4	4	4	4	Horikiri Stream at Snodgrass
4	4	4	3	Porirua Stream at Glenside
3	3	3	3	Porirua Stream at Wall Place
4	3	3	3	Pauatahanui Stream at Elmwood Bridge

Data Used:

The indicator we have used for stream health is the Macroinvertebrate Community Index (MCI) which measures the abundance of organisms like worms, insects, flies, beetles and snails. It is a nationally accepted index of macroinvertebrate health which accounts for the sensitivity of invertebrates to environmental stressors .

Macroinvertebrate sampling was undertaken at four sites in the Porirua Harbour catchment in 2016 as part of GWRC's Rivers State of the Environment (RSoE) monitoring programme. The MCI scores derived from this sampling are listed in Table 4. Under the RSoE programme a single macroinvertebrate sample is collected at or adjacent to each RSoE water sampling site during late summer/early autumn. The timing of sampling is determined at random, although macroinvertebrate sampling is, where practicable, avoided within two weeks of any flood event (ie, flows greater than three times the median river flow).

We have included the MCI mean score for the last three years and have used this rolling three year mean in determining the MCI Mean Quality Class.

Table 4: MCI scores for RSoE sites in the Porirua Harbour catchment sampled between 2013 and 2016

(Source : Morar SR, Perrie A, Greenfield S. 2016. *Rivers State of the Environment monitoring programme: Annual data report, 2015/16*).

Site no.	Site name	MCI 2013	MCI 2014	MCI 2015	MCI 2016	MCI Mean 2014 -16	MCI Mean quality class
RS13	Horokiri Stream at Snodgrass	116.5	115	98.3	109.6	107.6	Good
RS14	Pauatahanui S at Elmwood Bridge	100.0	105.6	92.5	90.9	96.3	Fair
RS15	Porirua Stream at Glenside	118.6	104.4	94.4	100.0	99.6	Fair
RS16	Porirua Stream at Wall Place	93.7	87.0	80.9	80.7	82.9	Fair

Key to quality classes (Stark & Maxted 2007): Excellent ≥ 120 , Good 100–119, Fair 80–99, Poor <80

Comment:

Two sites (Pauatahanui and Porirua Stream at Wall Place) have a lower MCI compared with previous years.

Horokiri Stream is the only one of the four monitored sites that has a good rating. Of concern is the MCI approaching a lower quality class across the whole of the Porirua Stream, not just at Wall Place but now at Glenside as well.

The three Porirua Catchment streams are recorded as being in the Fair category of the Water Quality Index for streams in the Greater Wellington region and in the lower third of all streams in the region.

What is being measured:**4.2 Ecological health of the Harbour**

Harbour condition based on the GWRC nutrient enrichment (eutrophication) measures for each inlet until 2015. These include RPD and low and high density macroalgal cover.

What is being Measured	Rating 2013	Rating 2014	Rating 2015	Rating 2016	Sites
Ecological Health of the harbour RPD	3	3	3	4	Onepoto Arm – intertidal
Ecological Health of the harbour RPD	3	3	3	3	Pauatahanui - intertidal
Ecological Quality Rating of the harbour for macroalgae	-	4	4	4	Porirua Harbour - EQR

Data Used:

GWRC assesses the ecological condition of the intertidal habitat within each arm of Porirua Harbour using a combination of broad and fine scale measures that target the common estuarine issues of sedimentation, eutrophication (nutrient enrichment) and toxic contamination. As sedimentation is already included separately in our scorecard, the review team has based the harbour estuarine health assessment on measures relating to eutrophication.

Increased nutrient enrichment (eutrophication) in estuaries can stimulate the abundance of fast growing green and red macroalgae. The resulting blooms can have significant effects on water and sediment quality. Annual indicators of eutrophication include a broad scale assessment of the change in the area of nuisance macroalgal growth and measurements of sediment oxygenation (as determined by the depth of the redox potential discontinuity (RPD) layer)*. This is the layer below which oxygen is severely reduced, as a result of which the diversity of life reduces.

It is important to note that the method for assessing the macroalgae condition has changed from simple percentage cover (density) estimates used in previous years, to an Ecological Quality Rating (EQR) for macroalgae. This rating incorporates a more comprehensive assessment of parameters such as macroalgae biomass, the degree to which the algae are found growing deep in the sediment (entrainment) and the area of available habitat (see Stevens & Robertson 2016 for more detail).

Table 5: Eutrophication indicator results for selected locations in Porirua Harbour assessed in early 2016 (subtidal RPD data also included for completeness). RPD cells shaded in light green and yellow equate to rankings of moderate and low risk, respectively
(Source: Oliver 2016 Coastal Water Quality and Ecology Annual Data Report, 2015/16)

Indicator	Onepoto Arm (RPD)							Pauatahanui Arm (RPD)										
	Intertidal			Subtidal				Intertidal					Subtidal					
Site No.	1	2	3	S6	S7	S8	S9	6	7	8	9	10	11	S1	S2	S3	S4	S5
RPD (cm) 2014	1.5	3	1	1	3	5	5	3	2	1	1.5	3	3	1	1	1	3	3
RPD (cm) 2015	1	2	1	2	2	2	3	1	1	1	1	3	3	1	1	1	1	1
RPD (cm) 2016	3	5	1	2	2	2	3	3	1	1	1	3	5	1	1	1	1	1

Ecological Quality Rating for macroalgae	Porirua Harbour
EQR 2014	<0.5
EQR 2015	0.58
EQR 2016	0.61

Metal Contaminants in Storm water discharges:

Contaminants in urban storm water discharges have been identified as a potential medium to long-term risk to the health of the marine organisms living in our harbour, largely through the accumulation of these contaminants in the sediments. Metals which tend to bind to the mud fraction of sediments have been measured since 2004 at five subtidal sites within the harbour and the results will be included in future reports.

Table 6: Mean concentrations of metals in sediments of five subtidal sites sampled in Porirua Harbour in Nov/Dec 2015. Values in amber exceed the ARC ERC amber criteria.
(Source: Oliver 2016 Coastal Water Quality and Ecology Annual Data Report, 2015/16)

Total Metals (mg/kg)	Fraction analysed	PAH 1	PAH 2	PAH 3	POR 1	POR 2
Arsenic	<500 µm	9.1	6.4	8.5	9.4	10.2
Cadmium	<500 µm	0.033	0.051	0.041	0.147	0.053
Chromium	<500 µm	18.2	14.0	15.1	19	21.7
Copper	<500 µm	11.0	9.5	8.0	20.5	18.2
Lead	<500 µm	21	17.6	16.0	38	37.3
Mercury	<500 µm	0.086	0.069	0.050	0.122	0.106
Nickel	<500 µm	11.7	9.1	9.8	11.4	13.0
Zinc	<500 µm	73	63	62	179	139

Comment:

The RPD results for 2016 show that the sediments were generally well oxygenated despite their often muddy nature. Throughout the estuary, sediment was relatively well oxygenated, had a low total organic carbon and sulphur content, and did not support nuisance macroalgal growths. These results provide a preliminary indication that Porirua Harbour sediments were in the “low” to “moderate”, rather than “high” (or poorly oxygenated) category, and likely reflect the combined influence of relatively low organic content, and the process of currents or wave action pumping oxygenated water into the sediments. Overall,

the sand-dominated habitats appeared to be in good (healthy) ecological condition.

The concentration of opportunistic macroalgae near the mouth of major streams entering the estuary (e.g. Porirua, Pauatahanui, Horokiri, Kakaho) suggest catchment nutrient inputs are the most likely driver of the observed growths. Combined with ongoing mud deposition both macroalgal growth and increasing muddiness remain continuing concerns within Porirua Harbour.

The concentrations of stormwater-derived metals are of concern especially copper, lead and zinc. Copper enters the harbour from vehicle brake pads, lead from paint products and zinc from galvanized iron roofs and car tyres.

5. WASTE

What is being measured:

5.1 Record of large items of waste collected in the intertidal and tidal area

Number of large items of rubbish collected each year in the Porirua Stream area of Onepoto Arm and an assessment in January of large items still to be collected.

Rating 2013	Rating 2014	Rating 2015	Rating 2016	Comment
2	3	3	3	

Data Used:

Information is collected by the Porirua City Council and an annual inspection is carried out in early 2017 at low tide of the area from the mouth of the Porirua Stream across the harbour from Wineera Point to the railway line on the east.

Comment:

The Porirua Stream mouth at the south end of the Onepoto Arm is a collection point for refuse coming down the Porirua and Kenepuru Streams. Over the years there has been a concentrated effort to remove large items from the tidal area of the stream bed. Some 400 plus tyres, road cones, shopping trolleys and other material was taken out of this part of Onepoto Arm by the Porirua City Council in 2009.

In recent years, various groups normally coordinated by Ngati Toa and Porirua City Council, have carried out tidal and intertidal clean ups of the Onepoto Arm with the emphasis on removal of large rubbish material in the intertidal zone of the Porirua Stream.

Over the years there has been an improvement in the reduction of large items removed from the Onepoto Arm. In 2009 there were 400 plus items, in 2012 there were over 260, in 2013 there were 172 large items, mainly car tyres (132) and road cones (35), in 2014, 89 large items mainly car tyres (85) with a small number of road cones (3) and in 2015 85 -90 items predominantly car tyres were removed from the area.

The number of large items collected in the 2016 year was similar to the last few years at around 90 large items. This is of concern as it shows a continuing pattern of disposal of these items into the waterways.

While the reduction from the peak of 400 in 2009 is commendable it is still of major concern that tyres continue to find their way into the stream and harbour rather than being disposed of in an appropriate manner. PCC needs to find a solution to large items, particularly tyres from being dumped in the harbour rather than taken to the land fill.

6. Acknowledgements:

The Porirua Harbour Trust acknowledges the strong support from the staff of Greater Wellington Regional Council, Porirua City Council and Wellington City Council in the provision of data and reports to assist the review team in preparing this scorecard.

The review team recognize that in supplying the environmental information Greater Wellington Regional Council has exercised all reasonable skill and care in compiling the contents of the information provided.

7. References

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Appendix One – What is being measured and our rating system.

	Agency Action	Sedimentation	Community and Recreational Usage	Ecological Health	Waste
	<p>An Annual Review of progress by all agencies against the Porirua Harbour Detailed Action Plan</p> <p>This includes a comparison of what was stated in the Detailed Action Plan vs what was funded and planned and achieved through outputs and outcomes.</p>	<p>Harbour Sedimentation. Utilising the Mean Annual sedimentation rate measurements from the 18 sedimentation plates, in the Onepoto Arm and Pauatahanui Inlet.</p> <p>Separate rating for subtidal and intertidal areas in each estuary inlet.</p> <p>Ratings based on those developed by Stevens and Robertson 2016</p>	<p>Recreational usage of the Harbour.</p> <p>Feedback from recreational groups on the quality of the harbour in providing their expectations.</p> <p>Recreational water quality monitoring results from weekly sampling carried out between December and March each year</p> <p>Education success, number of schools in the PHT education programme</p>	<p>Regular Testing of ecological health within streams and the Harbour</p> <p>Uses the annual measurement of Macroinvertebrate Community Index (MCI) for the three main streams.</p> <p>Harbour health based on the GWRC nutrient enrichment (eutrophication) measures and risk ratings developed by Stevens and Robertson 2016.</p>	<p>Annual Record of waste collected in the intertidal and tidal area</p> <p>Number of large items of rubbish collected each November in the Porirua Stream area of Onepoto Arm.</p>
5	All planned actions in the Action Plan funded and all agreed outputs and outcomes achieved and delivered on.	<p>Very Low</p> <p>Increase of 0 to 1mm for the year.</p> <p>Measure for each estuary.</p>	<p>Very Good - For all current and anticipated future activities</p> <p>Water Quality Very Good - Suitable for swimming</p> <p>45+ schools in the programme</p>	<p>MCI - Excellent</p> <p>Harbour Health – Very Good</p> <p>RPD - Excellent</p>	<p>Very Good</p> <p>Large items removed <25</p>
4	All planned actions in the Action Plan funded and most agreed outputs and outcomes delivered on.	<p>Low</p> <p>Increase of 1 to 2mm for the year.</p> <p>Measure for each estuary</p>	<p>Good - For current activities</p> <p>Water Quality Good - Suitable for swimming most of the time</p> <p>35+ schools in the programme</p>	<p>MCI – Good</p> <p>Harbour Health – Good</p> <p>RPD - Good</p>	<p>Good</p> <p>Large items removed <50</p>
3	Most planned actions in the Action Plan funded and most agreed outputs and outcomes delivered on.	<p>Moderate</p> <p>Increase of 2 to 5mm for the year.</p> <p>Measure for each estuary</p>	<p>Fair - For current activities</p> <p>Water Quality Fair - Generally suitable for swimming</p> <p>25+ schools in the programme</p>	<p>MCI – Fair</p> <p>Harbour Health – Moderate</p> <p>RPD - Fair</p>	<p>Fair</p> <p>Large items removed <100</p>
2	Most planned actions in the Action Plan funded and some agreed outputs and outcomes delivered on.	<p>High</p> <p>Increase of 5 to 10mm for the year.</p> <p>Measure for each estuary</p>	<p>Poor - For current activities</p> <p>Water Quality Poor - Not always suitable for swimming</p> <p>15+ schools in the programme</p>	<p>MCI – Poor</p> <p>Harbour Health – poor</p> <p>RPD - Poor</p>	<p>Poor</p> <p>Large items removed <150</p>
1	Some planned actions in the Action Plan funded and some agreed outputs and outcomes delivered on.	<p>Very High</p> <p>Greater than 10mm increase for the year. Measured for each estuary.</p>	<p>Very Poor - For current activities</p> <p>Water Quality Very Poor - Unsuitable for swimming</p> <p><15 schools in the programme</p>	<p>RPD – Very Poor</p>	<p>Very Poor</p> <p>Large items removed >150</p>

Appendix Two - Measurement Methodology

	Agency Action	Sedimentation	Community and Recreational Use	Ecological health	Waste
	<p>An Annual Review of progress by all agencies against the Porirua Harbour Detailed Action Plan This includes a comparison of what was stated in the Detailed Action Plan vs what was funded and planned and achieved through outputs and outcomes.</p>	<p>Harbour Sedimentation. Utilising the Mean Annual sedimentation data from the 18 sedimentation plates, (9 in the intertidal and 9 in the sub tidal) in the Onepoto Arm and Pauatahanui Inlet. Separate rating for subtidal and intertidal in each inlet.</p>	<p>Recreational Usage of the Harbour. Obtain feedback from the recreational users of the harbour, Water Quality monitoring of beaches using the national recreational water quality guideline. Schools utilizing the PHT education resource for the catchment</p>	<p>Regular Testing of ecological health within streams and the Harbour Uses the Macroinvertebrate Community Index (MCI) for the three main streams. Harbour condition based on the GWRC nutrient richness (eutrophication) measures for each inlet.</p>	<p>Annual Record of waste collected in the intertidal and tidal area Number of large items collected each November in the Porirua Stream area of Onepoto Arm. This would include a count of large items tyres, road cones and shopping trolleys to indicate the trend toward less rubbish entering the harbour.</p>
	<p>Assessment of the work carried out against the Detailed Action Plan taking into account the annual report provided to the three councils on the Porirua Harbour Action Plan, the annual plans and budgets for the next year and the long-term plan commitments of the councils and agencies compared to the Strategy. Will require a pre and post discussion with the Harbour Co-ordinator to ensure full understanding of what is included and excluded from the Detailed Action plan each year.</p>	<p>Utilising the Annual GWRC Porirua Harbour Intertidal Sediment Monitoring report. Using the 2008 data as the base where available and a minimum of two years data for each site. Information to be averaged separately for the Onepoto Arms and Pauatahanui Inlet for both sub tidal and inter tidal zones and each inlet to be reported separately. The result to include commentary on each estuary and granular size as well as mud impacts.</p>	<p>Survey once a year in December of the Harbour recreation user group. Use weekly summer monitoring as provided by GWRC of indicator bacteria levels at harbour beaches and measure against the national recreation grade. Evaluate the PHT education programme at the end of each year and identify the number of schools (primary, intermediate and secondary) - out of the 50 schools in the catchment who are utilising the PHT education programme.</p>	<p>Fresh water in the Wellington region is highly valued for a variety of uses, including water supply, irrigation, recreation and aquatic ecosystem health. The Macroinvertebrate Community index measures the health of the streams through an assessment of the health of the macro invertebrate community in each stream. The Harbour condition rating takes into account nutrient enrichment, (organic and nutrient content, sediment oxygenation, nuisance algae cover). There will be separate scores for each estuary.</p>	<p>Each year in November as part of the Love your Coast campaign the PHT will carry out intertidal and sub tidal clean ups around the Porirua Harbour. The Porirua Stream mouth is the main collection point for rubbish in the Onepoto Arm and will be used as the key indicator of rubbish in the harbour. The number of large items removed in the month (tyres, road cones, trolleys bikes etc) will give the annual measure of rubbish.</p>

Appendix Three: Results for 2016

RESULTS FOR 2016																							
Agency Action		Sedimentation				Community and Recreational Usage								Ecological Health				Waste					
An Annual Review of progress by all agencies against the Porirua Harbour Detailed Action Plan This includes a comparison of what was stated in the Detailed Action Plan vs what was funded and planned and achieved through outputs and outcomes.		Harbour Sedimentation. Utilising the Mean Annual sedimentation data from the 18 sedimentation plates, (9 in the intertidal and 9 in the subtidal) in the Onepoto Arm and Pauatahanui Inlet. Separate rating for subtidal and intertidal in each inlet.				Recreational usage of the Harbour. Feedback from recreational groups on the quality of the harbour in providing their recreational requirements. Water Quality at our beaches using the National Recreational water quality monitoring. Number of schools in the PHT Education programme								Regular Testing of ecological health within streams and the Harbour Uses the Macroinvertebrate Community Index (MCI) for the three main streams. Harbour condition based on the GWRC nutrient richness (eutrophication) measures for each inlet.				Annual Record of waste collected in the intertidal and tidal area Number of large items collected each November in the Porirua Stream area of Onepoto Arm.					
																			Onepoto		Pauatahanui		Usage
		Inter tidal	Sub tidal	Inter tidal	Sub tidal	Onepoto	Pauatahanui	South Beach Plimmerton	Plimmerton Beach at Bath St	Water Ski Clun Pauatahanui Inlet	Paremata Bridge Pauatahanui Inlet	Porirua Harbour Rowing Club	Karehana - Cluny Road	Number of Schools in the education	Horikiri	Pauatahanui	Porirua at Glenside	Porirua at Wall Place	Onepoto Intertidal	Pauatahanui Intertidal	Porirua Harbour density macroalgal		
5																							
4	Most planned actions delivered on.													39									
3																							
2																						>85 large items	
1																							

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