

**BEFORE THE ENVIRONMENT COURT  
I MUA I TE KOOTI TAIAO O AOTEAROA**

**ENV-2018-AKL-000078**

**IN THE MATTER** of the Resource Management  
Act 1991 (**RMA**)

**AND**

**IN THE MATTER** of the direct referral of  
applications for resource  
consent for the necessary  
infrastructure and related  
activities associated with  
holding the America's Cup in  
Auckland

**BETWEEN** **PANUKU DEVELOPMENT  
AUCKLAND**

**Applicant**

**AND**

**AUCKLAND COUNCIL**

**Regulatory Authority**

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**REBUTTAL EVIDENCE OF PAUL KENNEDY ON BEHALF OF  
PANUKU DEVELOPMENT AUCKLAND  
(COASTAL ENVIRONMENTAL)**

**4 September 2018**

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**1. INTRODUCTION**

**1.1** My full name is Paul Cameron Kennedy. I have prepared a primary statement of evidence dated 7 August 2018<sup>1</sup>, and confirm my qualifications and experience as set out in section 1 of that evidence.

**2. CODE OF CONDUCT**

**2.1** I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise.

**3. SCOPE OF EVIDENCE**

**3.1** I have reviewed the evidence in chief of the following witnesses:

- a) Dr Kala Sivaguru on behalf of Auckland Council dated 21 August 2018;
- b) Zaelene Rona Maxwell-Butler on behalf of Ngai Tai Ti Tamaki dated 28 August 2018;
- c) Dennis Raniera Kirkwood on behalf of Ngati Tamaoho dated 28 August 2018;
- d) Marian Josephine Taku Smith and Josephine Bernadette Peita on behalf of Ngaati Te Ata dated 28 August 2018;
- e) Martin Te Moni on behalf of Ngaati Whanaunga dated 28 August 2018;
- f) Karen Akamira Wilson on behalf of Te Akitai Waiohuria dated 28 August 2018;  
and
- g) Luke Faithfull on behalf of Manua Whenua dated 28 August 2018.

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1 EB Vol 1, E16.

**3.2** I have also read:

- h) The Cultural Values Assessment prepared by Sarah Mossman on behalf of Te Kawerau Iwi Tribal Authority; and
- i) The Cultural Values Assessment prepared by Mahuika Rawiri on behalf of Ngati Paoa.

**3.3** In my rebuttal evidence, I address the matters raised in other parties' evidence based on the following:

- j) Points of clarification in the evidence of Dr Sivaguru; and
- k) Matters raised in relation to cumulative effects on the Waitemata Harbour in the six statements of evidence on behalf of Mana Whenua listed above.

#### **4. CLARIFICATION OF MATTERS RAISED IN DR SIVAGURU'S EVIDENCE**

**4.1** Dr Sivaguru provided a number of comments in relation to the draft IVHEMP (EB, Vol 3, E32 at page 1552) in paragraphs 9.5 and 9.6 of her evidence. These points are clarified below. An updated version of the draft IVHEMP has been prepared (from the version attached to my evidence in chief) and is attached to this evidence as **Attachment A**.

**4.2** In paragraph 9.6a) Dr Sivaguru queried the month that ecological and sediment monitoring will be carried out in. The ecological and sediment monitoring will be carried out in the month of November each year. Section 4 and Table 4.1 have been updated in the revised IVHEMP to reflect this.

**4.3** In paragraph 9.6 b) Dr Sivaguru notes a query in relation to the baseline water quality sampling and temporal variability of water quality. In the water quality monitoring program, it is not possible to obtain a baseline set of samples that represent all aspects of temporal variability (e.g., seasonal changes) prior to any element of construction starting. It is likely that only three rounds of pre-construction sampling will be carried out as the first elements of construction will occur in November 2018. The frequency of water quality sampling during this period will be the same as the remaining monitoring period through the construction period (i.e., monthly). A series of five sets of survey

samples were also collected from four of the six sites in November-December 2016 (Golder 2018)<sup>2</sup> which adds to the available baseline data.

**4.4** In paragraph 9.6c) Dr Sivaguru comments on the selection of random sites for examination of biofouling communities in the monitoring program. The draft IVHEMP refers to biofouling communities – this is a reference to the biological communities growing on the structures (walls, piles and pontoons) within the Inner Harbour. The reference to random selection made in 5.2.2 of the Plan has been deleted to avoid confusion as it was a reference to the method of establishing the permanent sites. All sites selected in the pre-construction sampling will become permanent stations with the sites revisited in subsequent annual sampling. It is intended that the principal photo quadrats will remain untouched during the monitoring (reference samples for identification etc. will be collected from adjacent areas).

**4.5** I understand that Dr Sivaguru has reviewed my draft evidence and is happy with the clarifications provided above in response to her comments on the IVHEMP.

**4.6** The other changes to the IVHEMP can be summarised briefly as:

- a) Updates to section 1 to reflect the current set of agreed conditions;
- b) Edits to Section 3,1 in relation to construction activities;
- c) Inclusion of a new section 3.2 about the stages of construction;
- d) Changes to dates of work components in Table 3.1; and
- e) Minor change in Section 5.3 to undertaking water sampling following major stormwater discharges to the Wynyard Wharf South Water.

## **5. MANA WHENUA EVIDENCE**

**5.1** With reference to the six statements of evidence listed in paragraph 3.1(b) to (g) prepared on behalf of Mana Whenua, these statements provide commentary of “cumulative effects”. Specifically these are:

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<sup>2</sup> CBD Vol 1, CB21.

- l) Zaelene Rona Maxwell-Butler (Ngai Tai Ti Tamaki) discusses cumulative effects on the Waitemata Harbour on pages 2511-2512 of the evidence bundle.
- m) Dennis Raniera Kirkwood (Ngati Tamaoho), discusses cumulative effects on the Waitemata Harbour on pages 2497-2498 of the bundle.
- n) Marian Josephine Taku Smith and Josephine Bernadette Peita on behalf of Ngaati Te Ata Claims Support Whanau discusses cumulative effects on the Waitemata Harbour on pages 2486-2487 of the bundle.
- o) Martin Te Moni (Ngaati Whanaunga) discusses cumulative effects on the Waitemata Harbour on pages 2473-2474 of the bundle.
- p) Karen Akamira Wilson (Te Akitai Waiohua) discusses cumulative effects on the Waitemata Harbour on pages 2393-2394 of the bundle.

**5.2** Luke Faithfull on behalf of Mana Whenua<sup>3</sup> in opposition provides evidence that summarises matters relating to cumulative effects on the Waitemata Harbour (pages 2523-2524) summarising that “the mauri of the Waitemata has been significantly degraded by extensive historical reclamations and port developments and any further modifications are considered by Mana Whenua to have a significant adverse effect on the mauri of the Waitemata”. He notes that “the applicants cumulative effects considerations focuses largely on the physical effects of the project and fails to consider in any meaningful way the intangible effects which are significant to mana whenua”:

**5.3** I acknowledge the statements made by Mr Faithfull which reflect the statements made in the evidence I have identified above. Although my assessment of environmental impact has been made in relation to the potential effects, including cumulative effects, that could arise from the AC36 project, I am aware of the long-term changes that have occurred in the harbour and I am aware of the intricate relationships between pressures (developments, reclamations, catchment activities, stormwater, wastewater etc.) that combine to affect the state of the harbour (water quality, sediment quality, coastal ecology, kaimoana).

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3 EB Vol 4, E86.

**5.4** Over many decades there has been substantial work undertaken to understand the effects of the changing catchment and expanding urban environment on the Harbour (e.g., the Upper Waitemata Harbour Study undertaken by the Regional Council, Ministry for Primary Industry biosecurity management and monitoring). The nature of pressures have changed markedly from the 1800s with today's activities that might affect the well-being of Waitemata Harbour being subject to a greater deal of scientific scrutiny and process through the Unitary Plan and Resource Management Act.

**5.5** I also note that it is common for receiving environments to change over time, and the potential effects of the activity need to be considered in the context of the environment at the time the application is made. In this respect I reiterate that I consider the effects of this proposal to be no more than minor. In paragraph 69 of evidence (EB Vol 4, E82 at page 2472) Martin Te Moni (Ngaati Whanaunga) makes reference to the traditional kaimoana of the Waitemata Harbour and identifies that "adverse cultural impacts will result from any dredging, disturbed sediment and other contaminants". As described in my evidence in chief, the construction activities will result in localised seabed sediment disturbance within Freemans Bay. The activities on a relative scale are similar to activities that result in seabed disturbance on a routine basis. This includes movement of ferries and shipping in the port. The activities associated with the AC36 project are to be managed through consent conditions and Management Plans that in total result in less than minor effects and in my view are of a scale similar to many routine permitted and consented activities carried out in this part of the Waitemata Harbour.

## **6. CONCLUSION**

**6.1** I have provided clarification to the matters raised by Dr Sivaguru in relation to the IVHEMP.

**6.2** Mana Whenua have raised concerns regarding cumulative effects of changes on the well-being of the in the Waitemata Harbour. While I recognise that long-term changes have occurred, the assessment carried out of the specific activities proposed as part of the AC36 development indicates that the proposed activities will have no less than minor

environmental effects including cumulative effects when considered with other existing activities.

**Paul Kennedy**

4 September 2018

**Attachment A: Updated draft IVHEMP**



WYNYARD EDGE ALLIANCE



## Wynyard Edge Alliance

### America's Cup – Wynyard / Hobson Inner Viaduct Harbour Environmental Management Plan

## Revision History

Revision N <sup>o</sup>	Description	Prepared By	Reviewed by	Approved on behalf of Wynyard Edge Alliance	Date
A	Draft plan for Auckland Council pre-submission comment	Malea Zygado Raymond Chang	Brendon Barnett Bob Mawdsley Edwin Zwanenburg Kurt Grant Niksa Sardelic	Ian Campbell	3-07-18
B	Draft plan for inclusion in evidence	Malea Zygado Raymond Chang	Brendon Barnett Bob Mawdsley Kurt Grant	Ian Campbell	3-08-18
C	Updated draft plan for inclusion in rebuttal evidence	Malea Zygado Raymond Chang	Brendon Barnett Bob Mawdsley Kurt Grant Paul Kennedy	Iain Simmons	04-09-18

### Disclaimer

This report has been prepared by the Wynyard Edge Alliance for the benefit of the Panuku Development Auckland Ltd. No liability is accepted by the Alliance Partners or any employee of or sub-consultant to the Alliance Partners companies with respect to its use by any other person.

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# 1 Relevant consent conditions

The consent conditions relevant to the Inner Viaduct Harbour Environmental Management Plan (“IVHEMP”) are summarised in Table 1.1 below. The conditions referenced are as per the proposed draft resource consent conditions<sup>1</sup>.

Table 1.1: Summary of consent conditions relevant to the IVHEMP.

Condition Number	Condition requirement	Section referenced in the Plan
117	The consent holder shall prepare an Inner Viaduct Harbour Environmental Management Plan (IVHEMP) in consultation with the [Auckland Council Mana Whenua Kaitiaki Forum] ACMWKF in accordance with Condition 5D. The consent holder shall submit the IVHEMP to the Team Leader Compliance Monitoring – Central for certification that the IVHEMP gives effect to the objective in Condition 118 and complied with the requirements in Condition 119. The IVHEMP shall be prepared by a suitably qualified person and be in general accordance with the Draft Inner Viaduct Harbour Environmental Management Plan as referenced in Annexure B.	This Plan
118	The objective of the IVHEMP is to provide for monitoring of water quality within the Inner Viaduct Harbour water space to identify any ecological changes to the environment of the Inner Viaduct Harbour from works authorised by this consent.	This Plan
119	The IVHEMP shall include:	
	a) An environmental monitoring programme that shall include:	Section 4.2 and 5.1
	i) Water quality monitoring on a monthly basis at sites within the Inner Viaduct Basin and the Wynyard South Waterspace and in Freemans Bay. The samples are to be collected on a monthly basis and analysed for the constituents set out in the Golder report “Assessment of Coastal Environmental Effects Associated with the Development of America’s Cup Facilities for the Wynyard Hobson Option” as reference in Annexure A.	
	ii) In addition to the sites identified in (i), on a monthly basis, additional sites for the observation of aesthetic effects (identification of sheens, floatables, rubbish) with photographic records being kept;	Section 4.6 and 5.5
	iii) Sediment quality sampling on an annual at the water quality monitoring sites in the Inner Viaduct Harbour. The samples collected at each site are to be photographed and examined for grain size, total organic carbon, redox and concentration of copper, lead and zinc.	Section 4.4 and 5.4
	iv) Benthic ecological sampling collected annually, at the same time as the sediment quality sampling is undertaken, to provide information on the infauna at sediment quality sampling sites.	Section 5.2 and 4.3
	v) Intertidal and subtidal ecological monitoring on structures (pontoons, piles and walls) from at least three locations within the Inner Viaduct Harbour. Data will be collected annually from permanent photo-quadrats and for wall and pile sites, quadrats are to be established at surface and approximate mid and bottom water depths	
	vi) Water quality sampling is to be carried out following a minimum of three storm events, with the sampling being taken at Karanga Steps within the Inner Viaduct Harbour, and examined for enterococci and the field information as collected under (i) above.	Section 4.5 and 5.3

<sup>1</sup> Unio Environmental, 4 September 2018. America’s Cup Wynyard Hobson – Applicant’s Proposed Conditions of Consent

Condition Number	Condition requirement	Section referenced in the Plan
	<p>b) The following matters as they relate to the Inner Viaduct Harbour and Wynyard South Water Space:</p> <ul style="list-style-type: none"> <li>i) The extent to which there are any new, untreated stormwater discharges from surrounding development into the Inner Viaduct Harbour and Wynyard Wharf South Water Space;</li> <li>ii) Provisions for waste management, including flotsam removal, litter collection from adjacent quays; and</li> <li>iii) Any wider Council group initiatives for the Freemans Bay catchment stormwater improvement</li> </ul>	Section 7
119A	<p>Water quality, required by Condition 119 a) shall be carried out for a period of 12 months following the completion of the construction period. At the completion of the 12-month period the consent holder shall submit a report prepared by a suitably qualified ecologist to the Team Leader Compliance Monitoring – Central which summarises all environmental data collected during the monitoring period and provides an assessment on the following matters:</p> <ul style="list-style-type: none"> <li>i) Whether there have been any environmental or ecological changes within the Inner Viaduct Harbour that may have been influenced by possible changes in flushing within the Inner Viaduct Harbour.</li> <li>ii) Whether water quality in the Inner Viaduct Harbour and Wynyard Wharf South Water Space is suitable for contact recreation; and</li> <li>iii) Whether stormwater discharge to the Inner Viaduct Harbour and Wynyard Wharf South Water Space results in identifiable water quality changes</li> </ul>	Section 6
119B	<p>The report required by Condition 119A shall include a recommendation as to whether the monitoring period shall cease or if it is to be continued for an additional period and if so for what period for further review and reporting.</p>	Section 6

## 2 Introduction

This Inner Viaduct Harbour Environmental Management Plan (“IVHEMP”) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (“CEMP”) for the America’s Cup Infrastructure Project (“the Project”).

The Project is being delivered by the Wynyard Edge Alliance (“the Alliance”).

### 2.1 Scope and objective of the Inner Viaduct Harbour Environmental Management Plan

The objective of this Plan, in accordance with consent Condition 118, is to provide for monitoring of water quality and ecology within the Inner Viaduct Harbour water space to identify any changes to the environment of the Inner Harbour from the proposed works.

While these physical works will not be undertaken within the Inner Viaduct Harbour, the Harbour’s flushing regime may be impacted from the works. The objective of this Plan is to collect sufficient information to detect whether predicted changes to the flushing regime are in turn impacting the Harbour’s water quality and ecology. The Inner Viaduct Harbour refers to the area outlined in Figure 2.1.



Figure 2.1: Location of the Inner Viaduct Harbour (shaded blue).

The water quality and ecological monitoring set out in the conditions and detailed in this plan will be undertaken during construction of the Project. However, this plan does not set out to directly monitor construction effects; but rather the result of the design and installation of structures within the CMA. Some of the monitoring outlined in this plan is located outside of the Inner Viaduct Harbour, the purpose of which is to provide environmental controls and add to the realm of information for the area.

Whilst the monitoring and reporting regime forms part of the comprehensive suite of environmental controls for the Project as outlined in the CEMP, it focuses on gathering information resulting from the Project, for future consideration.

This Plan addresses the matters in Conditions 117-119B (refer to the quick reference guide to conditions in Section 1).

The final version of this IVHEMP will be submitted to the Team Leader Compliance Monitoring – Central for certification in accordance with Condition 16 and Condition 117.

This IVHEMP will be updated, if necessary to reflect changes in design, construction methods or to manage effects. In accordance with the consent Condition 19, any amendments to the certified IVHEMP shall be discussed with, and submitted to the Team Leader Compliance Monitoring – Central for confirmation in writing prior to implementation of any changes. Any changes to the IVHEMP that would result in a materially different outcome to the certified plan shall be submitted to the Team Leader Compliance Monitoring – Central for certification (Condition 20). Any material change must be consistent with the purpose of the IVHEMP and the requirements of the relevant conditions. A copy of the original IVHEMP and subsequent versions will be kept for the Project records, and marked as obsolete. Each update of the Plan will be issued with a version number and date.

## 2.2 Project description

For a description of the Project, refer to the Project Description within the CEMP. The construction details relevant to this plan are set out in Section 3.

## 2.3 Associated Management Plans

The CEMP outlines the environmental management framework for the Project and details the relationship between the CEMP, environmental management plans, design certification requirements and the resource consent conditions. It also provides an overview of the management plans required by the conditions (their purpose and content etc.) and other environmental mitigation measures to be implemented during construction.

## 2.4 Responsibilities

The Alliance Project Director has the overall responsibility for meeting the requirements of this Plan.

The Alliance Construction Environmental Manager will implement the Plan, including water quality and ecological monitoring.

Refer to the CEMP for more detail on roles and responsibilities.

## 2.5 Project contacts

The contact details for queries, compliments and complaints regarding the project are provided in Table 2.1. Further Project contact details and the complaints response procedure are contained in the CEMP.

Table 2.1: Project contact details

<b>Project hotline</b>	0800 WYNYARD (0800 996 9273)	
<b>Stakeholder Manager</b>	Michael Goudie	021810194
<b>Construction Manager</b>	Kurt Grant	021834512
<b>Construction Environmental Manager</b>	Brendon Barnett	021 527 461





### 3.2 Construction staging

The indicative construction programme for the marine-based Project works relevant to this IVHEMP is as follows:

- Construction of the Hobson Wharf Extension and associated breakwater and wave panels will be undertaken from November 2018 – November 2019.
- Dredging will be undertaken between November 2018 – September 2019 as follows:
  - Access channel November / December 2018 – January 2019;
  - Outer Viaduct Harbour January – March 2019; and
  - Wynyard Basin – March – April 2019 and November 2019 (dredging in the vicinity of the current Sealink site).
- Construction of breakwater and wave attenuation structures will be undertaken from November 2018 – December 2019. Refer to Table 3.1 for further detail in this regard and Figure 3.1 for the location of these works.

Table 3.1: Construction dates of relevant marine-based works

Element	Structure	Start Date <sup>1</sup>	End Date <sup>1</sup>
1	Hobson Wharf South breakwater (BW5)	Nov 2018	Sept 2019
2	New Hobson Wharf Extension Structure	July 2018	Nov 2019
3	Hobson Wharf East breakwater (BW6)	Sept 2019	Dec 2019
4	Hobson Wharf West Side breakwater	Nov 2018	April 2019
5	Hobson Wharf East Side breakwater (floating pontoon)	June 2019	Sept 2019
6	Dredging Works in the Outer Viaduct Harbour inner channel	Feb 2019	Mar 2019
7	Dredging Works Entrance Channel	Dec 2018	Jan 2019
8	Dredging Works J-Class area	Feb 2019	Mar 2019
9	New breakwater Halsey Wharf west	Nov 2018	Dec 2019
10	New Breakwater Wynyard Wharf east	March 2019	June 2019
11	Dredging Works Wynyard Wharf South Waterspace	July 2019	Nov 2019

<sup>1</sup>Note dates are approximate

## 4 Monitoring programme

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### 4.1 Introduction

As outlined in Section 2 of this plan, monitoring of water quality within the Inner Viaduct Harbour will be undertaken to identify any ecological changes to the environment of the Inner Viaduct Harbour as a result of the Project. The programme for water quality and ecological monitoring described in this Plan is outlined in Table 4.1 and Table 4.2 and described in the sections below. These timeframes are, in general, based around the works for construction of the wave attenuation structures and breakwaters. Should these dates change, the monitoring programme and commencement/end dates will also be reviewed.

The monitoring will provide for the collection of sufficient information in order to identify any changes to water quality and/or ecology as a result of changes to flushing regimes within the Inner Viaduct Harbour.

Refer to Section 5 of this Plan for details of the monitoring methodology for each aspect outlined below.

### 4.2 Water quality monitoring

The wave attenuation structures and breakwaters installed as part of the Project are predicted to increase flushing times within the Inner Viaduct Harbour. As required by consent Condition 119A, monitoring will continue until 12-months post completion of the wave attenuation structure and breakwater installations, unless otherwise agreed with the Team Leader Compliance Monitoring - Central.

Accordingly, water quality monitoring will be undertaken **monthly** from **August 2018 to December 2020**. Monitoring undertaken from August to November 2018 will inform an initial assessment of existing water quality parameters prior to the commencement of construction.

### 4.3 Ecological monitoring

Ecological monitoring (benthic and ecology of structures) will begin prior to the installation of the first breakwater/wave attenuation structures. While the consent conditions require monitoring for 12-months post completion of the works, ecological monitoring will be undertaken annually at the same time each year. This means that monitoring will continue until November 2020 which will provide three monitoring rounds.

Ecological monitoring will be undertaken **annually** each **November from 2018 to 2020**.

### 4.4 Sediment monitoring

Sediment quality monitoring will be undertaken in line with the ecological monitoring timeframes outlined in Section 4.3.

Accordingly, sediment monitoring will be undertaken **annually** each **November from 2018 to 2020**.

### 4.5 Storm event monitoring

The purpose of the storm event monitoring is separate to the above water quality monitoring. Three sample events are required at any time prior to, or within the works, period based on storm events.

Storm event monitoring will be undertaken **at any time** between **November 2018 and December 2020**.

### 4.6 Aesthetic monitoring

Aesthetic monitoring will be undertaken in conjunction with the water quality monitoring (refer to Section 4.2).

Aesthetic monitoring will be undertaken **monthly** from **August 2018 to December 2020**.

Table 4.1: Monitoring programme 2018 - 2019

	Frequency	2018					2019												
		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<b>Water quality monitoring</b>	monthly	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
<b>Ecological monitoring</b>	annually				Green												Blue		
<b>Sediment monitoring</b>	annually				Green												Blue		
<b>Storm event monitoring</b>	at any time	Yellow																	
<b>Aesthetic monitoring</b>	monthly	Green	Green	Green	Green	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue

**Note:** Construction works are due to start in November, however monitoring will occur in early November **before** works commence and are therefore coded **green**. **Yellow** – not related to works, **green** – before works influencing flushing regime commences, **blue** – during works influencing flushing regime

Table 4.2: Monitoring programme 2020

	Frequency	2020												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<b>Water quality monitoring</b>	monthly	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
<b>Ecological monitoring</b>	annually											Orange		
<b>Sediment monitoring</b>	annually											Orange		
<b>Storm event monitoring</b>	at any time	Yellow												
<b>Aesthetic monitoring</b>	monthly	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	

**Note:** **yellow** – not related to works, **orange** – post completion of works

## 5 Monitoring methodology

The below sections detail the monitoring methodology with monitoring locations shown in Figure 5.1.

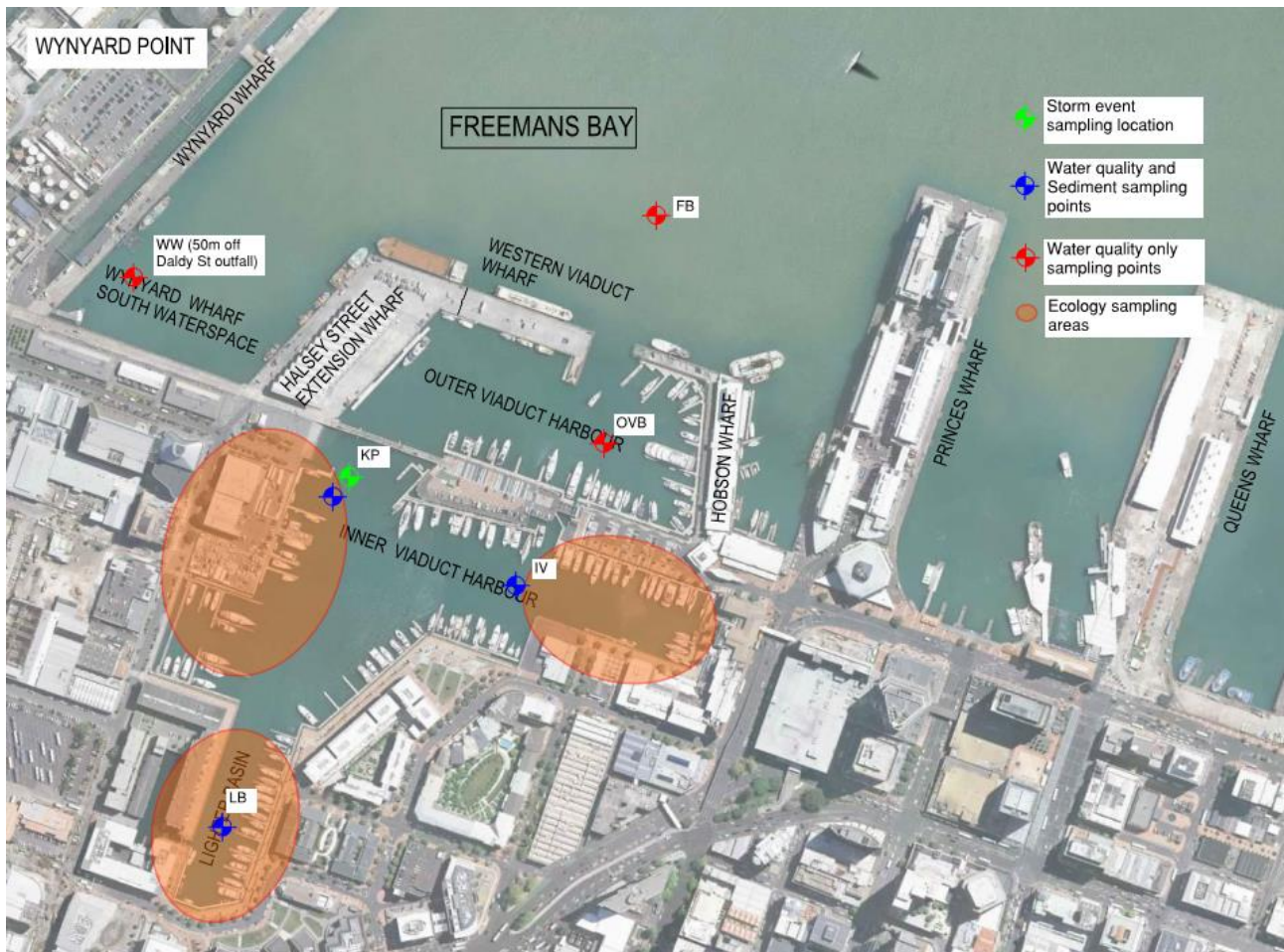


Figure 5.1: Approximate locations of monitoring points and areas.

### 5.1 Water quality

Condition 119 a) i) specifies the water quality monitoring programme within the Inner Viaduct Harbour to sample and analyse for the parameters detailed in Golder (2018) which are reproduced in Table 5.1. Monitoring locations are shown in Figure 5.1.

Baseline water quality samples will be collected **at least three times** prior to the commencement of construction. Samples will be taken from the six locations shown in Figure 5.1 (being identified as locations WW, OVB, FB, KP, IV, LB in Figure 5.1) and as follows:

- Samples shall be collected on a half ebb tide;
- Temperature and dissolved oxygen shall be collected from approximately 0.2 m below the surface and above the sea bed;
- Enterococci samples shall be collected just below the water surface, chilled to <4°C and analysed within 24 hours; and
- All other samples shall be collected just below the surface of the water and chilled before dispatch to the laboratory for analysis.

Sampling shall be undertaken by a suitably trained person.

Table 5.1: Water quality parameters and method for each sampling location identified in Figure 5.1.

Parameter	Method <sup>1</sup>
Temperature	field meter (top and bottom)
Dissolved oxygen (DO)	field meter (top and bottom)
Salinity	field meter
Secchi disc depth	in-field
Turbidity	lab analysis
Total suspended solids (TSS)	lab analysis
Nitrate-nitrogen and nitrite-nitrogen	lab analysis
Ammoniacal-nitrogen	lab analysis
Dissolved reactive phosphorus	lab analysis
Chlorophyll-a	lab analysis
Enterococci MPN	lab analysis
Dissolved copper	lab analysis
Dissolved zinc	lab analysis

<sup>1</sup>All samples taken from near surface unless otherwise stated.

## 5.2 Ecology

### 5.2.1 Monitoring requirements

Condition 119 a) iv-v) requires the identification of key ecological communities within the Inner Viaduct Harbour. Key ecological communities are defined for this Plan as the benthic and fouling communities as these are the communities that may be impacted by changes in flushing regimes. Identification of these communities will be carried out using standard ecological survey methodologies tailored to the outcomes sought from this monitoring.

As there is no existing Inner Viaduct Harbour ecological data suitable to provide pre-construction information, monitoring will be undertaken prior to the commencement of construction to provide baseline data for comparison against subsequent monitoring rounds. As set out in Section 3 above, wave attenuation/breakwater installation is expected to commence in November 2018. The first ecological monitoring round will be undertaken in **November 2018**, prior to these works and coinciding with a water quality monitoring round.

Ecological monitoring will be undertaken at the same time of year, each year as outlined in Section 4 in order to allow for seasonal comparability.

**Note:** Should the initial monitoring timeframe change, subsequent sampling should also be changed to keep consistent with this first sampling round; bearing in mind the overall need to sample a 'baseline' (prior to construction occurring) ecological sample within the months of November and March.

### 5.2.2 Biofouling communities

Ecological surveys will be undertaken to describe the intertidal and sub-tidal fouling assemblages on wharf piles, floating pontoons and basin walls in the Inner Viaduct Harbour (refer to Figure 5.1). Each area will include:

- Six selected wharf piles;

- Six pontoons; and
- Six vertical wall transects.

Three areas within the Inner Viaduct Harbour will be sampled within the general locations shown in Figure 5.1. These areas have been selected based on predicted changes in flushing regime within the Inner Viaduct Harbour.

Ecological surveys will use video transects and photo quadrats to describe the general ecological assemblage.

Video imagery will comprise of the following:

- For each wharf pile and sea wall station:
  - Video imagery from the water surface to 5 m below MLWS; and
  - Three photo quadrats (0.06 m<sup>2</sup>) will be taken at 0.5 m, 3 m, and 5 m depths (where available).
- For each pontoon station, video imagery will be taken and three photo quadrats will be spaced randomly along each of the following transects:
  - One transect beneath the pontoon (i.e. totally shaded); and
  - One transect along the exposed edge (i.e. exposed to sunlight).

The purpose of the ecological surveys is to describe the general ecological assemblage, abundant species (native and introduced species) and groups of organisms, where possible. The structure and composition of the assemblage will be described using estimates of the percentage cover of organisms within the imagery. Voucher specimens will be collected of dominant organisms to determine their identity. It is not anticipated that there will be a need to identify all macro-organisms within the assemblages to a species-level.

The wharf pile, sea wall and pontoon stations will establish the fixed photo quadrats to enable the annual monitoring of the ecological assemblages. The location of the photo quadrats sampled during the first survey will be permanently marked using a non-removable tag, attached to the substrate. One tag will be attached at the start point of each vertical transect (i.e. on a wharf pile or wall) and each horizontal transect (i.e. the point of the first quadrat on the underside and side wall of the pontoon). GPS coordinates and landmarks will be recorded to ensure the same location can be identified and re-sampled, should a tag be tampered-with or removed.

Samples of biofouling may need to be removed from the survey location for laboratory identification, particularly for dominant species that cannot be identified in the field. Re-sampling exact locations will not occur as the process of removing biofouling will alter the community in that quadrat. Therefore, the fixed locations between sampling rounds will be in close proximity to the prior location but not at the same location.

### 5.2.3 Benthic communities

Collection of sediment cores from Sites LB, IV and KP will be taken to assess the current ecological communities present within these areas. Sediment cores (100 mm diam. x 150 mm deep) and video transects will be taken at the three stations identified in Figure 5.1 to describe the benthic infauna within the Inner Viaduct Harbour.

Prior to coring, a continuous transect will be filmed using a GoPro 4 camera with video lights (or similar), held at a fixed distance (200 mm) above the seabed, and around a central shot line deployed from a dive boat. Three screen grabs will be used to during the analysis to characterise the habitat.

Collection of three 100 mm diameter core samples (i.e. three replicates per station) will be taken from the three stations identified in Figure 5.1. Individual cores will be pushed into the sediment to a depth of 150

mm, capped *in-situ* and then placed into a catch bag. Samples will be chilled until they can be processed in the laboratory. The samples will be passed through nested 1 mm and 0.5 mm sieves to separate the infauna. The 1 mm fraction will be sorted and identified to the lowest practical taxonomic unit to provide a basic description of the fauna present at each station. The 0.5 mm fraction will be preserved and retained if further description is required.

The number of sites and / or replicates may be reduced or ceased for subsequent monitoring based on the first round of results and the type of communities present.

### 5.3 Storm event monitoring

Storm events result in the discharge of stormwater into the harbour through outlets and diffuse runoff from the surrounding land area. Discharges of stormwater to the CMA have the potential to change the receiving environment's water quality following a storm event. Condition 119 a) vi) requires sampling following at least three storm events prior to the completion of the Project.

Certain water quality parameters (outlined in Table 5.2) will be sampled at the Karanga Plaza Steps (refer to Figure 5.1).

Rainfall will be monitored by a rain gauge with polling alerts. Two types of storm events will be targeted:

- >10 mm over 1 hour; and
- >20 mm over 24 hours.

Once the 20 mm or 10 mm threshold is reached (over the specified timeframe), sampling will be undertaken as soon as practicable.

Samples will be taken 30 minutes apart for a maximum of three hours, or for 30 minutes after the storm event ends, whichever is less. The state of the tide will also be considered and preference given to a storm event during a flood tide

Water samples will be collected as follows:

- Field meter samples will be collected from approximately 0.2 m below the surface; and
- Enterococci samples will be collected just below the water surface, chilled to <4°C and analysed within 24 hours.

Sampling and monitoring will be undertaken by a suitably trained person.

Table 5.2 (overleaf) details the parameters and method.

Table 5.2: Storm event sampling parameters and method for the sampling location identified in Figure 5.1.

Parameter	Method
Temperature	field meter
Dissolved Oxygen (DO)	field meter
Salinity	field meter
Secchi disc depth	in-field
Enterococci MPN	lab analysis

### 5.4 Sediment quality

Collection of sediment cores from sites LB, IV and ST (as shown in Figure 5.1) will also be taken for analysis of:

- Total organic carbon (TOC);
- Redox potential;
- Total petroleum hydrocarbons (TPH); and
- Copper, lead and zinc.

Sampling will coincide with the benthic community monitoring outlined above.

Three samples will be collected to a standard depth (2 cm) at each location. Analysis of sediment will be carried out on <2 mm material if the sediment contains any coarse material.

## 5.5 Aesthetics

Condition 119 a) ii) requires the establishment of visual monitoring points to identify where rubbish, floatable debris, and sheens may be present within the Inner Viaduct Harbour. These potential debris amalgamation points will be identified during the water quality baseline monitoring.

A walkover of the monitoring points will be undertaken **monthly** in conjunction with the water quality monitoring.

A written and photographic record of any identifiable sheens, floatables, and rubbish that may have an aesthetic effect on public amenity will be kept. The nature and scale of contaminants at each of these localities should be recorded.

Collection and disposal of accumulated debris will be undertaken in accordance with the CEMP during the Project period.



## 6 Reporting

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Following the completion of monitoring 12 months post-construction, a report will be prepared and submitted to the Team Leader Compliance Monitoring – Central within two months of the final sampling being undertaken. The report shall include a recommendation as to whether the monitoring period shall cease or continue for an additional period and if so, for what period for further review and reporting. The report should also address the following:

### For water quality:

- Summary of sample results;
- Summary of storm event results, both from targeted events and other events that may be captured in regular monitoring;
- Analysis and discussion of any changes in water quality since construction;
- An assessment of whether water quality in the Inner Viaduct Harbour is suitable for contact recreation;
- A discussion of any identifiable non-seasonal changes in water quality constituents; and
- Summary of observed sheens, floatables and rubbish during water quality sampling rounds.

### For ecology:

A summary report of the findings of the key ecological communities will be provided to Auckland Council within two months of completion of the monitoring rounds (i.e. 12-months post construction). The report shall include:

- Identification of fouling communities present on wharf piles, sea walls and pontoons;
- Identification of benthic community assemblage;
- Comparison of ecological assemblage pre-construction and post-construction; and
- A discussion of any identified changes.

### For sediment quality:

- Results of sediment quality analysis;
- Comparison of replicate core data by location and time; and
- Discussion of any identified changes in sediment constituents.

### For aesthetic monitoring:

- A summary of the results of monitoring shall be provided to Auckland Council to implement an on-going management programme for the Inner Viaduct Harbour.

## 7 Other matters

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As outlined in Section 2, the purpose of this Plan is to implement a monitoring regime to assess changes in water quality and ecological communities within the Inner Viaduct Harbour as a result of the Project. It is an opportunity to provide information to improve water quality within the Inner Viaduct Harbour and wider catchment with some scientific basis. This is captured within Conditions 119. The below sections describe the process in which information gathered during this monitoring programme will be used to inform wider stormwater quality initiatives.

### 7.1 Avoidance of new untreated stormwater discharges into the Inner Viaduct Harbour

The Alliance are responsible for the design and construction of Project infrastructure that provides for stormwater treatment in accordance with the stormwater discharge consent. Other discharges into the Inner Viaduct Harbour are outside the control of the Alliance, however works associated with the Project will be designed so as not to impede future stormwater improvement works.

Panuku and other Council organisations will work to develop and implement stormwater management strategies that avoid the discharge of any new stormwater discharges to the Inner Viaduct Harbour as part of optioneering and engineering design programmes.

### 7.2 On-going waste management

As noted in Section 6, results of the aesthetic monitoring, including the identification of sheens, floatables and rubbish within the Inner Viaduct Harbour will be shared with Auckland Council.

It is envisaged that these results will assist in informing where natural collection points of gross / floatable contaminants generally occur within the Inner Viaduct Harbour. This can therefore inform any on-going waste management education and or collection programme for the area. While the Alliance would not be responsible for the implementation of such a waste management programme, it could assist in collating the information required to inform those areas of the Inner Viaduct Harbour requiring management. It may be that a monitoring and collection regime can be developed for certain localities within the Inner Viaduct Harbour, at differing frequencies depending on the build-up of floatables over time.

### 7.3 Freemans Bay catchment stormwater improvement

The Project provides an opportunity for data sharing and combined efforts in developing stormwater improvements for the Freemans Bay catchment. The Alliance is aware of opportunities being investigated by Auckland Council's Healthy Waters team, including changes to the existing Daldy Street stormwater outfall that will assist in discharging stormwater contaminants further to sea; and not discharged in the near-shore environment. The Alliance and Auckland Council's Healthy Waters are investigating how the stormwater works can be delivered during the same construction period of the Project.

A significant amount of data will be collected as part of this Plan around the water quality of the Inner Viaduct Harbour and ecological environment. The Alliance will share the results with Auckland Council through the required reporting. The Alliance also proposes to share the data collected with the wider Auckland Council team to inform future project and initiatives within the area.