

Appendix 1

Single Site Reports

Part 2

Upper Waitemata Harbour

Explanatory notes

This appendix provides a summary of the sediment chemistry and particle size distribution data for each monitoring site. The appendix has been divided according to “Marine Reporting Areas” (MRAs):

- Part 1: Central Waitemata Harbour
- Part 2: Upper Waitemata Harbour
- Part 3: East Coast Bays
- Part 4: Hibiscus Coast
- Part 5: Tamaki Estuary
- Part 6: Tamaki Strait
- Part 7: Manukau Harbour

The summaries are given as “Single Site Reports” (SSRs), in which the key physical and chemistry data are provided in 2 pages:

1. The first page provides a brief description of the site: its location; classification in terms of sediment and contaminant transport/accumulation – “Settling Zone” (SZ) or “Outer Zone” (OZ), as described in ARC Technical Publication TP 170 (ARC 2002); key physical characteristics; notable features and relevant monitoring information (e.g. location of nearby sites).
2. The second page gives a summary of the sediment contaminant and sediment texture data: results from each year of monitoring for Cu, Pb, Zn, “high molecular weight” PAH (HWP AH), total organic carbon (TOC), and “mud content” (defined below). The contaminant results have been compared with sediment quality guidelines (the ARC “Environmental Response Criteria”, ERC). Indicative trends over time (see below), and a brief interpretative summary on key features of the data, have also been given.

Plots and summary statistics include all data reported to end of 2010, unless otherwise stated (e.g. occasional clear outlier removed before plotting & analysis). Where replicate analyses have been performed, data have been summarised as medians.

Trend data given in the SSRs have been determined by linear regression. The trend plots have been fitted with a quadratic curve “line of best fit” as an aid for visually assessing the nature of changes over time in the data series. Trend indicators, using “arrow” symbols, have been used to show the magnitude and direction of trends. No statistical significance associated with these trends is given (this is discussed in detail in the body of the Status and Trends Report). The trend indicators should be interpreted as follows:

- $<\pm 1\%$ per annum change probably indicates no (or very little) trend;
- $\pm 1\text{--}2\%$ per annum indicates a small, or emerging, trend. Changes of this magnitude could be largely associated with analytical and/or sampling variation, so trends in this range may not have any “real world” significance; and
- $>\pm 2\%$ indicates a stronger trend, equivalent to $> \pm 20\%$ per decade, which is probably worth investigating further to better understand possible causes.

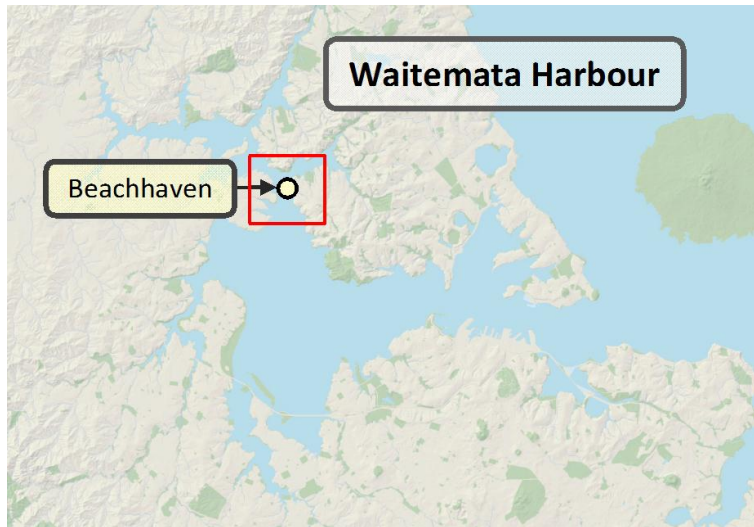
Mud content is given as the % of the $<500\ \mu\text{m}$ fraction of the sediment that is $<63\ \mu\text{m}$. Where this has been determined by more than one method in any year, the average of the values has been used.

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1.1 Beachhaven

Site	Type	Description & Notes
Beachhaven	Muddy SZ	
Reporting Area	Land Use	Site is located on the northern shore of Waitemata Harbour, just south of the mouth of Hellyers Creek estuary. The embayment receives runoff from mature urban catchment and influences from the wider Waitemata Harbour. The sediment here is muddy.
Upper Waitemata Harbour	Urban	

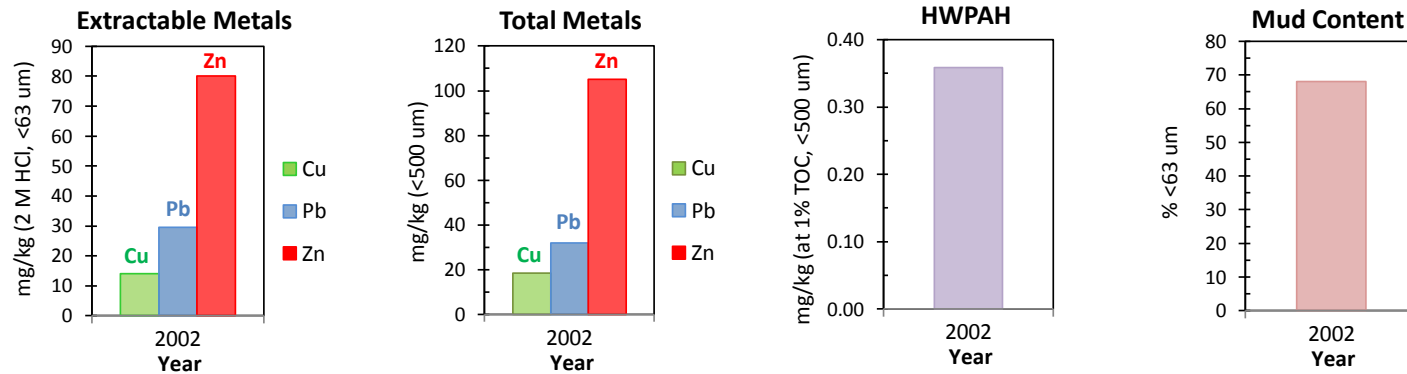


Additional Notes

Site sampled in 2002 only (KML for ARC). The "Central Waitemata East" (OHbv) site for the UWH programme (sampled annually from 2005) lies approximately 300 m north of the Beachhaven site.

Site	Description	ERC Status	Trends & Comments
Beachhaven Reporting Area Upper Waitemata Harbour	Muddy SZ site. Urban catchment.	Cu Pb Zn PAH	1 year of monitoring only. Not sampled since 2002. No trends can therefore be assessed. Current contaminant status ERC-Green/Amber. See the UWH "OHbv" site for data from 2005 onwards (OHbv lies approx. 300 m north of Beachhaven site).

Sediment chemistry summary



Annual median concentrations. Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2002	68.1	1.29	14.0	29.5	80	18.5	32.0	105	0.465	0.359
Trend (absolute units per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value
Trend (% of median per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

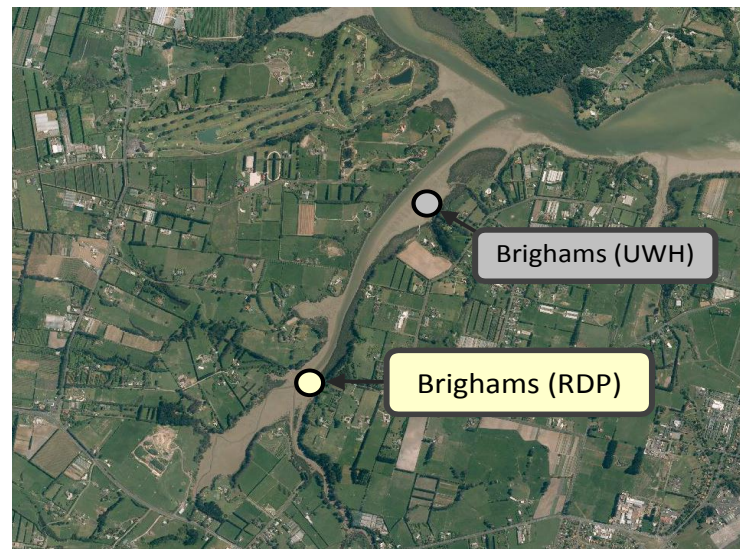
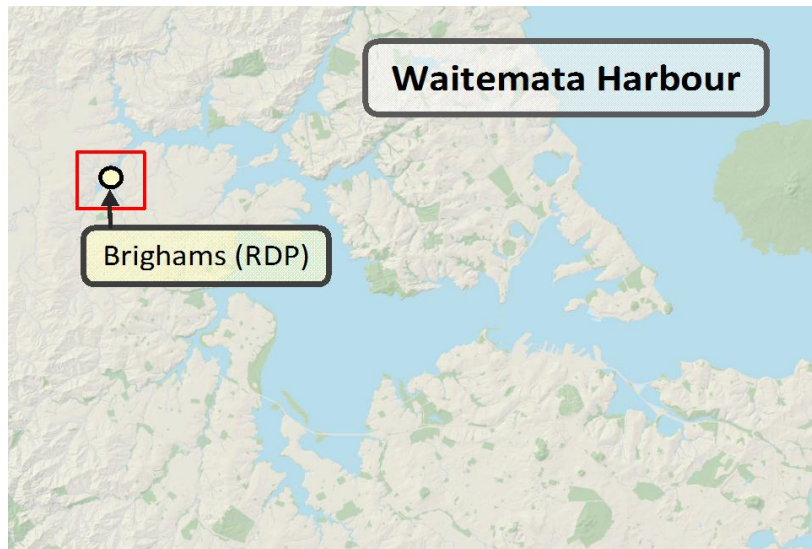
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fractions. Settling Zones - the <500 µm fraction

1.2 Brigham's Creek - RDP site

Site	Type	Description & Notes
Brighams (RDP site)	Muddy SZ	
Reporting Area	Land Use	Site is located in the mid-to-upper reaches of Brighams Creek estuary, approximately 1.7 km from the confluence with the Upper Waitemata Harbour. The catchment is rural. The sediment here is muddy.
Upper Waitemata Harbour	Rural	

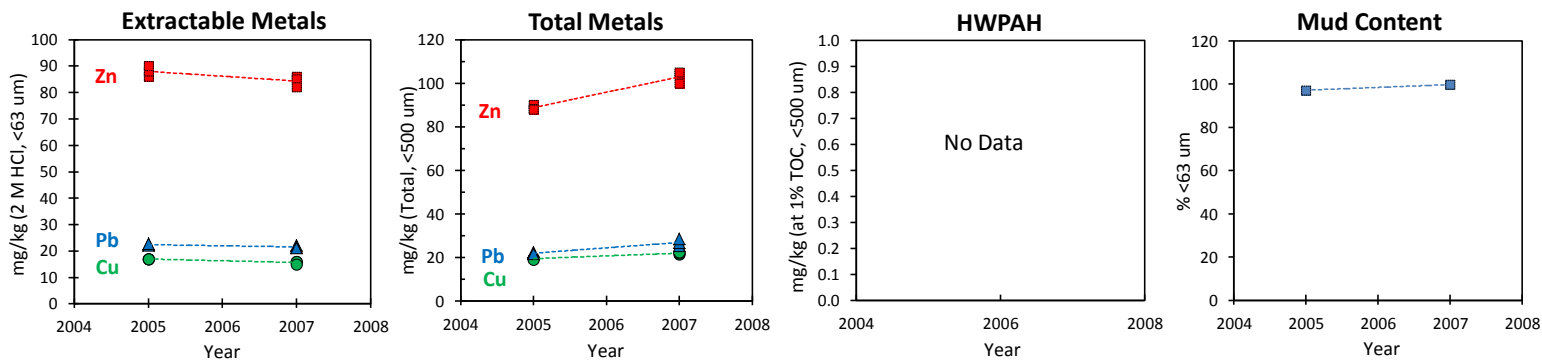


Additional Notes

The Brighams UWH programme site, located approximately 1 km downstream of the RDP site, has replaced the Brighams RDP site for on-going monitoring.

Site	Description	ERC Status	Trends & Comments
Brighams (RDP site)	Muddy SZ site. Rural catchment. RDP site ca. 1 km upstream of UWH site.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	2 years of monitoring only. No trends can therefore be assessed. 2005 & 2007 results are similar. Current contaminant status ERC-Amber/Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 um	Organic Carbon TOC (% , <500 um)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAP (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	97.2	no data	17.0	22.5	88	19.6	21.9	88	no data	no data
2007	99.8	no data	16.0	21.4	85	22.0	26.8	104	no data	no data
Median	98.5	no data	16.5	22.1	86	20.7	24.0	95	no data	no data
Trend (absolute units per year)	1.3	no value	-0.7	-0.4	-1.8	1.3	2.5	7.1	no value	no value
Trend (% of median per year)	↗ 1.3	no value	↘ -4.0	↘ -2.0	↘ -2.1	↗ 6.0	↗ 10.3	↗ 7.4	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fraction data. Settling Zones - the <500 μm fraction data

Trend Indicators

↔ < ±1%

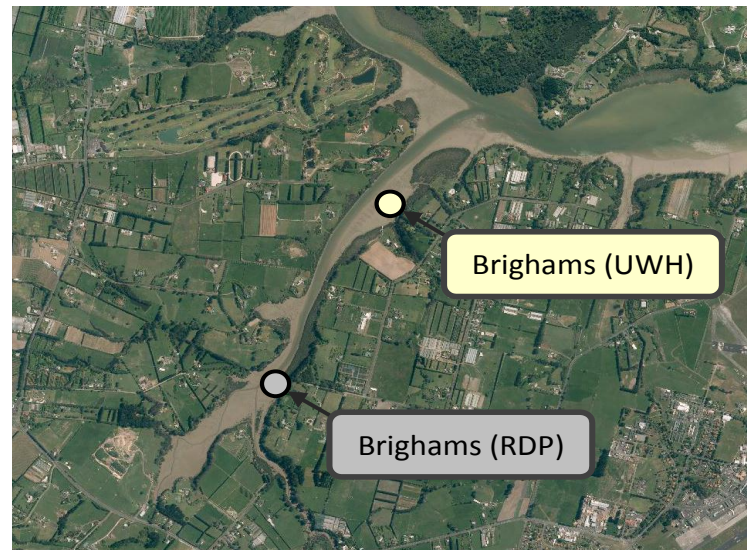
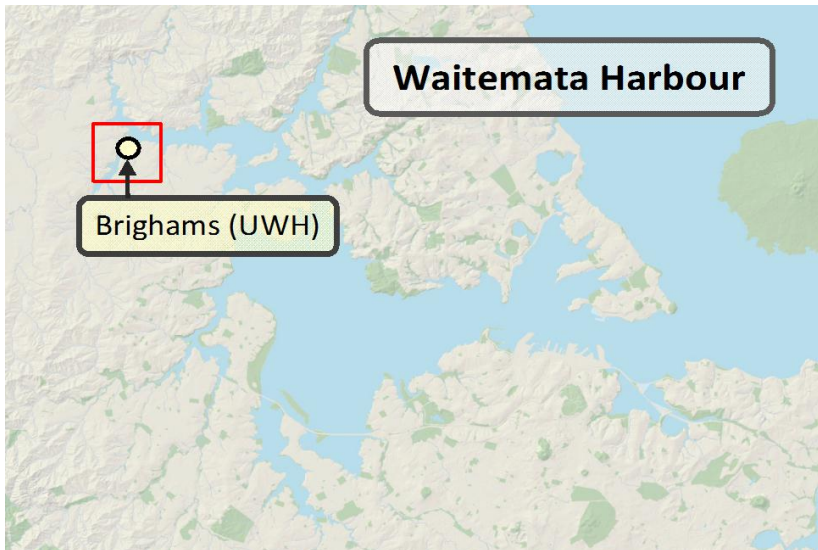
↗↘ ±1 - 2%

↕ > ±2%

Average annual rate of change, as % of median per year

1.3 Brigham’s Creek – UWH programme site

Site	Type	Description & Notes
Brighams UWH	Muddy SZ	
Reporting Area	Land Use	Site is located in the lower reaches of Brighams Creek estuary, approximately 600 m from the confluence with the Upper Waitemata Harbour. The catchment is rural. The sediment here is muddy.
Upper Waitemata Harbour	Rural	

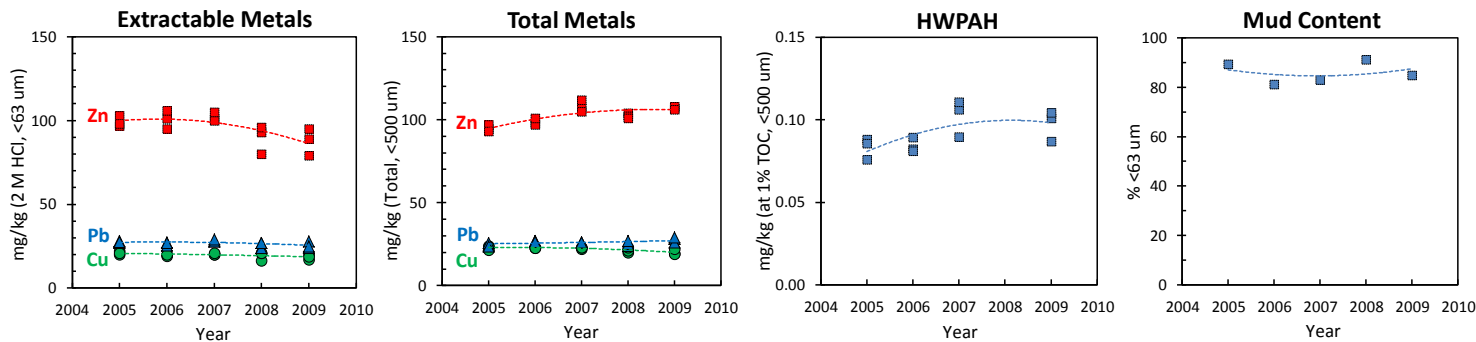


Additional Notes

RDP site approximately 1 km upstream was sampled in 2005 and 2007 (location shown above).

Site	Description	ERC Status	Trends & Comments
Brighams UWH	Muddy SZ site. Rural catchment.	Cu Pb Zn PAH	Short (4 year) monitoring period. Trends indicative only. No large changes in sediment chemistry & mud content. Green/amber contaminant levels. Overall: Fairly stable chemistry and muddiness, low-medium contamination levels.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	89.2	2.45	21.0	27.5	98	23.3	24.3	95	0.200	0.086
2006	81.2	2.47	20.0	27.0	101	22.7	26.9	98	0.200	0.082
2007	83.1	2.30	20.0	28.0	101	23.0	26.0	107	0.234	0.106
2008	91.3	2.40	21.0	27.0	93	21.0	25.0	102	no data	no data
2009	84.8	1.93	18.9	25.0	89	19.3	28.0	107	0.191	0.101
Median	84.8	2.30	20.0	27.0	97.0	22.7	26.0	102	0.200	0.089
Trend (absolute units per year)	0.11	-0.10	-0.50	-0.45	-3.43	-0.70	0.48	2.81	-0.002	0.004
Trend (% median per yr)	→ 0.1	↓ -4.3	↓ -2.5	↔ -1.7	↓ -3.5	↓ -3.1	↔ 1.8	↑ 2.8	→ -0.9	↑ 4.6

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

→ < ±1%

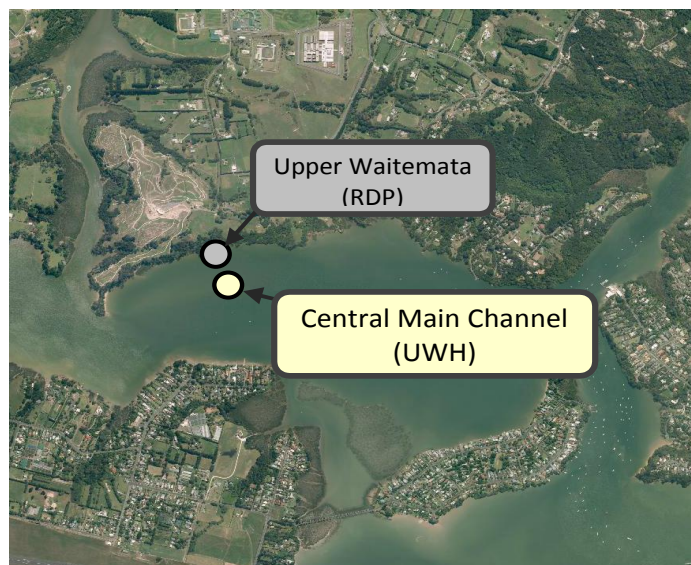
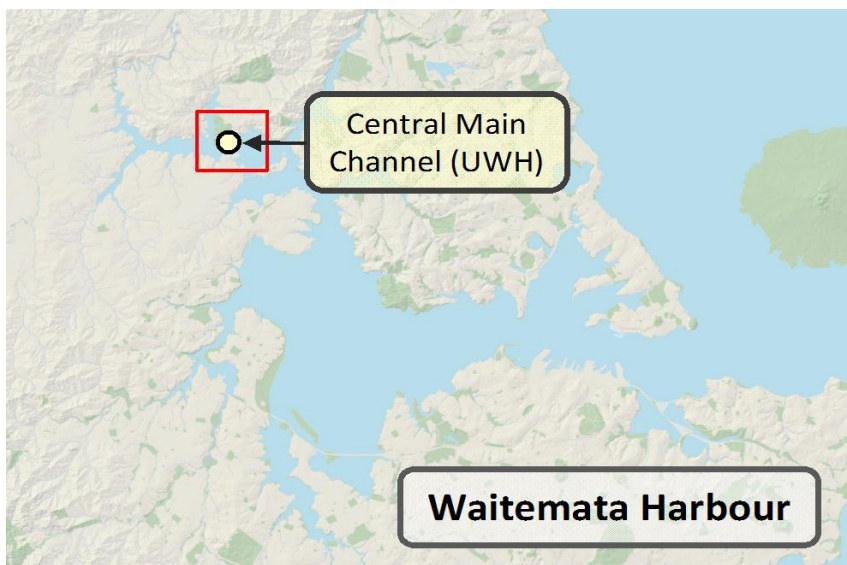
↔ ±1 - 2%

↑↓ > ±2%

Average annual rate of change, as % of median per year

1.4 Central Main Channel (“MainC”, UWH)

Site	Type	Description & Notes
Central Main Channel (MainC) UWH	Muddy OZ	
Reporting Area	Land Use	Site is located in the central basin of the Upper Waitemata Harbour. Site is likely to be influenced by mixed land uses of whole upper harbour. The sediment at MainC is deep fine sandy mud.
Upper Waitemata Harbour	Mixed rural/urban	

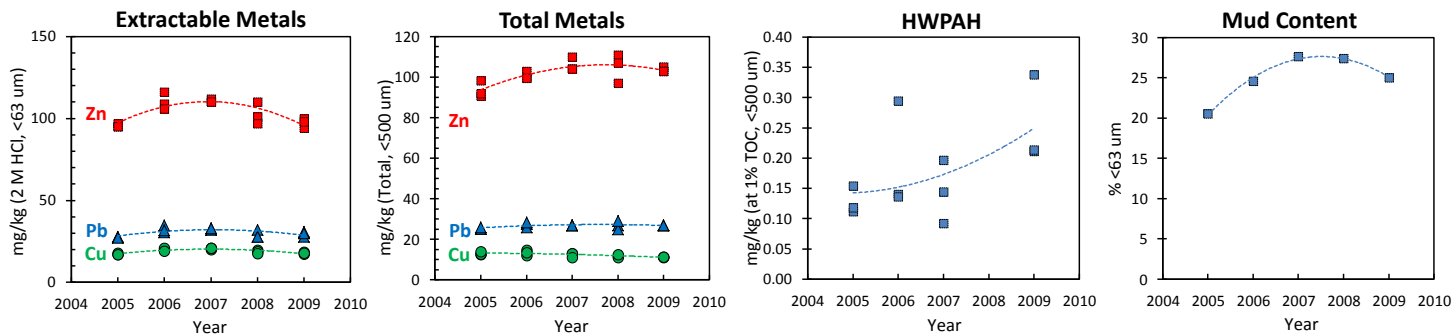


Additional Notes

Upper Waitemata RDP site located inshore from MainC UWH site (see location aerial), sampled 2007 only.

Site	Description	ERC Status	Trends & Comments
Central Main Channel (MainC) UWH	Muddy OZ site. Catchment is mixed land use, with wider Upper Waitemata Hbr influences.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">PAH</div> </div>	Short (4 year) monitoring period. Trends indicative only. ERC Green/amber contaminant levels (Pb borderline green/amber). Fairly consistent contaminant levels, with little overall trends.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	20.6	1.18	17.0	27.6	95	12.8	25.3	92	0.167	0.118
2006	24.6	1.06	20.0	31.7	109	13.4	27.5	100	0.200	0.140
2007	27.6	1.10	21.0	33.0	110	13.0	27.0	104	0.159	0.145
2008	27.4	1.28	18.7	28.0	101	11.9	27.0	107	no data	no data
2009	25.0	1.13	17.9	30.0	98	11.2	27.0	103	0.245	0.214
Median	25.0	1.16	18.7	30.6	101	12.5	27.0	103	0.186	0.150
Trend (absolute units per year)	1.17	-0.02	-0.01	0.11	-0.43	-0.54	0.29	2.43	0.026	0.028
Trend (% median per yr)	↑ 4.7	↘ -1.6	→ -0.1	→ 0.4	→ -0.4	↓ -4.3	↗ 1.1	↑ 2.4	↑ 14.0	↑ 18.4

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

↔ < ±1%

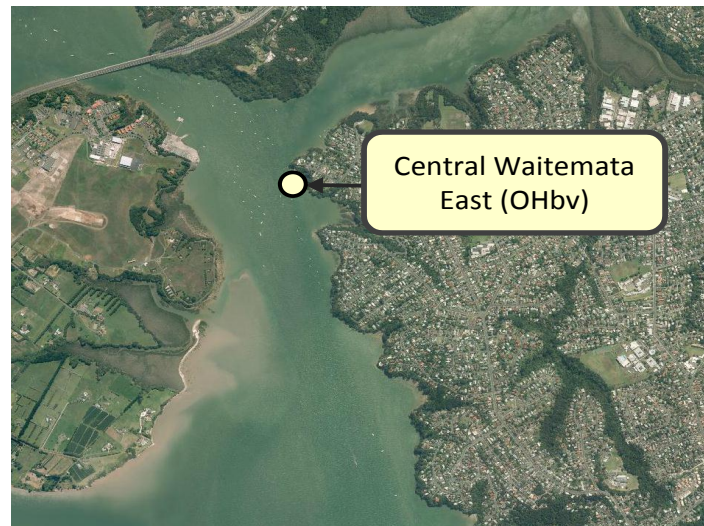
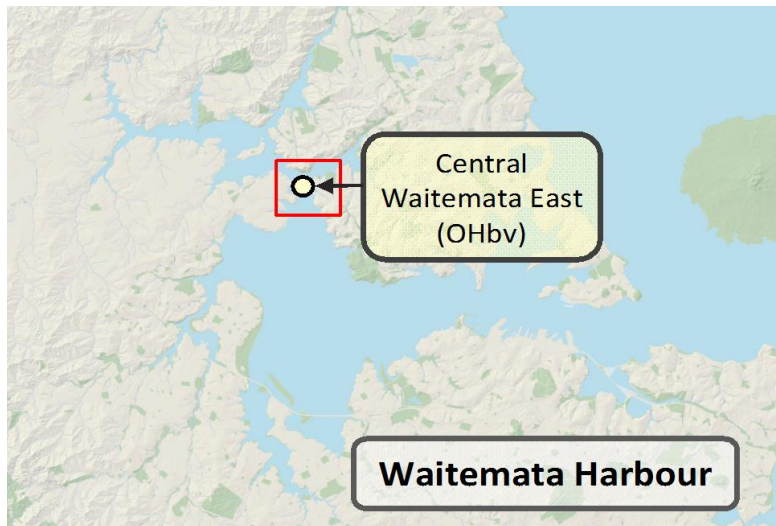
↗ ↘ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.5 Central Waitemata Harbour East (“OHbv”, UWH)

Site	Type	Description & Notes
Central Waitemata East (OHbv) UWH	Muddy OZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Middle Waitemata Harbour, on mud bank opposite the Hobsonville peninsula. The site is likely to be influenced by mixed rural/urban landuse from the broader Waitemata catchment. The sediment here is muddy.
Central Waitemata Harbour	Mixed urban/rural	

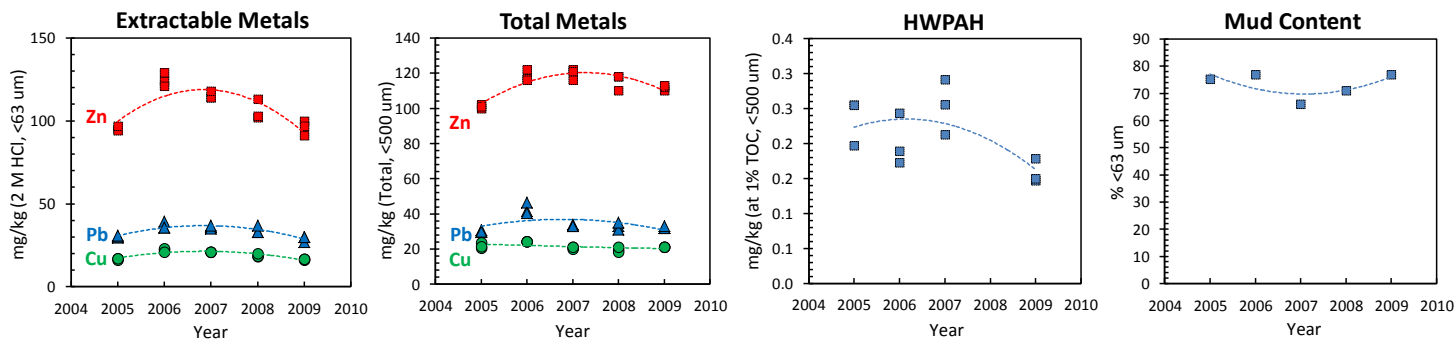


Additional Notes

The UWH programme site name is Central Waitemata East - "opposite Hobsonville" (OHbv). The adjacent urban area is Beachhaven (RDP site in the embayment to the south of OHbv - sampled once in 2002.

Site	Description	ERC Status	Trends & Comments
Central Waitemata East (Ohbv)	Muddy OZ site at upper reaches of the Middle Waitemata Hbr. Mixed land use influences from wider harbour.	<div style="display: flex; flex-wrap: wrap;"> <div style="margin: 2px;">Cu</div> <div style="margin: 2px;">Pb</div> <div style="margin: 2px;">Zn</div> <div style="margin: 2px;">PAH</div> </div>	Short (3 year) monitoring period. Trends indicative only. Green/amber contaminant levels. Little overall change over time.
Reporting Area			
Central Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	75.2	1.71	17.0	30.2	95	21.4	30.0	101	0.405	0.255
2006	76.9	1.60	22.0	35.7	124	24.2	41.6	117	0.309	0.190
2007	66.1	1.40	21.0	36.0	114	21.0	33.0	121	0.358	0.256
2008	70.9	1.35	18.4	33.0	103	19.7	33.0	118	no data	no data
2009	76.8	1.7	16.7	30.0	97.0	21.0	32.0	112	0.256	0.150
Median	75.2	1.60	18.4	33.0	103	21.0	33.0	116	0.328	0.205
Trend (absolute units per year)	-0.26	-0.04	-0.35	-0.51	-1.73	-0.63	-0.56	1.83	-0.031	-0.016
Trend (% median per yr)	→ -0.3	↓ -2.3	↘ -1.9	↘ -1.5	↘ -1.7	↓ -3.0	↘ -1.7	↗ 1.6	↓ -9.4	↓ -8.0

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

→ < ±1%

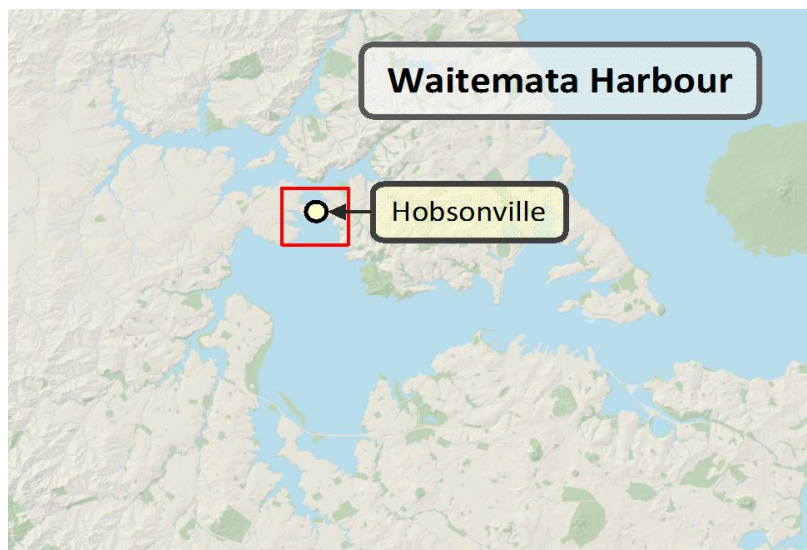
↘ ↗ ±1 - 2%

↕ > ±2%

Average annual rate of change, as % of median per year

1.6 Central Waitemata West (Hobsonville site, "Hbv", UWH programme)

Site	Type	Description & Notes
Central Waitemata West (Hbv) UWH	Sandy OZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Middle Waitemata Harbour, on sand flats adjacent to the Hobsonville peninsula. The site is influenced by mixed rural/urban landuse from the broader Waitemata catchment. The sediment here is sandy.
Central Waitemata Harbour	Mixed urban/rural	

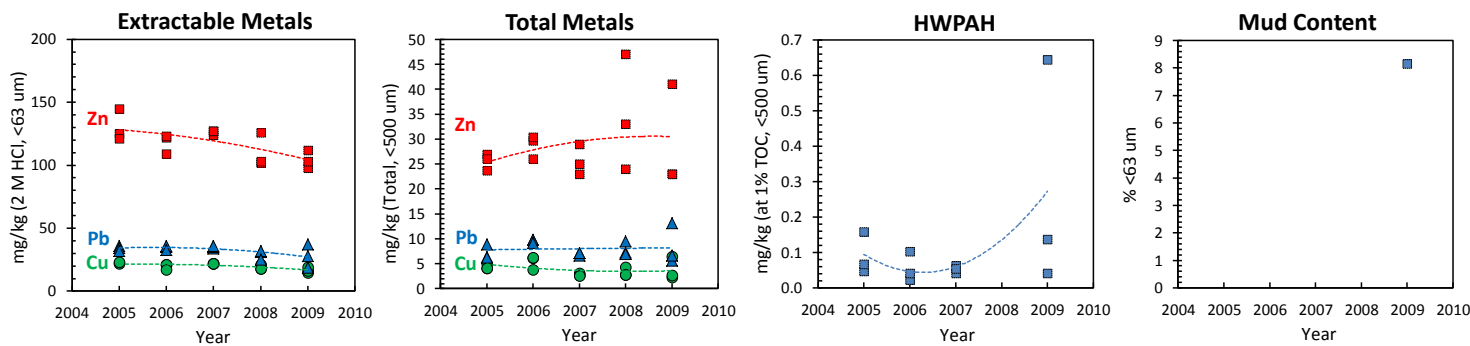


Additional Notes

The UWH programme site name is "Central Waitemata West (Hbv)". Hobsonville site has been sampled in 2002, 2005, and 2010 for the "Central Waitemata Harbour" (CWH) benthic ecology programme (sampling by ARC and AC) and annually since 2005 for the "Upper Waitemata Harbour" (UWH) ecology monitoring programme (sampling by NIWA).

Site	Description	ERC Status	Trends & Comments
Central Waitemata West (Hbv)	Sandy OZ site. Mixed rural/urban, wider Waitemata Hbr catchment influences.	<div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">PAH</div> </div>	<p>Short (4 year) monitoring period. Trends indicative only. Extreme outlier for extractable Cu (143 mg/kg in 2005) removed. One PAH rep in 2009 very high. Green contaminant levels (in mud fraction). Little overall change over time.</p>
Reporting Area			
Central Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 μm	Organic Matter TOC (% , <500 μm)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAAH (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	no data	0.31	22.5	34.5	125	4.1	6.3	26	0.021	0.068
2006	no data	0.31	21.0	35.3	122	6.1	9.7	30	0.011	0.041
2007	no data	0.26	22.0	35.0	127	2.7	7.1	25	0.014	0.055
2008	no data	0.34	18.0	31.0	103	2.8	7.2	33	no data	no data
2009	8.2	0.34	16.4	28.0	103	2.7	6.6	23	0.081	0.137
Median	8.2	0.31	21.0	34.0	122	3.8	7.1	26	0.015	0.059
Trend (absolute units per year)	no value	0.02	-1.23	-1.78	-5.97	-0.33	0.09	1.29	0.018	0.049
Trend (% median per yr)	→ no value	↑ 4.9	↓ -5.9	↓ -5.2	↓ -4.9	↓ -8.6	↑ 1.3	↑ 5.0	↑ 123.4	↑ 83.7

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fraction data. Settling Zones - the <500 μm fraction data

Trend Indicators

→ < ±1%

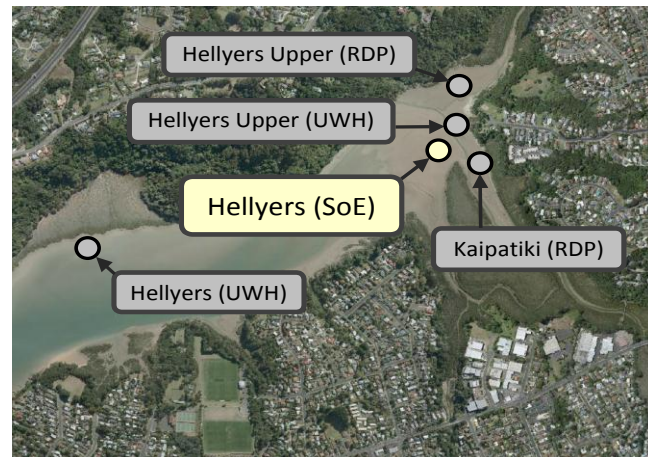
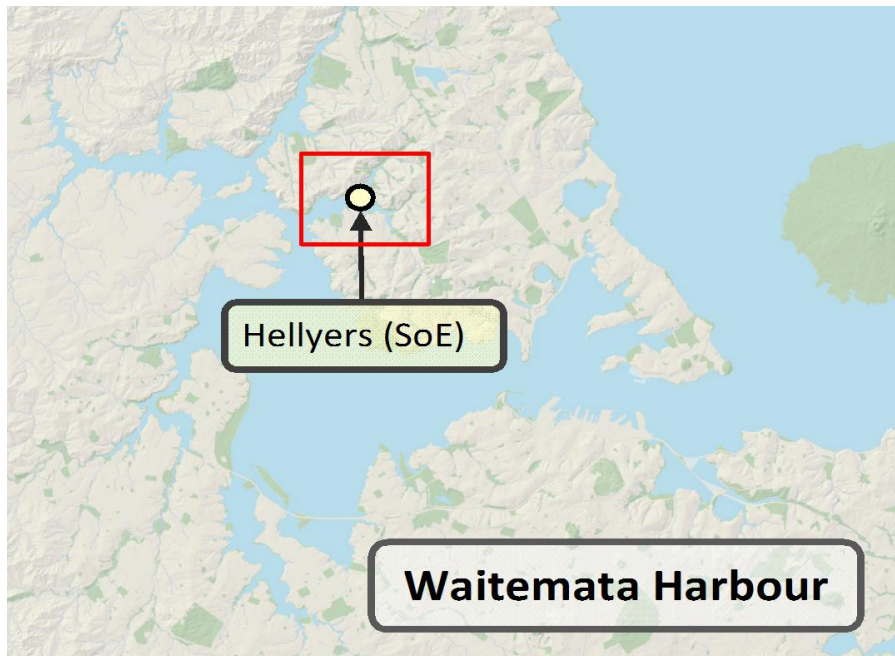
↔ ±1 - 2%

↑↓ > ±2%

Average annual rate of change, as % of median per year

1.7 Hellyers Creek (SoE)

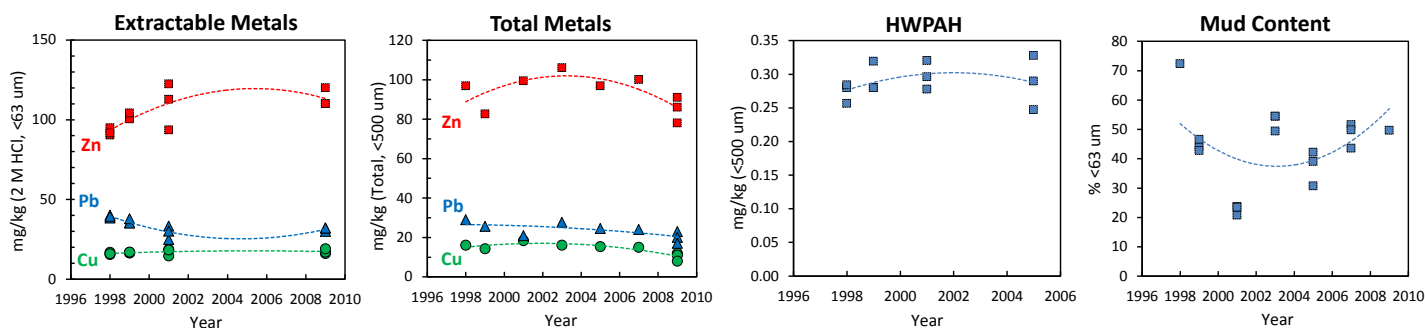
Site	Type	Description & Notes
Hellyers (SoE)	Muddy OZ	
Reporting Area	Land Use	Site is located at the confluence of Hellyers and Kaipatiki Creeks. Catchment predominantly urban (residential). Site is muddy.
Upper Waitemata Harbour	Urban	



Additional Notes
 SoE site. Note other sites nearby (Hellyers Upper - RDP and UWH, Kaipatiki RDP).

Site	Description	ERC Status	Trends & Comments
Hellyers Creek (SoE site)	Muddy OZ site . Mostly urban catchment. Immediately d/s of junction of Kaipatiki & Upper Hellyers.	<div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	11 year monitoring period. Extractable metals' data for 2003-2007 considered unreliable, therefore not shown. Assess metals' trends from Total Metals. Current contaminant status - ERC Amber (Pb). Overall, no major changes over time.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
1998	72.4	no data	16.0	39.4	92	16.0	29.0	97	0.280	no data
1999	44.0	no data	16.7	35.3	101	14.2	25.6	83	0.280	no data
2001	23.5	no data	18.3	30.1	113	18.4	20.9	99	0.296	no data
2003	54.4	1.48	no data	no data	no data	16.0	27.7	106	no data	no data
2005	39.0	1.39	no data	no data	no data	15.3	24.5	97	0.290	0.201
2007	49.8	1.30	no data	no data	no data	15.0	24.0	100	no data	no data
2009	49.6	no data	17.0	32.0	110	11.0	20.0	86	no data	no data
Median	44.0	1.40	16.7	34.2	103	15.0	24.0	97	0.282	0.201
Trend (absolute units per year)	0.2	-0.04	0.1	-0.6	1.5	-0.5	-0.6	-0.6	0.001	no value
Trend (% of median per year)	⇒ 0.3	⇩ -2.9	⇒ 0.5	⇩ -1.6	⇒ 1.5	⇩ -3.4	⇩ -2.4	⇒ -0.7	⇒ 0.4	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66	Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7	Cu >34 Pb >50 Zn >150 PAH >1.7
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ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data .

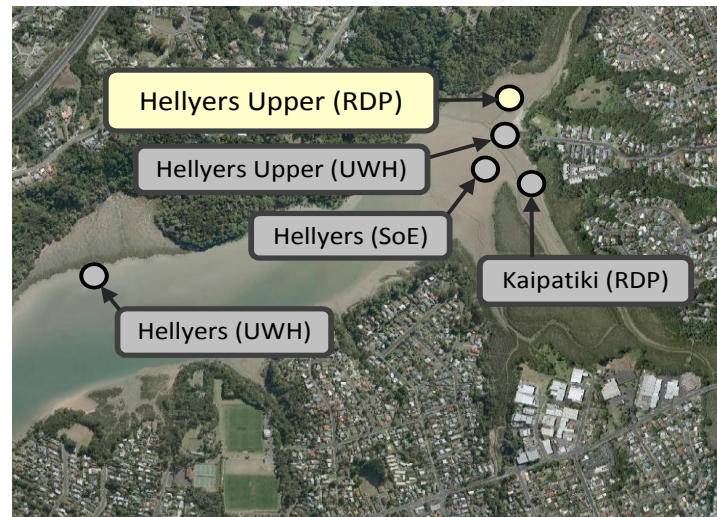
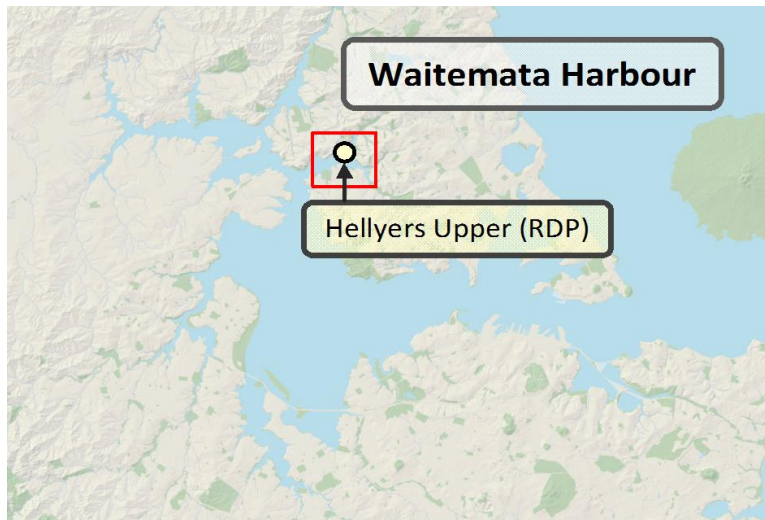
Trend Indicators

⇨ < ±1%	⇨⇩ ±1 - 2%	⇨⇩ > ±2%
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Average annual rate of change, as % of median per year

1.8 Hellyers Upper (RDP)

Site	Type	Description & Notes
Hellyers Upper (RDP)	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of Hellyers estuary above the confluence with the Kaipatiki Creek arm. The site is influenced by a mainly urban catchment (lower density bush/urban on western side). The sediment is muddy.
Upper Waitemata Harbour	Mainly urban	

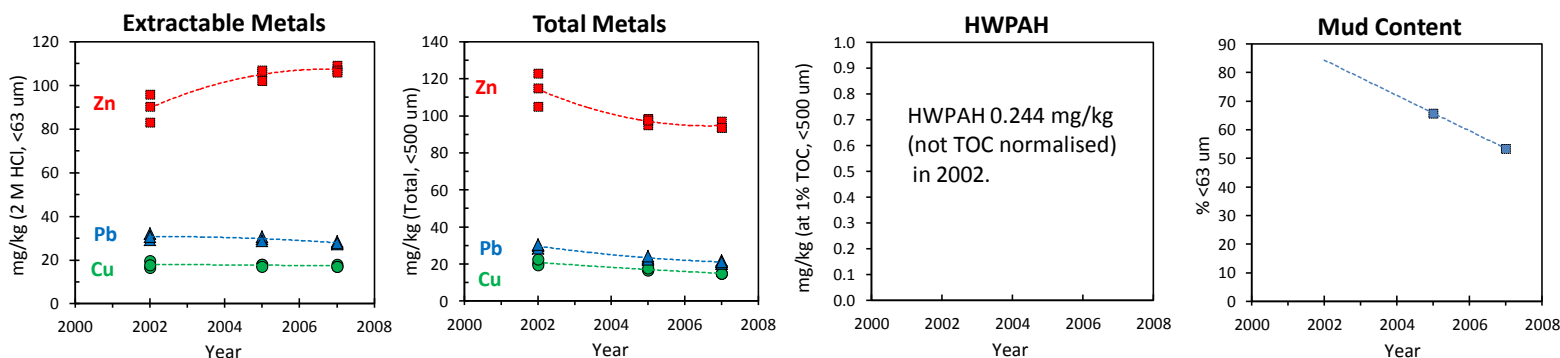


Additional Notes

There are 3 other monitoring sites nearby - Hellyers SoE programme (biannual sampling 1998 onwards), Kaipatiki RDP site (2005, 2007, & 2009), and Hellyers Upper UWH site (annual from 2005). Note that the Kaipatiki and Hellyers Upper RDP sites were also sampled in 2002, but exact site locations are uncertain.

Site	Description	ERC Status	Trends & Comments
Hellyers Upper (RDP site)	Muddy SZ site. Urban/bush catchment. Site is u/s of confluence with Kaipatiki Creek estuary.	<div style="display: flex; flex-wrap: wrap;"> <div style="margin: 2px;">Cu</div> <div style="margin: 2px;">Pb</div> <div style="margin: 2px;">Zn</div> <div style="margin: 2px;">PAH</div> </div>	Only 3 samplings. Trends therefore not yet reliable. Current contaminant status ERC-Green. PAH (only) measured in 2002 (exact site location unknown) - no TOC measured, but PAH likely to be ERC-Green. Mud content only measured twice, therefore trends not reliable. 2002 metals data from
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2002	no data	no data	17.8	30.8	90	20.6	30.0	115	0.244	no data
2005	65.8	no data	18.0	29.8	106	16.9	23.2	98	no data	no data
2007	53.4	no data	17.0	27.9	107	15.0	21.0	94	no data	no data
Median	59.6	no data	17.8	29.4	106	16.9	23.2	98	0.244	no data
Trend (absolute units per year)	-6.19	no value	-0.12	-0.55	3.66	-1.19	-1.74	-4.07	no value	no value
Trend (% of median per year)	↓ -10.4	no value	→ -0.7	↘ -1.9	↑ 3.5	↓ -7.0	↓ -7.5	↓ -4.2	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66	Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7	Cu >34 Pb >50 Zn >150 PAH >1.7
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ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data .

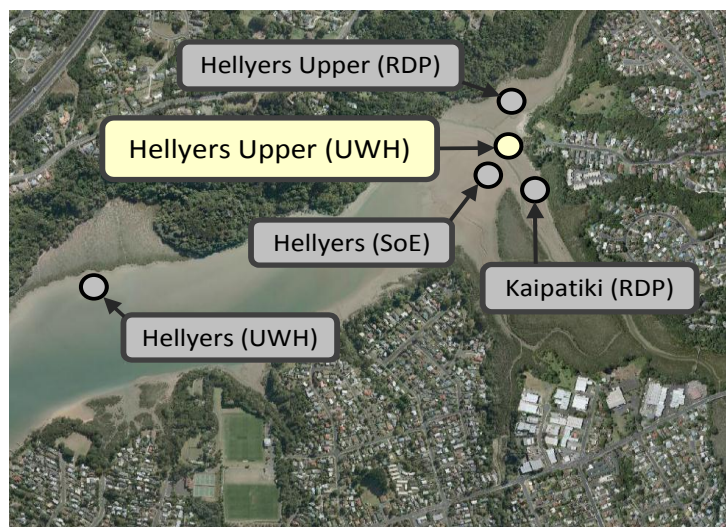
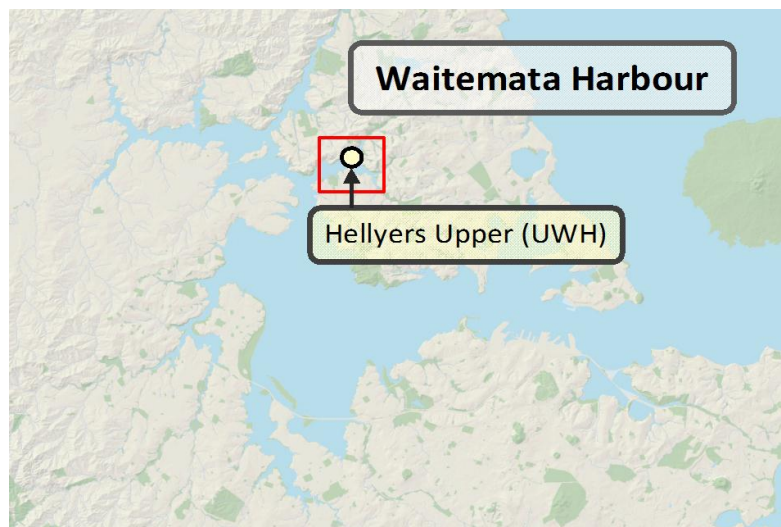
Trend Indicators

→ < ±1%	↔ ±1 - 2%	↑↓ > ±2%
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Average annual rate of change, as % of median per year

1.9 Hellyers Upper (“HellU”, UWH)

Site	Type	Description & Notes
Hellyers Upper (UWH)	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of Hellyers estuary at the confluence with the Kaipatiki Creek arm. The site is influenced by a mainly urban catchment. The sediment here is muddy. This site has been sampled annually since 2005 for the UWH benthic ecology programme.
Upper Waitemata Harbour	Mainly urban	

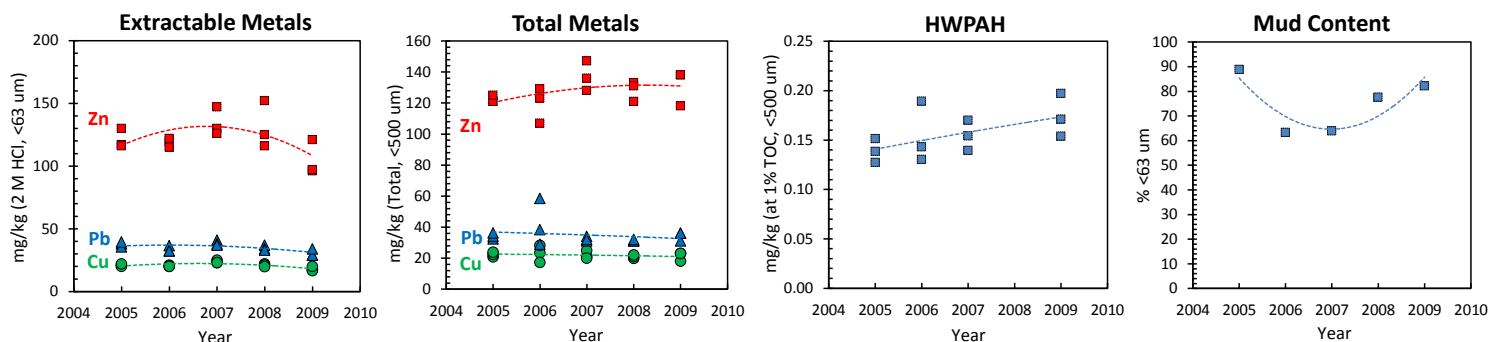


Additional Notes

There are 3 other monitoring sites nearby in the upper reaches of Hellyers Creek - Hellyers SoE programme site (biannual sampling 1998 onwards), Kaipatiki RDP site (2005, 2007, & 2009), and Hellyers Upper RDP site (2005 & 2007). Note that the Kaipatiki and Hellyers Upper RDP sites were also sampled in 2002, but exact site locations are uncertain. The Hellyers UWH programme site lies approximately 1.2 km downstream.

Site	Description	ERC Status	Trends & Comments
Hellyers Upper UWH	Muddy SZ site in upper Hellyers estuary. Primarily urban catchment.	Cu Pb Zn PAH	Short (4 year) monitoring period. Trends indicative only. Amber metals' levels, PAH Green. Little overall change over time.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations and indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	88.8	2.14	21.0	37.9	117	22.4	34.1	121	no data	0.068
2006	63.3	2.05	20.0	32.4	119	23.4	38.3	123	0.297	0.041
2007	63.8	1.80	23.0	38.0	130	21.0	32.0	136	0.251	0.055
2008	77.6	2.00	21.0	34.0	125	21.0	31.0	131	no data	no data
2009	82.1	1.95	17.2	29.0	97	23.0	36.0	138	0.300	no data
Median	77.6	2.00	21.0	35.6	121	22.0	32.4	128	0.295	0.059
Trend (absolute units per year)	0.10	-0.06	-0.55	-1.31	-2.04	-0.39	-1.05	2.67	0.007	0.008
Trend (% median per yr)	→ 0.1	↓ -3.0	↓ -2.6	↓ -3.7	↘ -1.7	↘ -1.8	↓ -3.2	↑ 2.1	↑ 2.2	↑ 5.3

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7
Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data.

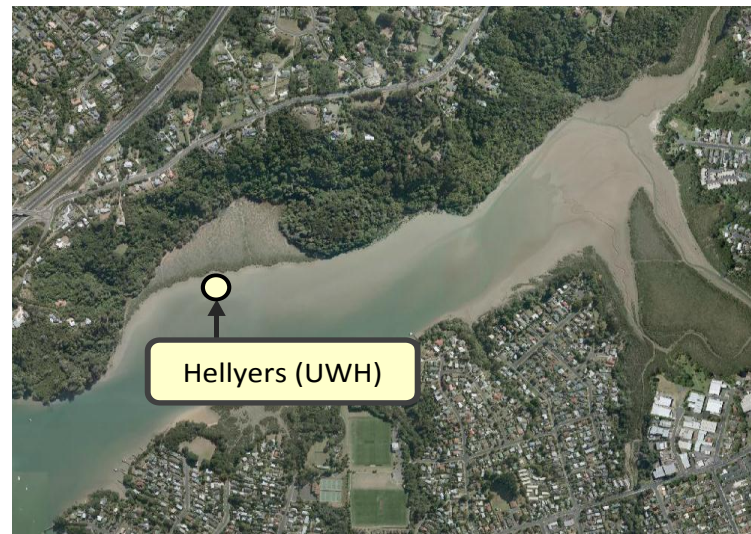
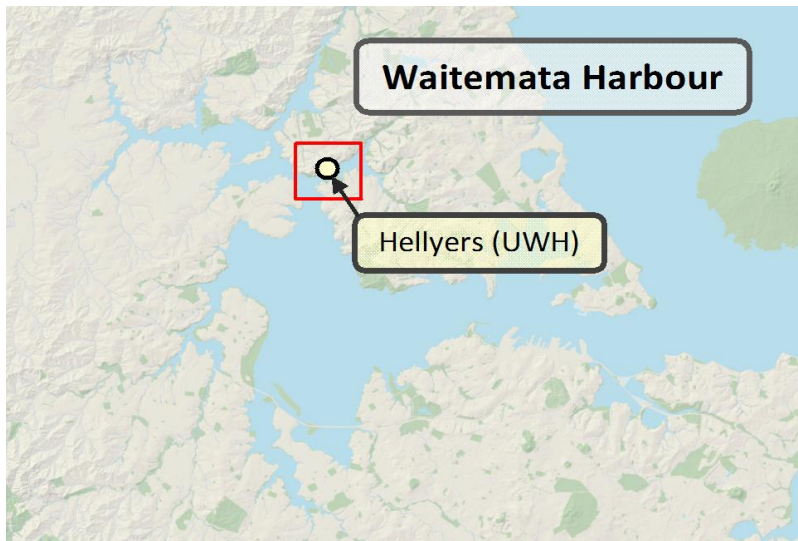
Trend Indicators

↔ < ±1%
↗ ↘ ±1 - 2%
↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.10 Hellyers (“Hell”, UWH)

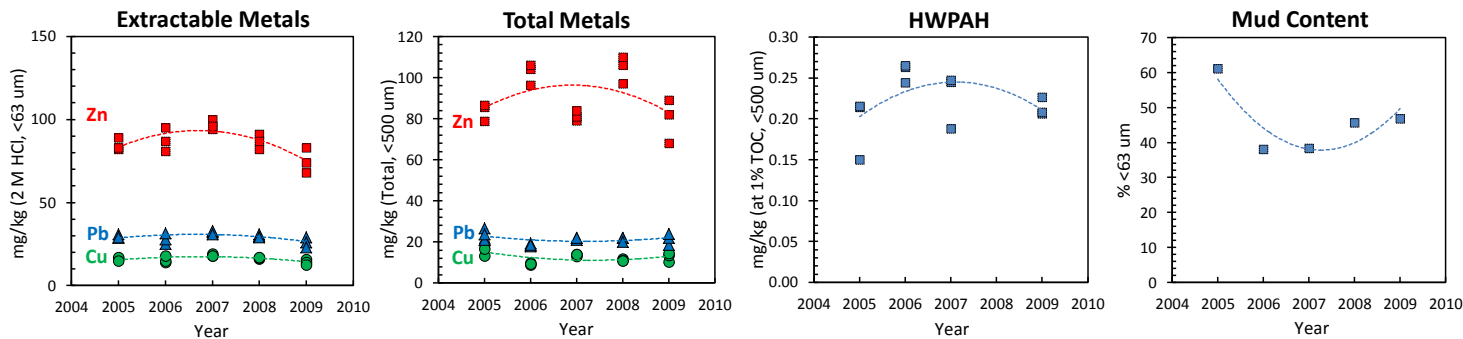
Site	Type	Description & Notes
Hellyers (UWH)	Muddy OZ	
Reporting Area	Land Use	Site is located in the lower reaches of Hellyers estuary. The site is influenced by a mainly urban catchment. The sediment here is muddy. This site has been sampled annually since 2005 for the UWH benthic ecology programme.
Upper Waitemata Harbour	Mainly urban	



Additional Notes

Site	Description	ERC Status	Trends & Comments
Hellyers UWH	Muddy OZ site in mid-lower Hellyers estuary. Primarily urban catchment.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid gray; padding: 2px; margin: 2px;">PAH</div> </div>	Short (4 year) monitoring period. Trends indicative only. Green contaminant levels (in mud fraction). Little overall change over time.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	61.1	1.47	16.0	29.0	83	16.7	23.8	86	no data	0.068
2006	38.1	0.76	15.0	28.0	87	9.4	18.6	104	0.200	0.041
2007	38.4	1.10	18.0	32.0	96	14.0	22.0	81	0.272	0.055
2008	45.6	0.81	16.7	30.0	87	11.0	22.0	106	no data	no data
2009	46.7	1.16	14.1	26.0	74	13.5	22.0	82	0.258	no data
Median	45.6	1.06	16.2	29.0	87	13.0	22.0	87	0.243	0.059
Trend (absolute units per year)	-2.12	-0.08	-0.28	-0.54	-2.03	-0.52	-0.19	-0.55	-0.006	0.001
Trend (% median per yr)	↓ -4.6	↓ -7.6	↔ -1.7	↔ -1.9	↓ -2.3	↔ -4.0	↔ -0.9	↔ -0.6	↓ -2.6	↔ 0.3

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7
Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

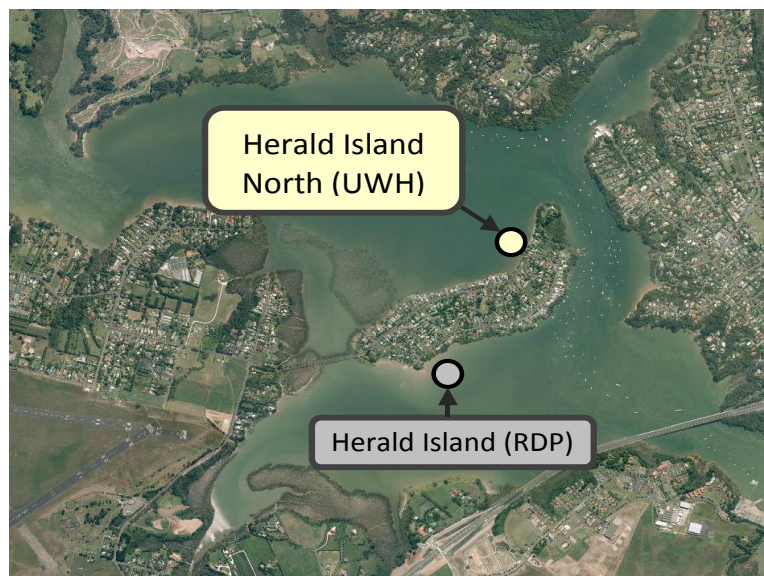
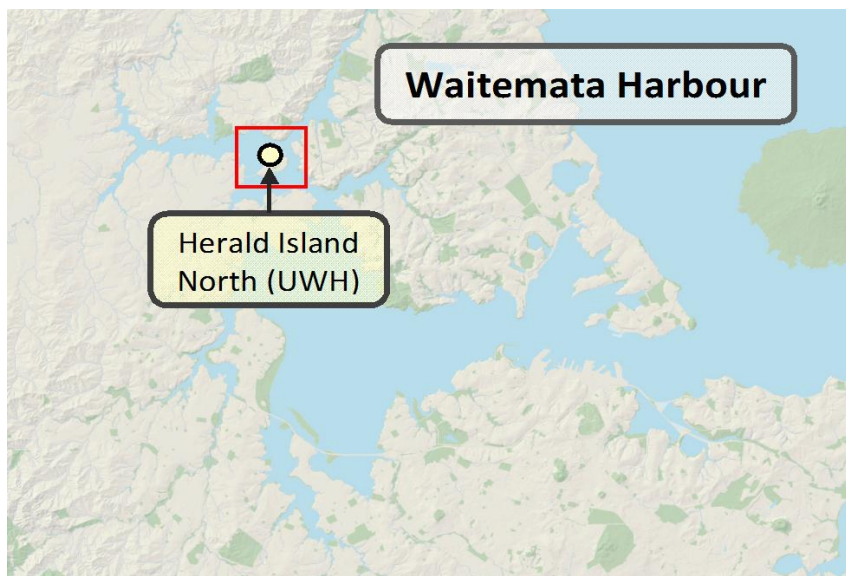
Trend Indicators

↔ < ±1%
↔ ↗ ↘ ±1 - 2%
↕ ↕ > ±2%

Average annual rate of change, as % of median per year

1.11 Herald Island North (“HIN”, UWH)

Site	Type	Description & Notes
Herald Island North (HIN) UWH	Sandy OZ	
Reporting Area	Land Use	Site is located on the northern side of Herald Island (Christmas Beach). Site likely to be influenced by mixed land uses - localised urban and wider rural/urban Upper Waitemata Harbour. The sediment here is sandy.
Upper Waitemata Harbour	Mixed rural/urban.	

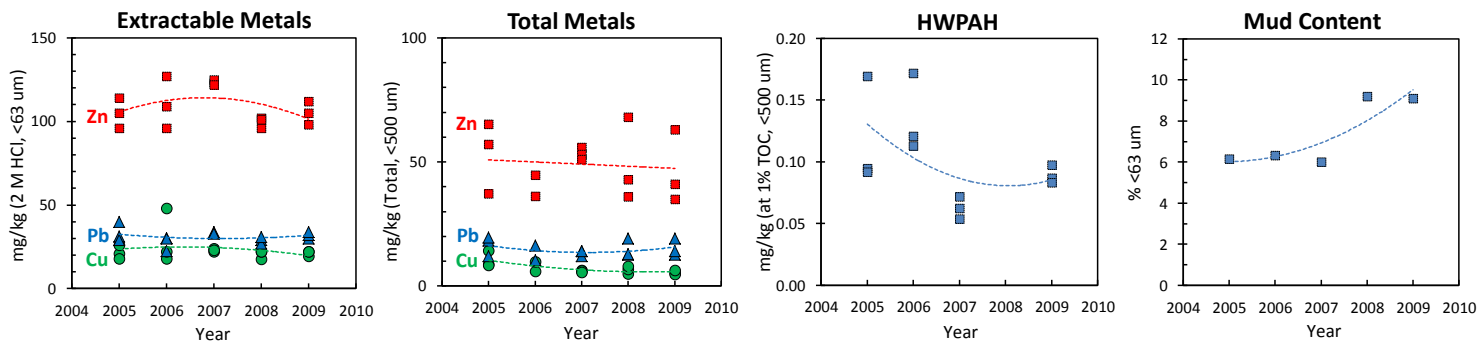


Additional Notes

Herald Island RDP site is on opposite side of the island & was sampled in 2005 only (location shown above).

Site	Description	ERC Status	Trends & Comments
Herald Island North (HIN) UWH	Sandy OZ site. Mixed land use, mainly rural catchment (Upper Waitemata Hbr). Local urban influences.	<div style="display: flex; flex-wrap: wrap;"> <div style="margin: 2px;">Cu</div> <div style="margin: 2px;">Pb</div> <div style="margin: 2px;">Zn</div> <div style="margin: 2px;">PAH</div> </div>	<p>Short (4 year) monitoring period. Trends indicative only.</p> <p>Variable sediment chemistry, possibly due to sandy texture & low mud content. Green/amber (just) contaminant levels. Increasing trend in muddiness?</p>
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	6.1	0.58	21.0	31.3	105	8.9	18.3	57	0.055	0.095
2006	6.3	0.46	22.0	30.0	109	8.0	13.4	40	0.052	0.121
2007	6.0	0.37	23.0	33.0	123	6.1	14.0	53	0.023	0.062
2008	9.2	0.46	22.0	29.0	101	6.7	12.8	43	no data	no data
2009	9.1	0.42	22.0	32.0	105	5.3	14.0	41	0.040	0.087
Median	6.3	0.46	22.0	31.0	105	6.4	14.0	48	0.047	0.093
Trend (absolute units per year)	0.88	-0.03	-0.98	-0.15	-1.10	-1.17	-0.16	-0.85	-0.008	-0.011
Trend (% median per yr)	↑ 13.9	↓ -6.4	↓ -4.5	→ -0.5	↘ -1.0	↓ -18.4	↘ -1.2	↘ -1.8	↓ -17.4	↓ -11.3

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

⇒ < ±1%

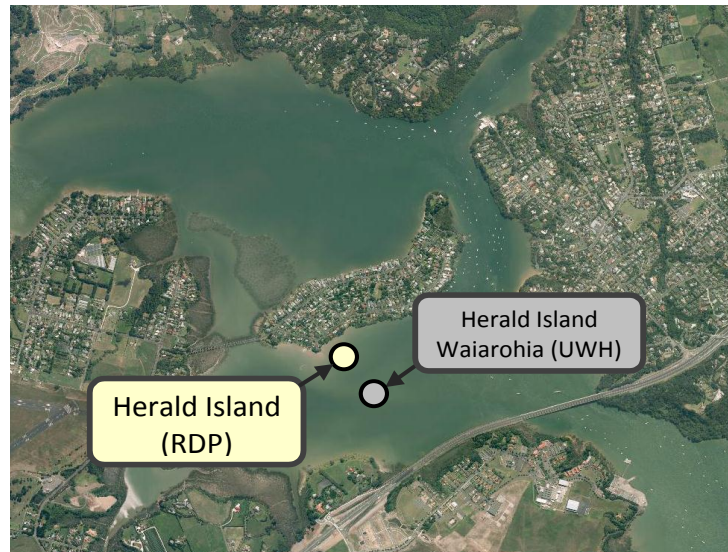
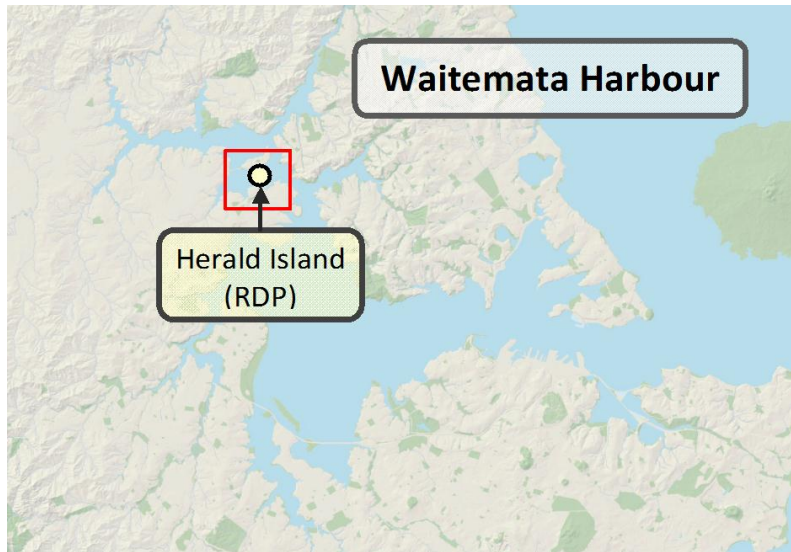
↗ ↘ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.12 Herald Island (RDP)

Site	Type	Description & Notes
Herald Island (RDP site)	Sandy OZ	
Reporting Area	Land Use	Site is located on a large sand flat on the southern side of Herald Island in Waiarohia Inlet. Site likely to be influenced by mixed land uses - localised urban and wider rural/urban Upper Waitemata Harbour. The sediment here is sand.
Upper Waitemata Harbour	Mixed rural/urban.	

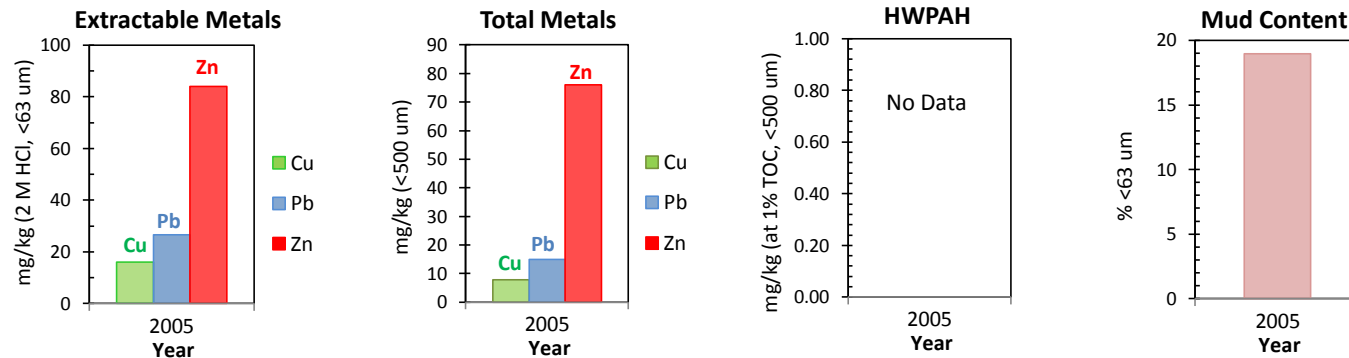


Additional Notes

Herald Island Waiarohia (HIW) UWH programme site, sampled annually from 2005, is approximately 250 m south east of the Herald Island RDP site.

Site	Description	ERC Status	Trends & Comments
Herald Island (RDP)	Sandy OZ site, southern shores of Herald Island. Large mixed catchment influences.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	1 year of monitoring only. Not sampled since 2005. No trends can therefore be assessed. Current contaminant status ERC-Green. See UWH site "HIW" for annual monitoring from 2005.
Reporting Area			
Upper Waitemata Harbour			

Sediment chemistry summary



Annual median concentrations. Colours refer to ERC (see footnotes).

Year	Mud Content % <63 μm	Organic Carbon TOC (% , <500 μm)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAH (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	18.9	no data	16.0	26.6	84	7.8	15.0	76	no data	no data
Trend (absolute units per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value
Trend (% of median per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

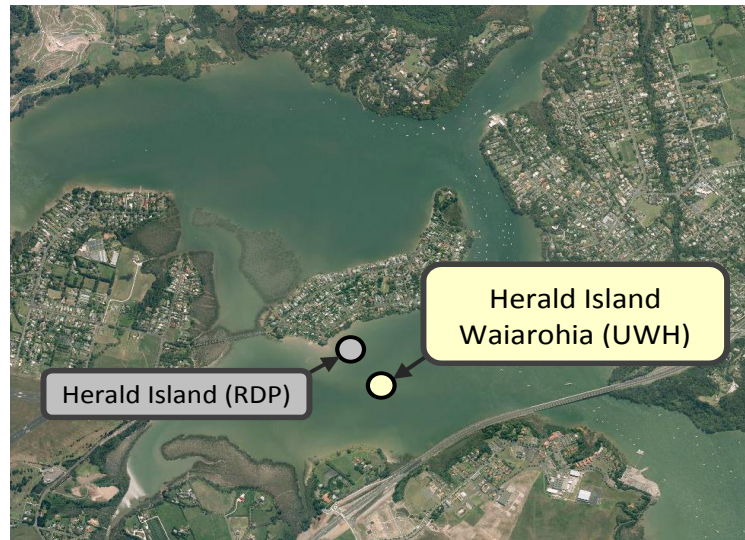
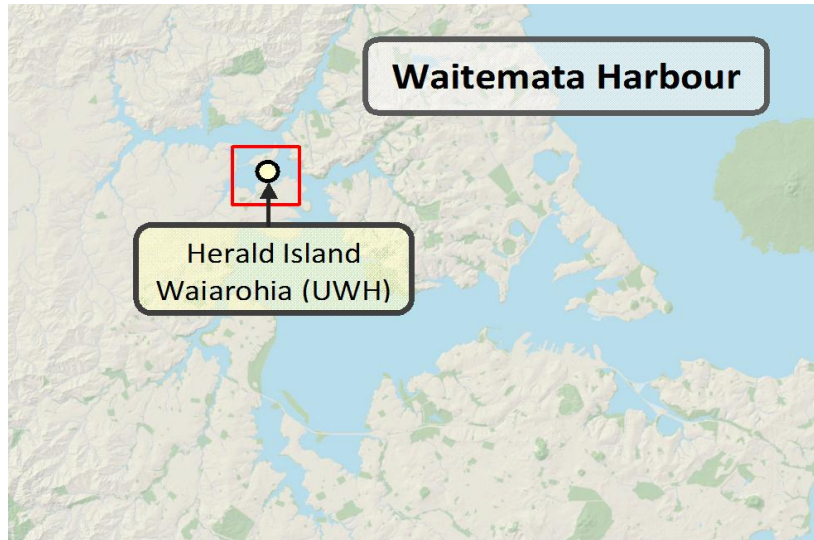
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fractions. Settling Zones - the <500 μm fraction

1.13 Herald Island Waiarohia (“HIW”, UWH)

Site	Type	Description & Notes
Herald Island Waiarohia (HIW)	Sandy OZ	
Reporting Area	Land Use	Site is located on the southern side of Herald Island in Waiarohia Inlet. Site likely to be influenced by mixed land uses - localised urban and wider rural/urban Upper Waitemata Harbour. The sediment here is fine muddy sand.
Upper Waitemata Harbour	Mixed rural/urban.	

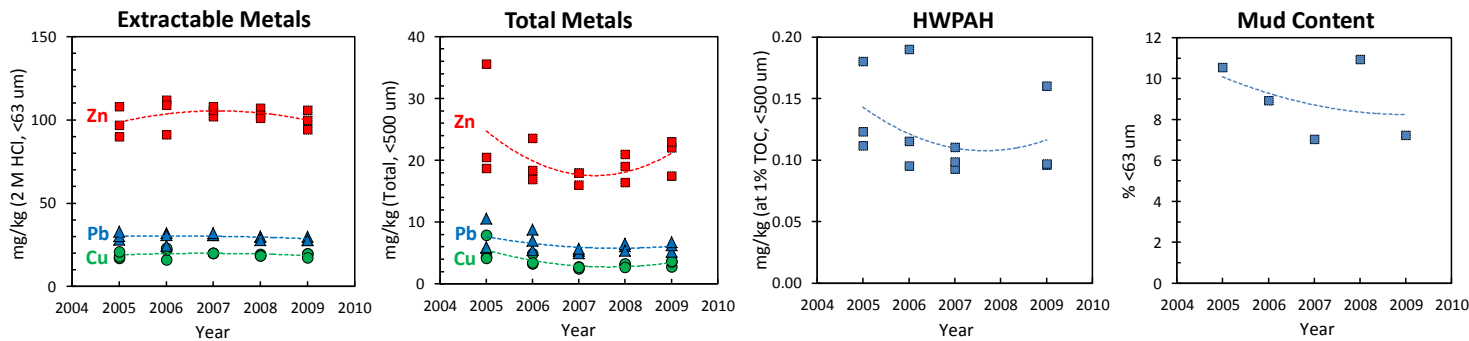


Additional Notes

Herald Island RDP site is approximately 250 m closer to Herald Island & was sampled in 2005 only (location shown above).

Site	Description	ERC Status	Trends & Comments
Herald Island Waiarohia (HIW)	Sandy OZ site. Mixed land use, mainly rural catchment. Local urban influences possible.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	<p>Short (4 year) monitoring period. Trends indicative only.</p> <p>Variable sediment chemistry, possibly due to sandy texture & low mud content. Green/amber (just) contaminant levels.</p>
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	10.5	0.34	18.0	30.3	97	4.4	5.9	21	0.038	0.123
2006	8.9	0.26	22.0	30.8	109	3.4	7.0	18	0.030	0.115
2007	7.0	0.26	20.0	31.0	106	2.7	5.4	18	0.028	0.099
2008	10.9	0.30	18.6	30.0	103	3.2	6.1	19	no data	no data
2009	7.2	0.35	19.6	28.0	100	3.6	6.3	22	0.034	0.097
Median	8.9	0.30	19.6	30.0	103	3.3	5.9	19	0.032	0.111
Trend (absolute units per year)	-0.46	-0.01	-0.10	-0.34	0.30	-0.51	-0.38	-0.90	-0.004	-0.006
Trend (% median per yr)	↓ -5.2	↓ -2.1	→ -0.5	↘ -1.1	→ 0.3	↓ -15.4	↓ -6.5	↓ -4.8	↓ -11.1	↓ -5.3

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

⇒ < ±1%

↗ ↘ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.14 Hobsonville

Site	Type	Description & Notes
Hobsonville	Sandy OZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Middle Waitemata Harbour, on sand flats adjacent to the Hobsonville peninsula. The site is influenced by mixed rural/urban landuse from the broader Waitemata catchment. The sediment here is sandy.
Upper Waitemata Harbour	Mixed urban/rural	



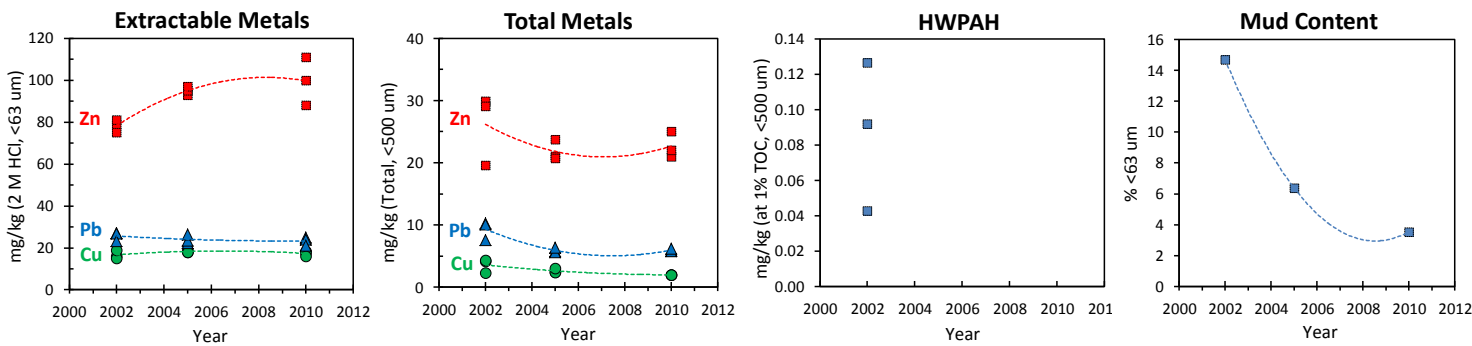
Additional Notes

Hobsonville site has been sampled in 2002, 2005, and 2010 for the "Central Waitemata Harbour" (CWH) benthic ecology programme (sampling by ARC and AC) and annually since 2005 for the "Upper Waitemata Harbour" (UWH) ecology monitoring programme (sampling by NIWA). The UWH site is called "Central Waitemata West" (Hbv).

1.14.1 Data from sampling conducted in CWH ecology programme

Site	Description	ERC Status	Trends & Comments
Hobsonville (CWH data)	Sandy OZ site. Mixed rural/urban, Upper Waitemata Hbr catchment.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">PAH</div> </div>	3 years of monitoring only. 2005 to 2009 also sampled annually in UWH programme (site "Hbv"). Current contaminant status ERC-Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2002	14.7	0.43	16.0	26.8	79	4.2	10.1	29	0.048	0.092
2005	6.4	no data	18.0	23.5	95	2.5	5.8	21	no data	no data
2010	6.4	no data	18.0	23.5	95	2.5	5.8	21	no data	no data
Median	6.4	0.43	18.0	24.0	93	2.4	6.2	22	0.048	0.092
Trend (absolute units per year)	-1.3	no value	0.1	-0.3	2.5	-0.2	-0.4	-0.4	no value	no value
Trend (% of median per year)	↓ -20.5	no value	→ 0.3	↘ -1.2	↑ 2.7	↘ -8.0	↘ -6.1	↘ -1.7	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7
Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

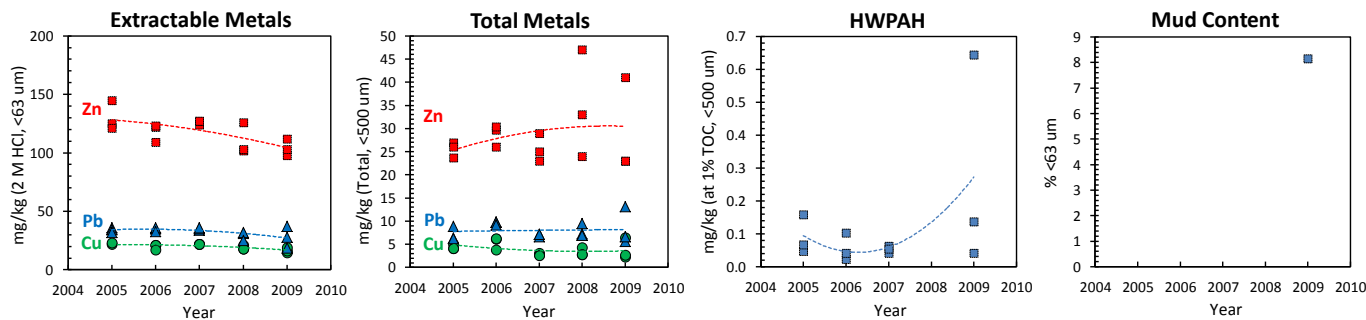
↔ < ±1%
↗↘ ±1 - 2%
↕ > ±2%

Average annual rate of change, as % of median per year

1.14.2 Data from sampling conducted in UWH programme

Site	Description	ERC Status	Trends & Comments
Central Waitemata West (Hbv)	Sandy OZ site. Mixed rural/urban, wider Waitemata Hbr catchment influences.	Cu Pb	Short (4 year) monitoring period. Trends indicative only. Extreme outlier for extractable Cu (143 mg/kg in 2005) removed. One PAH rep in 2009 very high. Green contaminant levels (in mud fraction). Little overall change over time.
Reporting Area		Zn PAH	
Central Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	no data	0.31	22.5	34.5	125	4.1	6.3	26	0.021	0.068
2006	no data	0.31	21.0	35.3	122	6.1	9.7	30	0.011	0.041
2007	no data	0.26	22.0	35.0	127	2.7	7.1	25	0.014	0.055
2008	no data	0.34	18.0	31.0	103	2.8	7.2	33	no data	no data
2009	8.2	0.34	16.4	28.0	103	2.7	6.6	23	0.081	0.137
Median	8.2	0.31	21.0	34.0	122	3.8	7.1	26	0.015	0.059
Trend (absolute units per year)	no value	0.02	-1.23	-1.78	-5.97	-0.33	0.09	1.29	0.018	0.049
Trend (% median per yr)	no value	4.9	-5.9	-5.2	-4.9	-8.6	1.3	5.0	123.4	83.7

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

↔ < ±1%

↕ ±1 - 2%

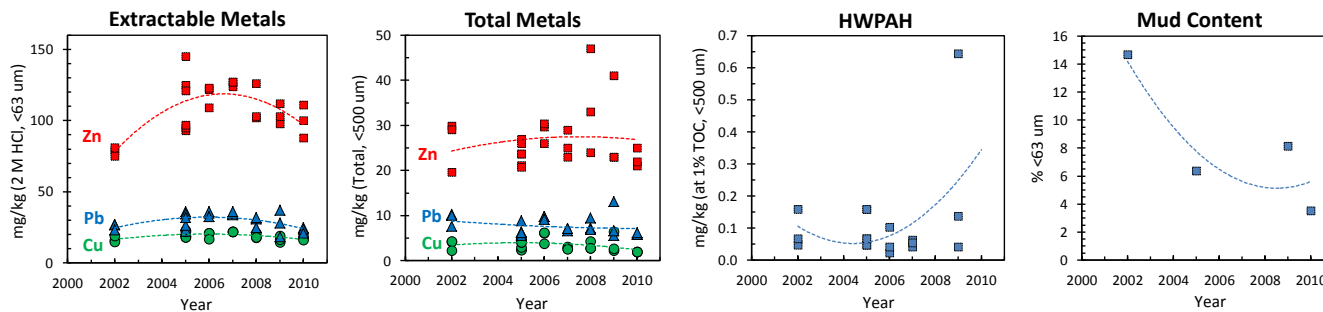
↕ > ±2%

Average annual rate of change, as % of median per year

1.14.3 Data from CWH and UWH programmes combined

Site	Description	ERC Status	Trends & Comments
Hobsonville CWH and UWH	Sandy OZ site. Mixed rural/urban catchment (Upper/Central Waitemata Harbour).	Cu	Data from CWH (2002, 2005, 2010) and UWH (2005, 6, 7, 8 & 9) combined. Extreme outlier for extractable Cu (143 mg/kg in 2005, UWH programme) removed. One PAH replicate in 2009 very high (hence large "trend"). ERC Green contaminant levels.
Reporting Area		Pb	
Central Waitemata Harbour		Zn PAH	

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 um	Organic Matter TOC (% <500 um)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAAH (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2002	14.7	0.43	16.0	26.8	79	4.2	10.1	29	0.021	0.068
2005	6.4	0.31	19.0	29.2	109	3.6	6.3	24	0.021	0.068
2006	no data	0.31	21.0	35.3	122	6.1	9.7	30	0.011	0.041
2007	no data	0.26	22.0	35.0	127	2.7	7.1	25	0.014	0.055
2008	no data	0.34	18.0	31.0	103	2.8	7.2	33	no data	no data
2009	8.2	0.34	16.4	28.0	103	2.7	6.6	23	0.081	0.137
2010	3.5	no data	17.5	24.0	100	2.0	5.9	22	no data	no data
Median	7.3	0.31	18.4	29.5	106	2.9	7.0	25	0.019	0.065
Trend (absolute units per year)	-1.05	-0.004	-0.06	-0.16	1.93	-0.14	-0.20	0.29	0.007	0.020
Trend (% median per yr)	↘ -14.4	↘ -1.4	↔ -0.3	↔ -0.6	↗ 1.8	↘ -4.9	↘ -2.8	↗ 1.2	↗ 37.8	↗ 30.8

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66 Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7 Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fraction data. Settling Zones - the <500 μm fraction data

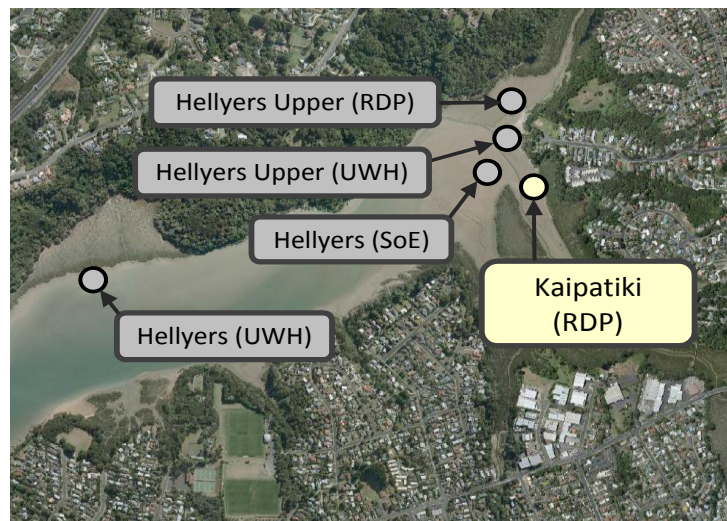
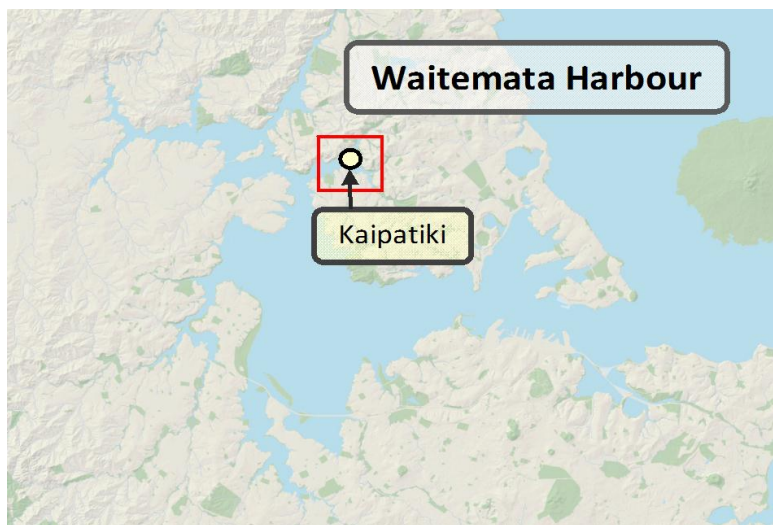
Trend Indicators

↔ < ±1% ↗ ↘ ±1 - 2% ↗ ↘ > ±2%

Average annual rate of change, as % of median per year

1.15 Kaipatiki

Site	Type	Description & Notes
Kaipatiki (RDP)	Muddy SZ	
Reporting Area	Land Use	Site is located in the lower reaches of the Kaipatiki Creek estuary immediately above the confluence with the main body of Hellyers estuary. The catchment is urban. The sediment is muddy.
Upper Waitemata Harbour	Urban	

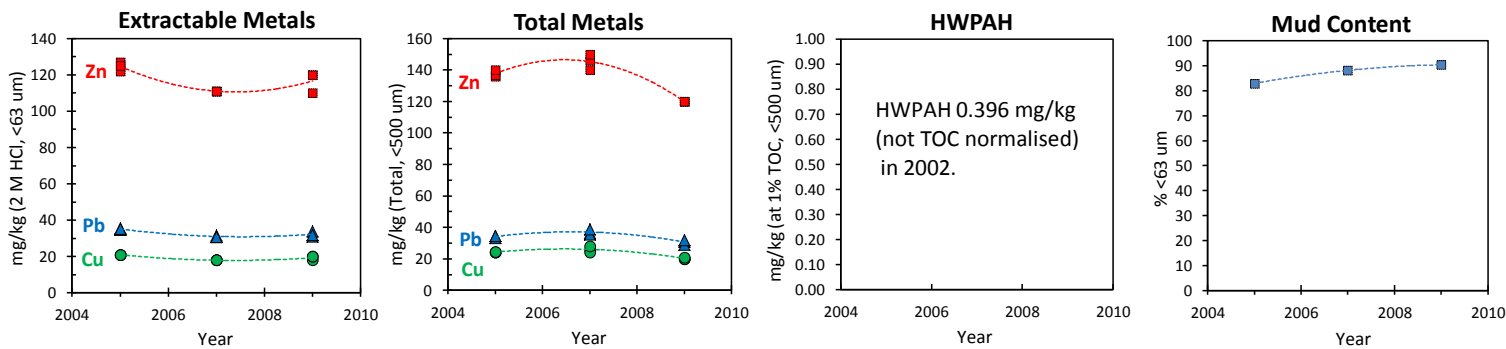


Additional Notes

There are 2 other monitoring sites nearby, that are likely to have similar influences - Hellyers SoE programme (biannual sampling 1998 onwards), and Hellyers Upper UWH site (annual from 2005). Hellyers Upper RDP site is location upstream of the Kaipatiki/Hellyers confluence. Note that the Kaipatiki and Hellyers Upper RDP sites were also sampled in 2002, but exact site locations are uncertain.

Site	Description	ERC Status	Trends & Comments
Kaipatiki (RDP site)	Muddy SZ site. Urban catchment. Site immediately u/s of confluence with Hellyers Creek estuary.	<div style="display: flex; flex-wrap: wrap;"> <div style="margin: 2px;">Cu</div> <div style="margin: 2px;">Pb</div> <div style="margin: 2px;">Zn</div> <div style="margin: 2px;">PAH</div> </div>	Only 4 year monitoring period, 3 samplings. Trends therefore indicative. No major changes to date. Current contaminant status ERC-Amber. PAH (only) measured in 2002, but exact site location unknown - no TOC measured, but PAH likely to be ERC-Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 μm	Organic Carbon TOC (% <500 μm)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAH (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	82.9	no data	21.0	35.4	125	24.2	34.5	137	no data	no data
2007	88.1	no data	18.0	30.9	111	25.8	36.5	146	no data	no data
2009	90.3	no data	20.0	32.0	120	20.0	31.0	120	no data	no data
Median	88.1	no data	20.0	32.0	120	24.2	34.5	137	no data	no data
Trend (absolute units per year)	1.9	no value	-0.4	-0.7	-2.0	-1.0	-0.9	-4.4	no value	no value
Trend (% of median per year)	↑ 2.1	no value	↓ -2.1	↓ -2.2	↘ -1.7	↓ -4.0	↓ -2.5	↓ -3.2	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fraction data. Settling Zones - the <500 μm fraction data

Trend Indicators

⇒ < ±1%

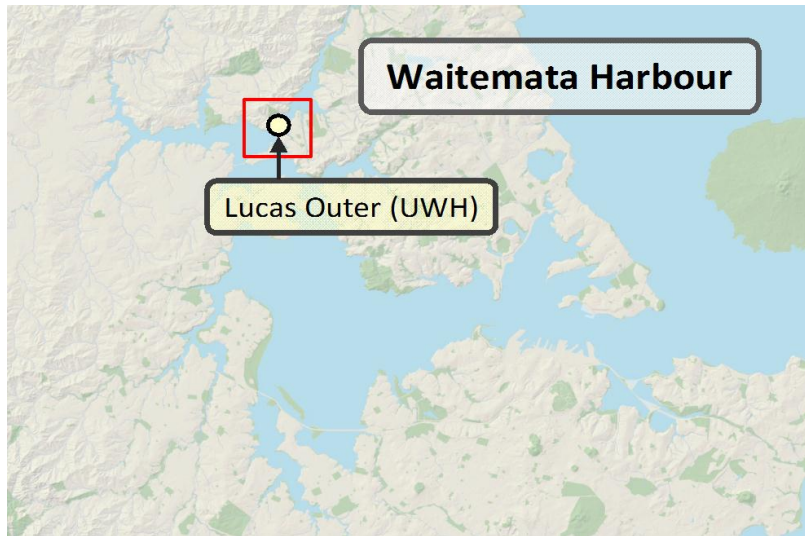
↘ ↗ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.16 Lucas Outer (“Luc”, UWH)

Site	Type	Description & Notes
Lucas Outer (LUC) UWH	Muddy SZ	Site is located near the mouth of Lucas Creek estuary. Lucas Creek catchment is low density urban/rural on north/east side and urban on the western side. Likely to be increasing urban influence. The sediment at LUC is fine sand/mud over hard clay base.
Reporting Area	Land Use	
Upper Waitemata Harbour	Urban	

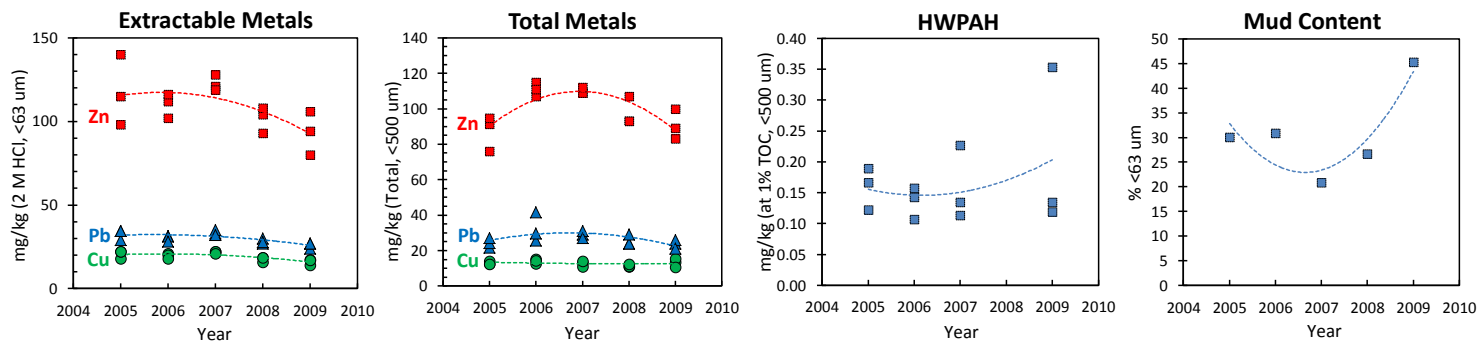


Additional Notes

Note commercial boatyard and slipway opposite site.

Site	Description	ERC Status	Trends & Comments
Lucas Outer (LUC) UWH	Muddy SZ site. Thin mud/sand over hard clay base. Catchment is mostly urban, with lower density rural/urban on NE side.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid green; padding: 2px; margin: 2px;">PAH</div> </div>	Short (4 year) monitoring period. Trends indicative only. ERC Green contaminant levels. Variable texture.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 um	Organic Matter TOC (% <500 um)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	30.1	0.86	22.0	34.4	115	12.5	24.3	91	0.135	0.167
2006	30.8	0.93	20.0	31.3	112	14.2	29.6	111	0.133	0.143
2007	20.8	0.83	22.0	33.0	121	13.0	29.0	109	0.112	0.135
2008	26.7	0.81	18.5	28.0	104	11.2	24.0	93	no data	no data
2009	45.3	1.17	16.9	27.0	94	13.5	24.0	89	0.139	0.135
Median	30.1	0.86	18.6	30.0	108	12.7	26.0	100	0.134	0.139
Trend (absolute units per year)	2.63	0.03	-1.11	-1.53	-5.70	-0.19	-0.81	-0.66	0.026	0.013
Trend (% median per yr)	↑ 8.7	↑ 3.6	↓ -6.0	↓ -5.1	↓ -5.3	↓ -1.5	↓ -3.1	→ -0.7	↑ 19.3	↑ 9.4

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

↔ < ±1%

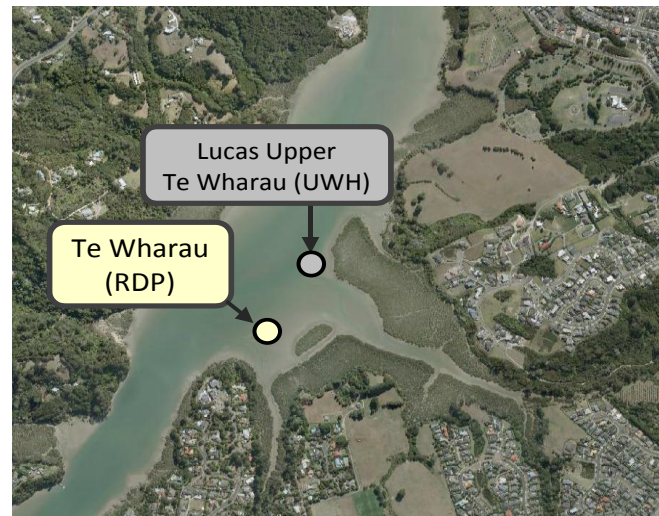
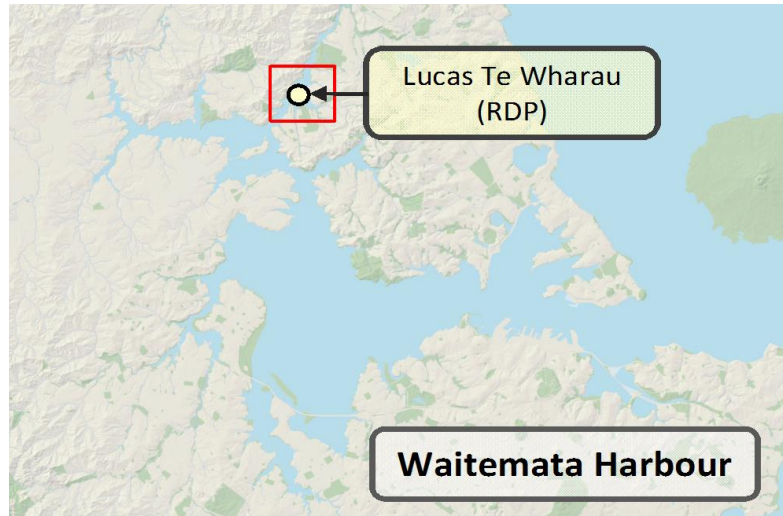
↗ ↘ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.17 Lucas Creek, Te Wharau (RDP)

Site	Type	Description & Notes
Lucas Te Wharau (RDP)	Muddy SZ	
Reporting Area	Land Use	Site is located at the confluence of Lucas Creek and Te Wharau Creek estuaries. Lucas Creek catchment is low density urban/rural on north/east side and urban on the western side. Likely to be increasing urban influence. The sediment is deep mud.
Upper Waitemata Harbour	Urban	

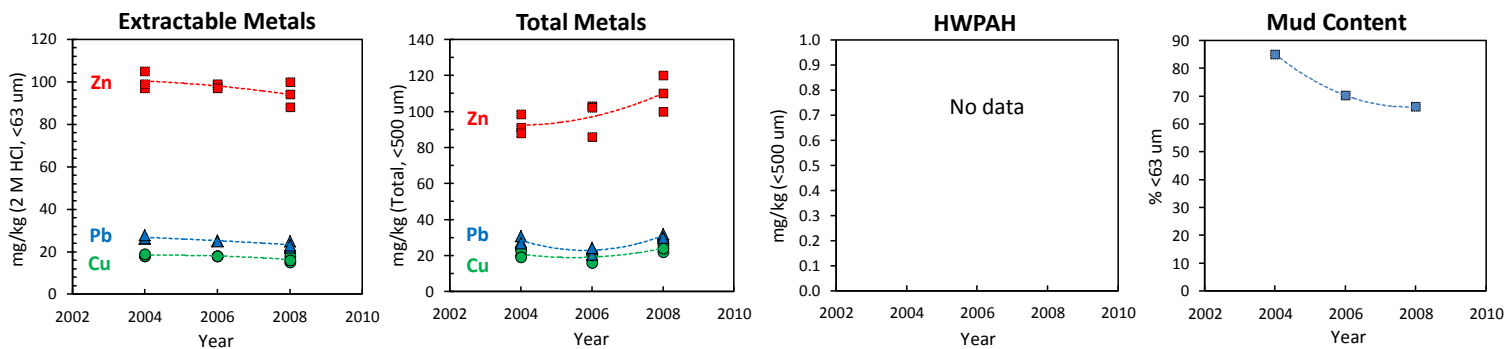


Additional Notes

Te Wharau UWH site (LUCU) is located nearby (see location aerial), sampled annually from 2005. Te Wharau also sampled in 2002 (URS for NSCC), but exact location of site uncertain.

Site	Description	ERC Status	Trends & Comments
Lucas Te Wharau (RDP site)	Muddy SZ site in lower reaches of Lucas Creek. Urban catchment. Exact location of 2002 site uncertain.		4 year monitoring period. 2002 data (URS for NSCC) not included as site location uncertain. Current contaminant status - ERC Amber/Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2004	85.1	no data	18.0	26.4	99	20.1	27.7	91	no data	no data
2006	70.3	no data	18.0	25.3	98	20.4	24.0	102	no data	no data
2008	66.2	no data	16.0	23.0	94	24.0	31.0	110	no data	no data
Median	70.3	no data	18.0	25.3	98	21.0	27.7	100	no data	no data
Trend (absolute units per year)	-4.7	no value	-0.5	-0.9	-1.6	0.8	0.6	4.4	no value	no value
Trend (% of median per year)	↓ -6.7	no value	↓ -2.8	↓ -3.4	↘ -1.6	↑ 3.9	↑ 2.3	↑ 4.4	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction

Trend Indicators

⇌ < ±1%

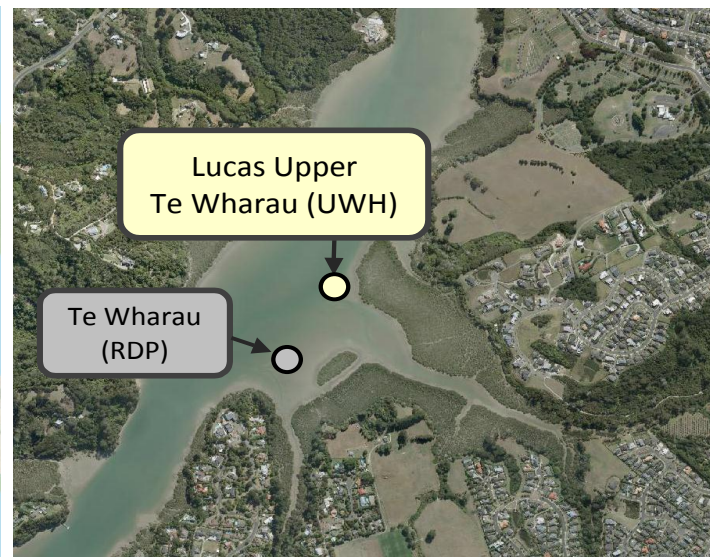
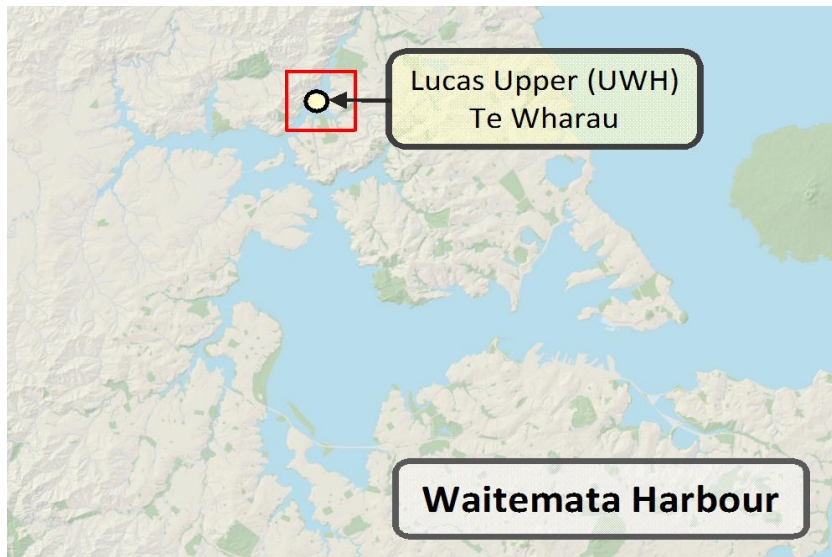
↗ ↘ ±1 - 2%

↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.18 Lucas Upper, Te Wharau (“LucU”, UWH)

Site	Type	Description & Notes
Lucas Upper (Te Wharau) UWH	Muddy SZ	
Reporting Area	Land Use	Site is located at the confluence of Lucas Creek and Te Wharau Creek estuaries. Lucas Creek catchment is low density urban/rural on north/east side and urban on the western side. Likely to be increasing urban influence. The sediment at LUCU is mud.
Upper Waitemata Harbour	Urban	

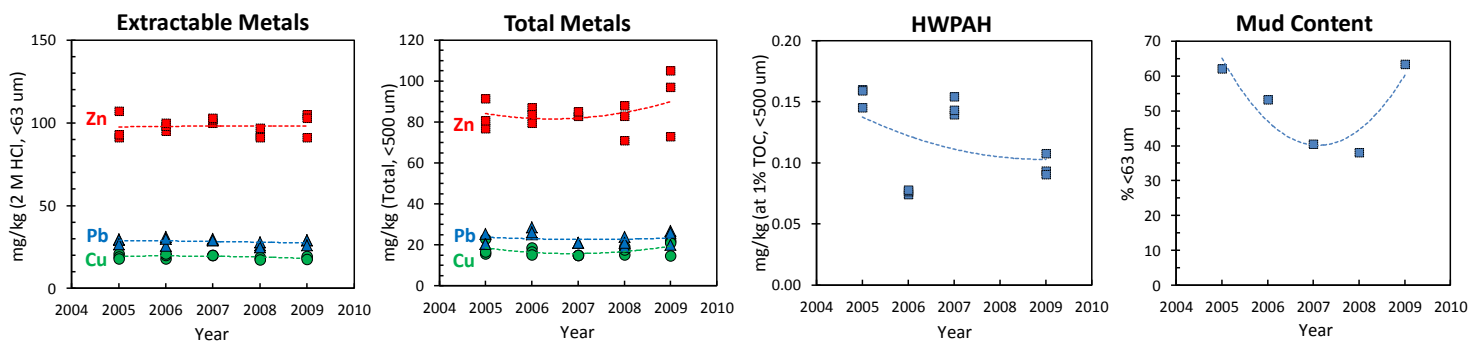


Additional Notes

Te Wharau RDP site located nearby (see location aerial), sampled 2004, 2006, and 2008. Te Wharau also sampled in 2002 (URS for NSCC), but exact location of site uncertain.

Site Lucas Upper Te Wharau (LUCU) UWH	Description Muddy SZ site. Catchment is mostly urban.	ERC Status Cu Pb Zn PAH	Trends & Comments Short (4 year) monitoring period. Trends indicative only. ERC Green contaminant levels (Cu borderline green/amber). Variable texture. TOC variable.
Reporting Area Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	62.1	1.47	19.0	29.4	93	16.6	20.6	81	0.234	0.159
2006	53.2	1.64	20.0	30.0	98	16.7	26.1	84	0.126	0.077
2007	40.5	1.20	20.0	29.0	102	15.0	21.0	83	0.172	0.143
2008	38.0	2.40	17.9	26.0	92	17.6	21.0	83	no data	no data
2009	63.5	2.50	18.4	29.0	103	21.0	26.0	97	0.226	0.094
Median	53.2	1.53	19.0	29.0	98	16.6	21.0	83	0.176	0.124
Trend (absolute units per year)	-1.24	0.23	-0.34	-0.39	0.10	0.20	-0.10	1.45	0.003	-0.008
Trend (% median per yr)	↓ -2.3	↑ 14.8	↘ -1.8	↘ -1.3	→ 0.1	↗ 1.2	↔ -0.5	↗ 1.7	↗ 2.0	↓ -6.7

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66 Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7 Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

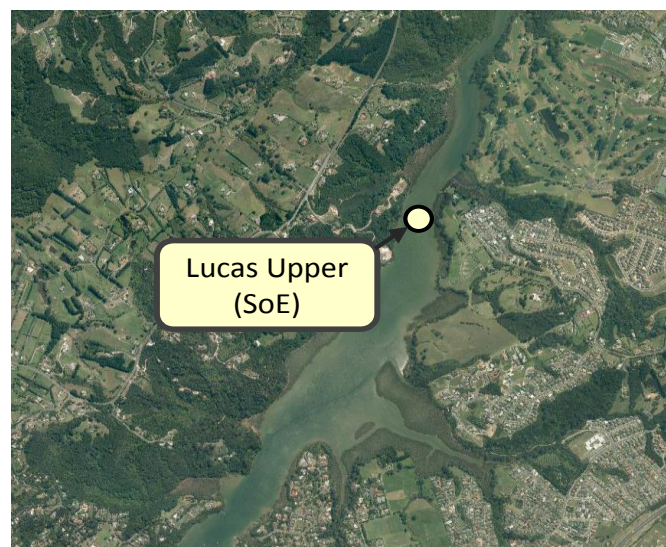
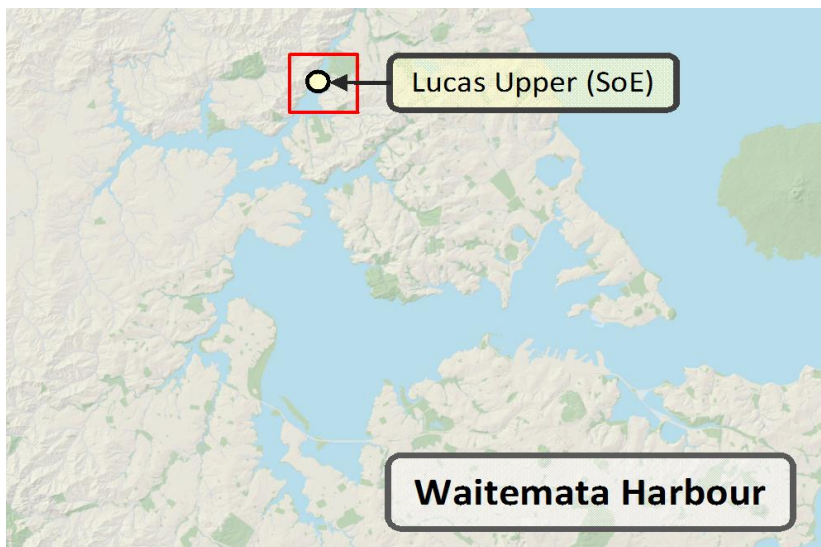
Trend Indicators

→ < ±1% ↗ ↘ ±1 - 2% ↕ > ±2%

Average annual rate of change, as % of median per year

1.19 Lucas Upper (SoE)

Site	Type	Description & Notes
Lucas Upper (SoE site)	Muddy SZ	
Reporting Area	Land Use	Site is located in the mid-to-upper reaches of Lucas Creek estuary. Catchment is low density urban/rural on east side and urban on the western/northern sides. Likely to be increasing urban influence over time. The sediment is mud.
Upper Waitemata Harbour	Urban	

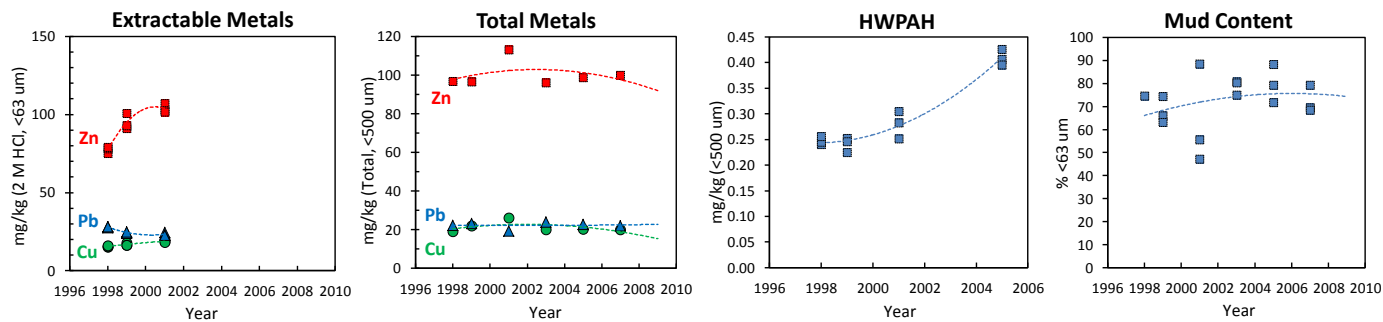


Additional Notes

Lucas Upper SoE site located approximately 1 km upstream of Te Wharau Inlet RDP and UWH programme sites.

Site	Description	ERC Status	Trends & Comments
Lucas Upper (SoE site)	Muddy SZ site . Large urban catchment.	Cu Pb Zn PAH	9 year monitoring period (no sampling in 2009). Extractable metals' data for 2003-2007 considered unreliable, therefore not shown. Assess metals' trends from Total Metals. Current contaminant status - ERC Green/amber. Trend data limited - total metals little change, PAH possibly increasing?
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 μm	Organic Carbon TOC (% , <500 μm)	Extractable Metals (mg/kg, <63 μm)			Total Metals (mg/kg, <500 μm)			HWPAAH (mg/kg, <500 μm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
1998	74.7	no data	15.6	28.0	78	19.1	22.3	97	0.246	no data
1999	66.0	no data	16.5	24.5	93	21.9	23.3	97	0.246	no data
2001	55.5	no data	18.7	22.8	103	26.2	19.4	113	0.283	no data
2003	80.4	1.98	no data	no data	no data	20.0	24.0	96	no data	no data
2005	79.4	1.99	no data	no data	no data	20.3	22.7	99	0.407	0.204
2007	69.5	2.00	no data	no data	no data	20.0	22.0	100	no data	no data
2009	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Median	74.5	1.99	16.5	24.5	93	20.2	22.5	98	0.254	0.204
Trend (absolute units per year)	1.0	-0.01	1.1	-1.4	8.2	-0.1	0.0	0.0	0.025	no value
Trend (% of median per year)	↗ 1.3	→ -0.6	↗ 6.6	↘ -5.7	↗ 8.8	↘ -0.7	→ 0.1	→ 0.0	↗ 9.7	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 μm and <500 μm fraction data. Settling Zones - the <500 μm fraction data

Trend Indicators

⇒ < ±1%

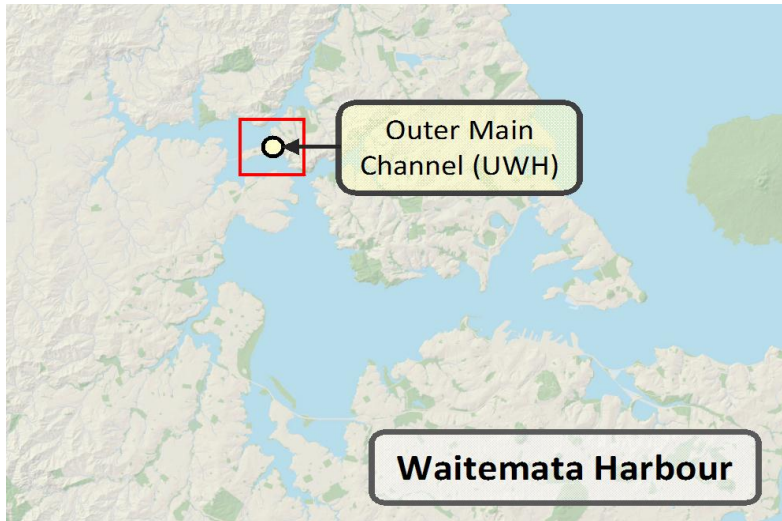
↗ ↘ ±1 - 2%

↕ > ±2%

Average annual rate of change, as % of median per year

1.20 Outer Main Channel (“MainO”, UWH)

Site	Type	Description & Notes
Outer Main Channel (MainO) UWH	Muddy OZ	
Reporting Area	Land Use	Site is located in the lower basin of the Upper Waitemata Harbour. Adjacent land use is urban, but the site may also be influenced by mixed land uses of the wider harbour. The sediment texture at MainO is variable with gradient from sand to mud.
Upper Waitemata Harbour	Mixed urban/rural	

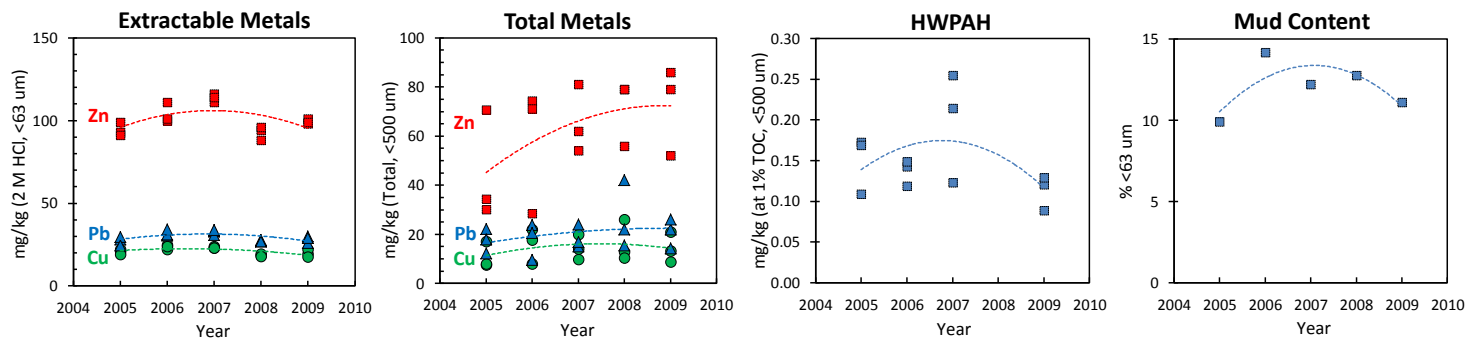


Additional Notes

Site has textural gradient - sand to mud - so that "sediment samples are collected and processed separately from the two distinctly different areas ..." (Benthic ecology 2005-2008 report: TR2008_013). This may account for variable total metals & PAH data.

Site	Description	ERC Status	Trends & Comments
Outer Main Channel (MainO) UWH	Muddy OZ site. Variable sediment texture. Adjacent land use is urban, but wider Waitemata Hbr may also	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	<p>Short (4 year) monitoring period. Trends indicative only.</p> <p>ERC Green/amber contaminant levels (Cu borderline green/amber). Fairly consistent mud fraction metals levels, with little overall trends. Total metals variable, possibly reflecting textural variation at this site.</p>
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	9.9	0.33	21.0	28.1	93	7.9	18.0	34	0.044	0.169
2006	14.2	0.40	24.0	31.1	101	17.8	20.5	71	0.057	0.143
2007	12.2	0.42	23.0	33.0	114	14.0	17.0	62	0.107	0.214
2008	12.8	0.60	18.4	27.0	94	12.8	22.0	79	no data	no data
2009	11.1	0.72	19.5	29.0	99	13.2	22.0	79	0.087	0.121
Median	12.2	0.42	22.0	29.8	99	13.2	20.5	71	0.064	0.136
Trend (absolute units per year)	0.09	0.06	-0.70	-0.29	-0.13	0.74	1.50	6.80	0.005	-0.007
Trend (% median per yr)	0.8	15.3	-3.2	-1.0	-0.1	5.6	7.3	9.6	8.6	-5.2

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

⇒ < ±1%

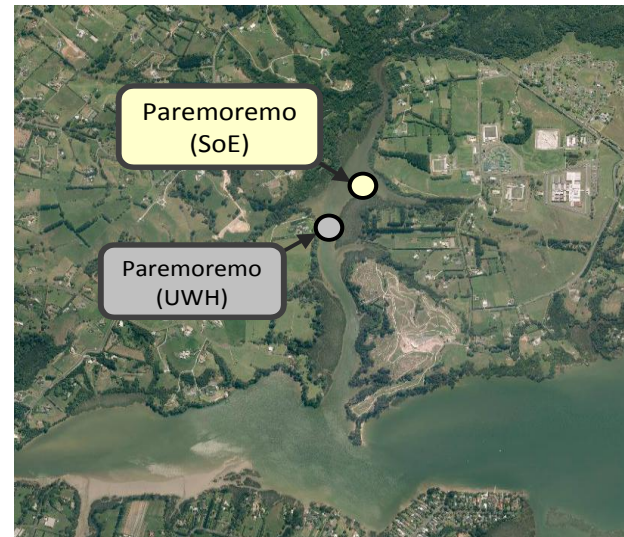
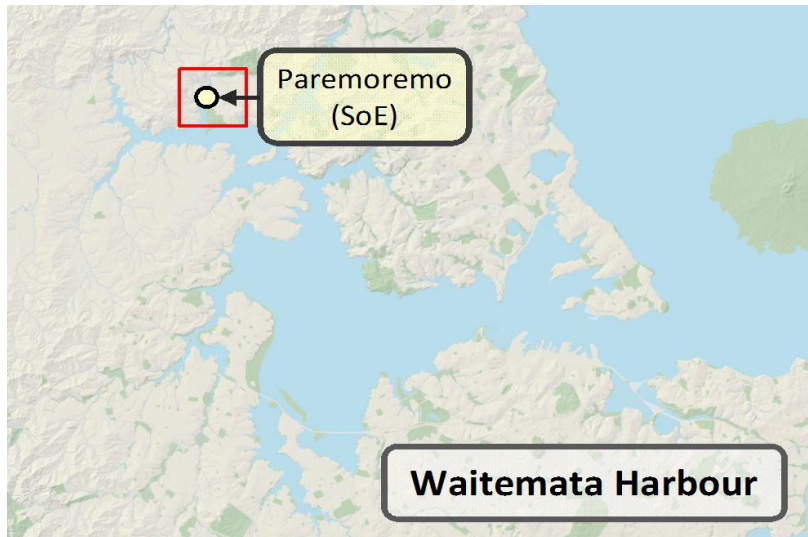
↔ ±1 - 2%

↑↓ > ±2%

Average annual rate of change, as % of median per year

1.21 Paremoremo (SoE)

Site	Type	Description & Notes
Paremoremo (SoE site)	Muddy SZ	
Reporting Area	Land Use	Site is located in the mid-upper reaches of the Paremoremo estuary. The catchment is largely rural/low density urban, but also includes the prison & village. The sediment here is deep mud.
Upper Waitemata Harbour	Mainly rural	

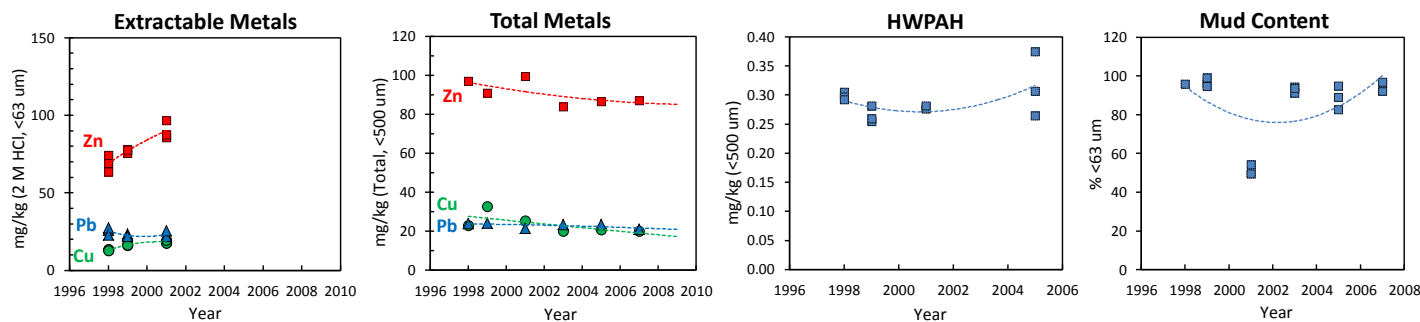


Additional Notes

The SoE Paremoremo site is approximately 200-300 m north of the UWH programme site, near the confluence of the estuary main stem and side branch. UWH site sampled annually 2005-2008. SoE site sampled biannually from 1998 to 2008. No sampling at either site in 2009. SoE site sampled again in 2011. UWH site not sampled after 2008.

Site	Description	ERC Status	Trends & Comments
Paremoremo (SoE)	Muddy SZ site. Mainly rural catchment but also prison & rural residential.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	9 year monitoring period. Not sampled in 2009. Extractable metals' data for 2003-2007 considered unreliable, therefore not shown. Assess metals' trends from Total Metals. Current contaminant status - ERC Amber/Green. No major changes over time. Mud content analysis
Reporting Area	Upper Waitemata Harbour		

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
1998	95.9	no data	12.9	26.0	69	23.1	24.0	97	0.298	no data
1999	96.5	no data	16.5	22.5	78	32.8	24.2	91	0.260	no data
2001	49.7	no data	17.7	22.3	88	25.3	21.6	99	0.277	no data
2003	93.8	2.61	no data	no data	no data	20.0	23.4	84	no data	no data
2005	89.1	2.24	no data	no data	no data	20.7	23.5	87	0.307	0.130
2007	96.2	2.90	no data	no data	no data	20.0	21.0	87	no data	no data
2009	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Median	94.2	2.61	16.5	22.9	78	21.9	23.5	89	0.282	0.130
Trend (absolute units per year)	1.1	0.06	1.6	-0.6	6.9	-0.9	-0.2	-1.2	0.004	no value
Trend (% of median per year)	↗ 1.1	↗ 2.3	↗ 9.9	↘ -2.6	↗ 8.9	↘ -4.3	↘ -1.0	↘ -1.3	↗ 1.5	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66
Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7
Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

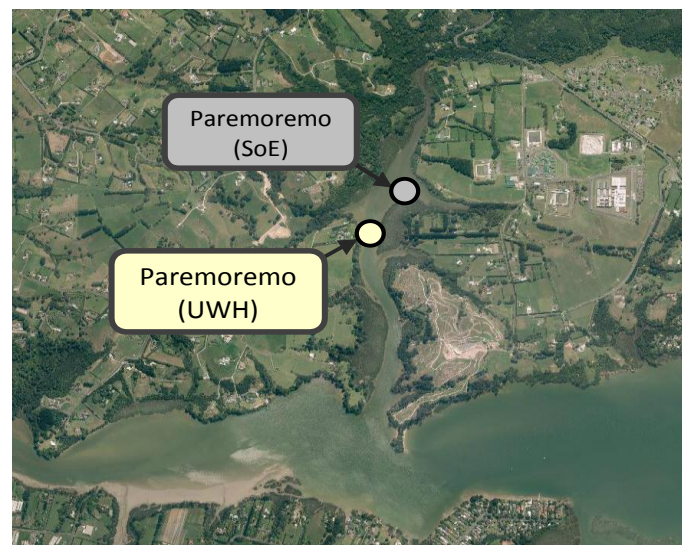
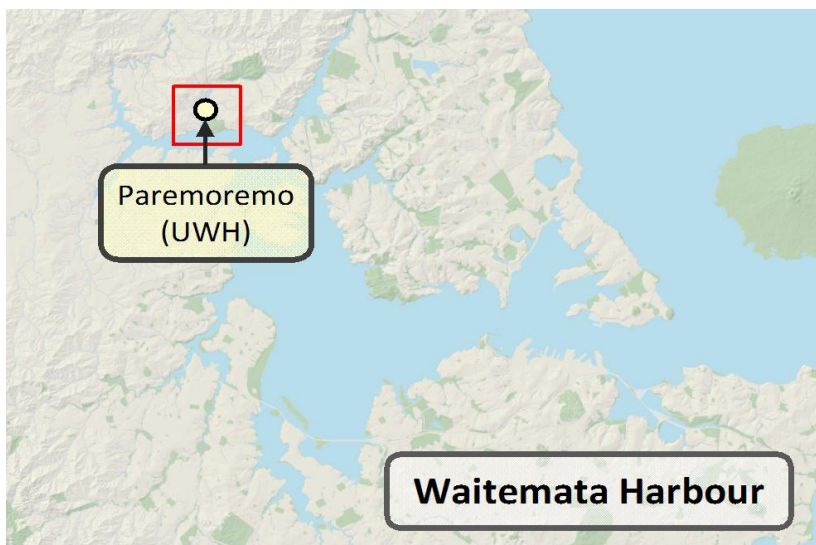
Trend Indicators

↔ < ±1%
↗ ↘ ±1 - 2%
↕ > ±2%

Average annual rate of change, as % of median per year

1.22 Paremoremo Upper (“ParU”, UWH)

Site	Type	Description & Notes
Paremoremo (ParU) UWH	Muddy SZ	
Reporting Area	Land Use	Site is located in the mid-upper reaches of the Paremoremo estuary, opposite the water ski club. The catchment is largely rural/low density urban, but also includes the prison (& village). The sediment here is deep mud.
Upper Waitemata Harbour	Mainly rural	

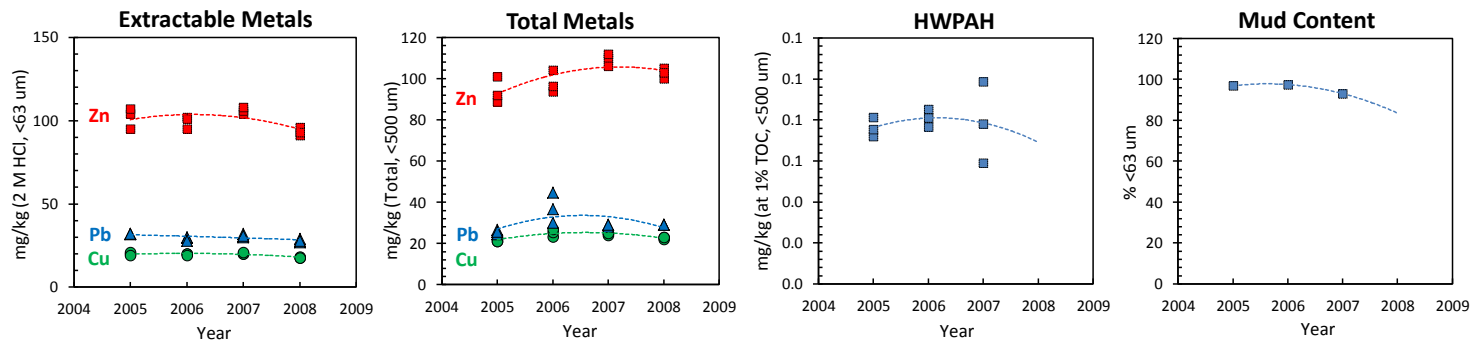


Additional Notes

The SoE Paremoremo site is approximately 200-300 m north of the UWH programme site, near the confluence of the estuary main stem and side branch. UWH site sampled annually 2005-2008. SoE site sampled biannually from 1998 to 2008. No sampling at either site in 2009. SoE site sampled again in 2011. UWH site not sampled after 2008.

Site	Description	ERC Status	Trends & Comments				
Paremoremo (ParU) UWH	Muddy SZ site. Mainly rural catchment - also low density urban and prison.	<table border="1"> <tr> <td>Cu</td> <td>Pb</td> </tr> <tr> <td>Zn</td> <td>PAH</td> </tr> </table>	Cu	Pb	Zn	PAH	Short (3 year) monitoring period. Trends indicative only. Green/amber contaminant levels. Little overall change over time (increasing Total Zn?).
Cu	Pb						
Zn	PAH						
Reporting Area							
Upper Waitemata Harbour							

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



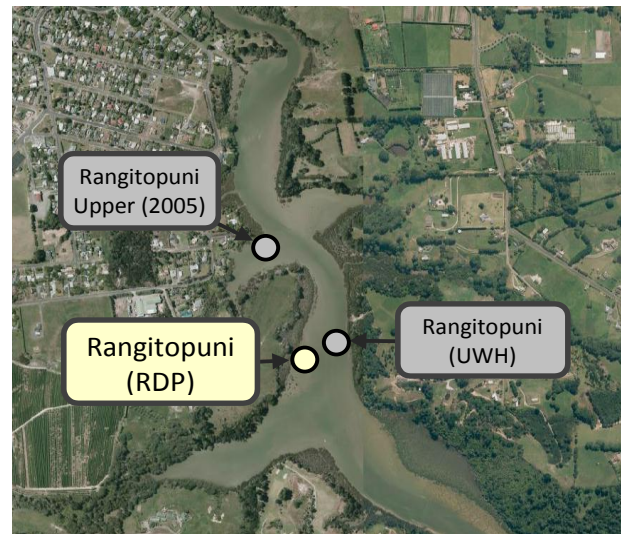
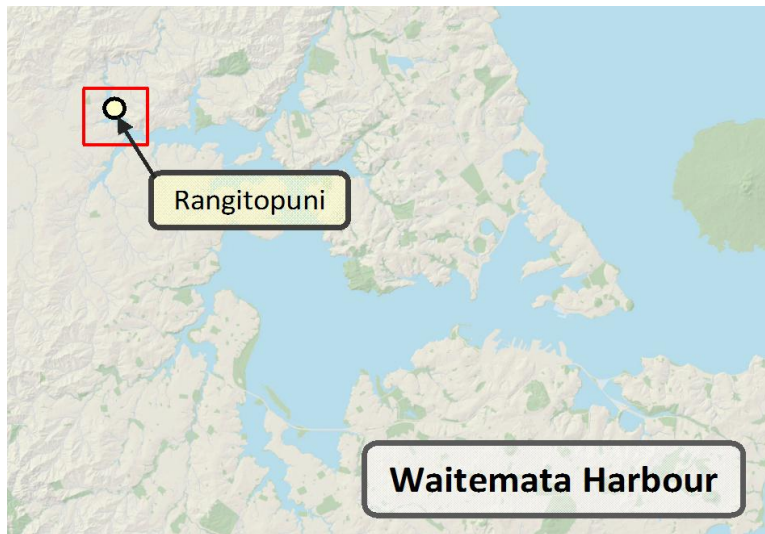
Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	96.8	2.45	20.0	32.0	104	21.1	25.7	92	0.185	0.076
2006	97.5	2.61	20.0	29.6	101	25.5	36.6	96	0.213	0.081
2007	93.0	3.30	20.0	31.0	106	25.0	29.0	110	0.258	0.078
2008	no data	2.70	17.7	28.0	93	23.0	29.0	103	no data	no data
2009	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Median	96.8	2.66	20.0	30.0	102	23.1	29.0	102	0.212	0.078
Trend (absolute units per year)	-1.91	0.12	-0.57	-1.01	-1.93	0.23	0.18	3.76	0.033	0.001
Trend (% median per yr)	↘ -2.0	↗ 4.7	↘ -2.9	↘ -3.4	↘ -1.9	↗ 1.0	↗ 0.6	↗ 3.7	↗ 15.7	↗ 1.5

Environmental Response Criteria (ERC)	Trend Indicators						
<table border="1"> <tr> <td>Cu <19 Pb <30 Zn <124 PAH <0.66</td> <td>Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7</td> <td>Cu >34 Pb >50 Zn >150 PAH >1.7</td> </tr> </table>	Cu <19 Pb <30 Zn <124 PAH <0.66	Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7	Cu >34 Pb >50 Zn >150 PAH >1.7	<table border="1"> <tr> <td>↔ < ±1%</td> <td>↗ ↘ ±1 - 2%</td> <td>↗ ↘ > ±2%</td> </tr> </table>	↔ < ±1%	↗ ↘ ±1 - 2%	↗ ↘ > ±2%
Cu <19 Pb <30 Zn <124 PAH <0.66	Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7	Cu >34 Pb >50 Zn >150 PAH >1.7					
↔ < ±1%	↗ ↘ ±1 - 2%	↗ ↘ > ±2%					
ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data	Average annual rate of change, as % of median per year						

1.23 Rangitopuni (RDP)

Site	Type	Description & Notes
Rangitopuni (RDP)	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Waitemata Hbr. The upstream catchment is largely rural but also includes low density residential and the township of Riverhead. The sediment here is mud.
Upper Waitemata Harbour	Mainly rural	

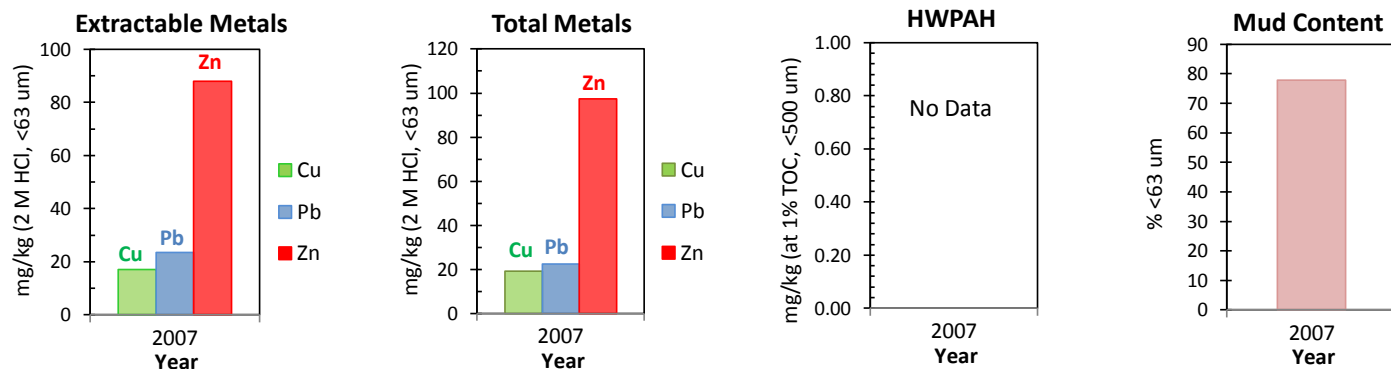


Additional Notes

Rangitopuni UWH site lies opposite the RDP site. The UWH site ("Rng") has been sampled annually since 2005. Another site, "Rangitopuni Upper" (approx. 400 m upstream, on the true right side of the channel, in the next inlet north of the RDP site) was also sampled once in 2005.

Site	Description	ERC Status	Trends & Comments
Rangitopuni (RDP site) Reporting Area Upper Waitemata Harbour	Muddy SZ site near head of Upper Waitemata Hbr. Replaced by Rangitopuni UWH site. Largely rural catchment.	Cu Pb Zn PAH	1 year of monitoring only (2007). No trends can therefore be assessed. Current contaminant status ERC-Green/Amber (Cu, just).

Sediment chemistry summary



Annual median concentrations. Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2007	77.9	no data	17.0	23.5	88	19.1	22.4	97	no data	no data
Trend (absolute units per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value
Trend (% of median per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

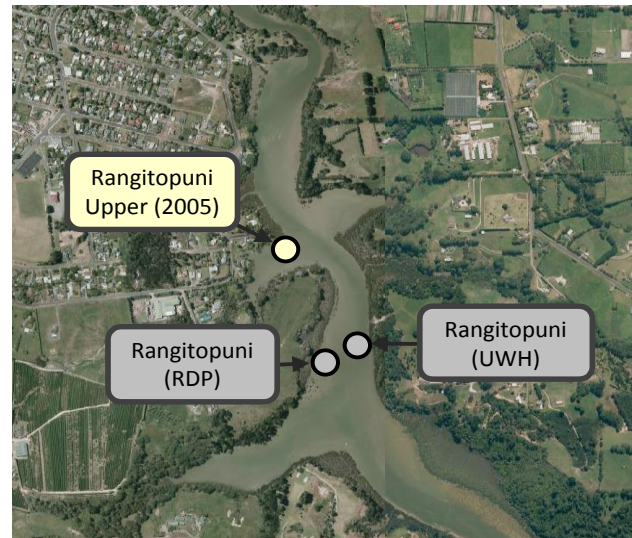
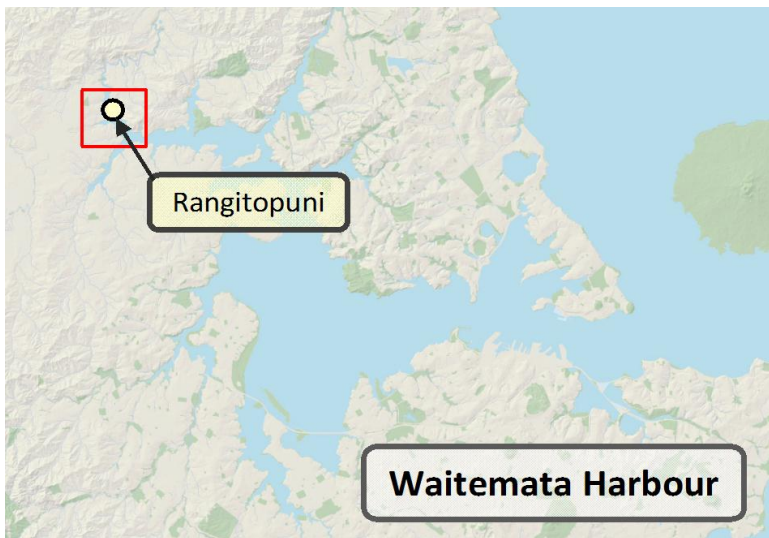
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fractions. Settling Zones - the <500 µm fraction

1.24 Rangitopuni Upper

Site	Type	Description & Notes
Rangitopuni Upper "2005"	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Waitemata Hbr. The upstream catchment is largely rural but also includes low density residential and the township of Riverhead. The sediment here is mud.
Upper Waitemata Harbour	Mainly rural	

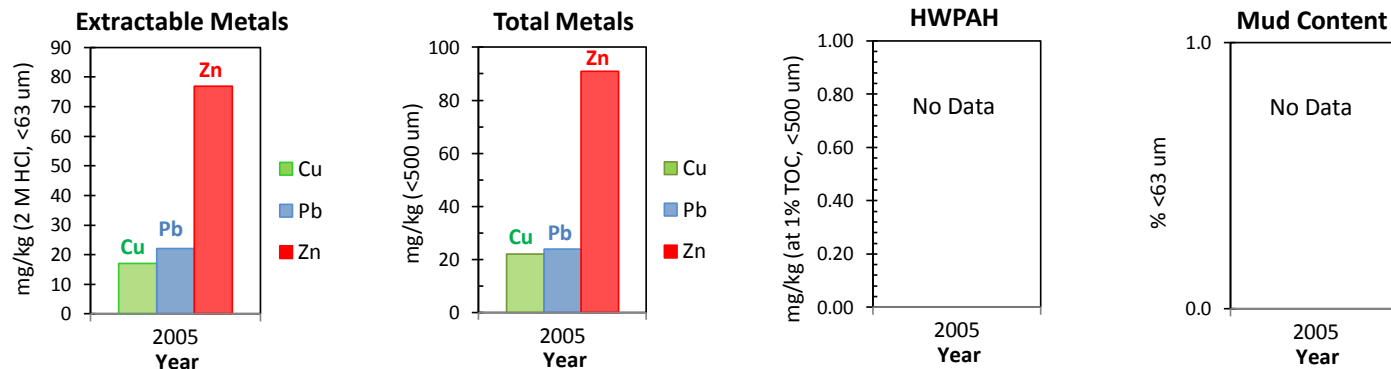


Additional Notes

This site has been sampled only once, in 2005. The Rangitopuni UWH and RDP sites lie downstream of this site. The UWH site ("Rng") has been sampled annually since 2005, and the RDP site once, in 2007.

Site	Description	ERC Status	Trends & Comments
Rangitopuni Upper "2005"	Muddy SZ site near head of Upper Waitemata Hbr (400 m u/s of RDP and UWH sites). Largely rural catchment.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	1 year of monitoring only (2005). No trends can therefore be assessed. Current contaminant status ERC-Amber.
Reporting Area			
Upper Waitemata Harbour			

Sediment chemistry summary



Annual median concentrations. Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	no data	no data	17.0	22.0	77	22.0	23.9	91	no data	no data
Trend (absolute units per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value
Trend (% of median per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

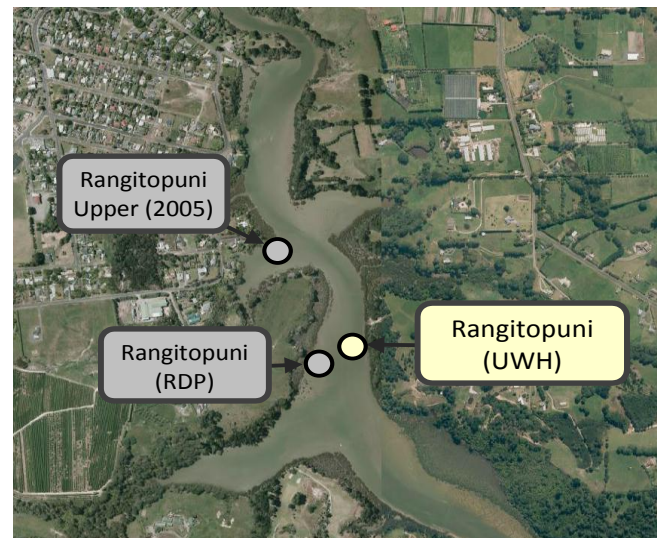
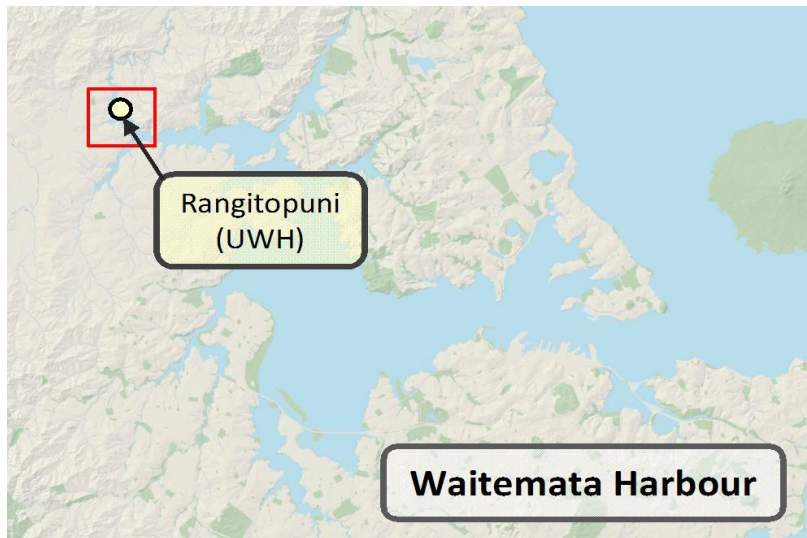
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fractions. Settling Zones - the <500 µm fraction

1.25 Rangitopuni (“Rng” UWH)

Site	Type	Description & Notes
Rangitopuni (Rng) UWH	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Waitemata Hbr. The upstream catchment is largely rural but also includes low density residential and the township of Riverhead. The sediment here is mud.
Upper Waitemata Harbour	Mainly rural	

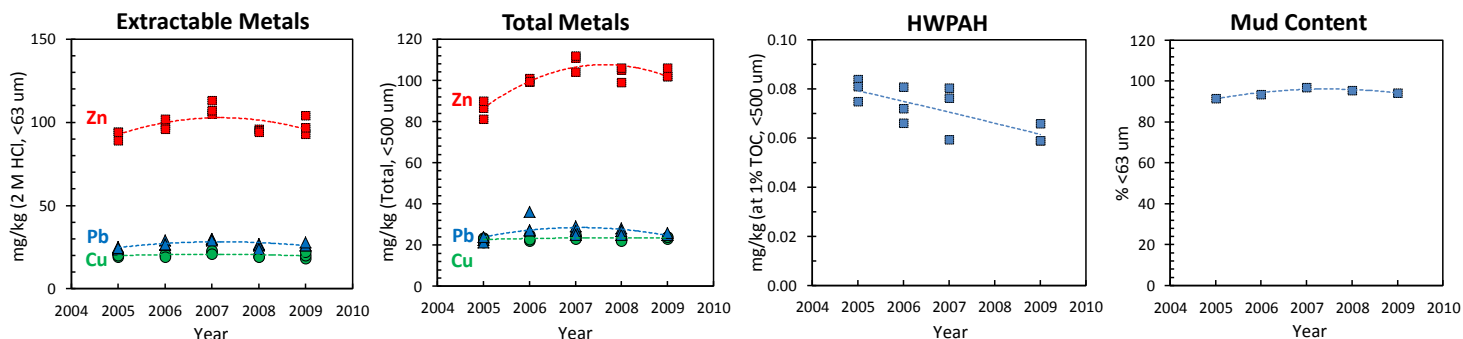


Additional Notes

A Rangitopuni RDP site lies opposite the UWH site. The RDP site has been sampled once, in 2007. Another site, "Rangitopuni Upper" (approx. 400 m upstream, on the true right side of the channel, in the next inlet north of the RDP site), was also sampled once in 2005.

Site	Description	ERC Status	Trends & Comments				
Rangitopuni (Rng) UWH	Muddy SZ site. Large mainly rural upstream catchment - also some urban (Riverhead).	<table border="1"> <tr> <td>Cu</td> <td>Pb</td> </tr> <tr> <td>Zn</td> <td>PAH</td> </tr> </table>	Cu	Pb	Zn	PAH	Short (4 year) monitoring period. Trends indicative only. Green/amber contaminant levels. Little overall change over time (possibly increasing Total Zn, influenced by lower 2005 results?).
Cu	Pb						
Zn	PAH						
Reporting Area							
Upper Waitemata Harbour							

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	91.6	2.59	20.0	24.6	94	22.9	22.6	87	0.210	0.081
2006	93.4	2.71	20.0	26.6	98	22.7	27.2	100	0.195	0.072
2007	97.0	2.80	22.0	30.0	107	24.0	27.0	111	0.206	0.076
2008	95.5	2.90	19.3	26.0	95	23.0	27.0	105	no data	no data
2009	94.2	2.8	20.0	26.0	97.0	24.0	25.0	102	0.165	0.059
Median	94.2	2.80	20.0	26.5	96	23.0	26.0	102	0.196	0.073
Trend (absolute units per year)	0.73	0.06	-0.05	0.27	0.77	0.16	0.19	3.83	-0.009	-0.004
Trend (% median per yr)	→ 0.8	↗ 2.0	→ -0.2	↗ 1.0	→ 0.8	→ 0.7	→ 0.7	↑ 3.8	↓ -4.7	↓ -6.0

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7
Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

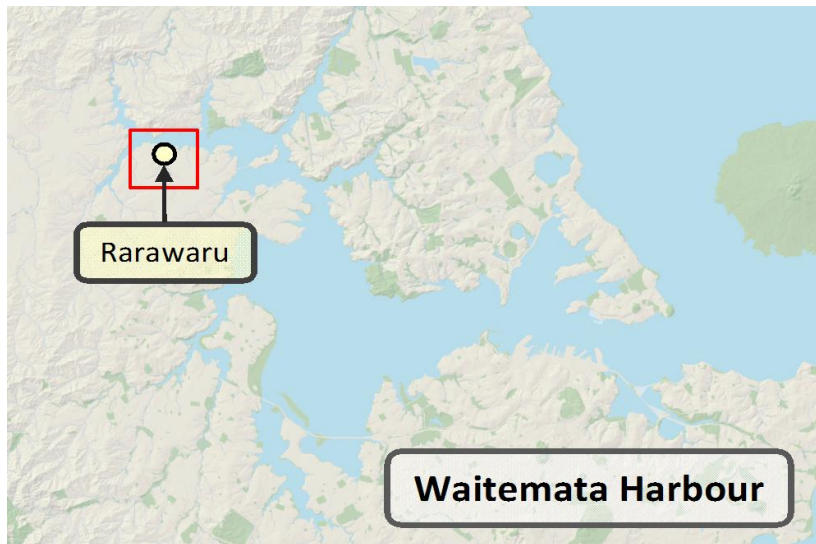
Trend Indicators

↔ < ±1%
↗ ↘ ±1 - 2%
↑ ↓ > ±2%

Average annual rate of change, as % of median per year

1.26 Rarawaru

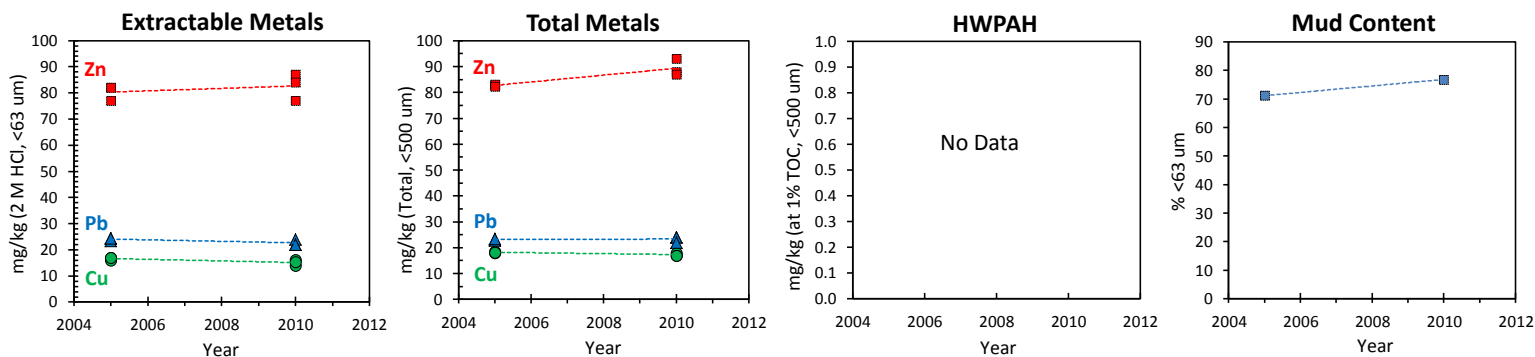
Site	Type	Description & Notes
Rarawaru	Muddy SZ	Site is located in the middle-to-upper reaches of Rarawaru sub-estuary, approximately 300 m from the confluence with the main stem of the Upper Waitemata Harbour. The sediment here is mud.
Reporting Area	Land Use	
Upper Waitemata Harbour	Rural	



Additional Notes

Site	Description	ERC Status	Trends & Comments
Rarawaru	Muddy SZ site. Rural catchment.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	2 years of monitoring only. No trends can therefore be assessed, but 2005 & 2010 results are very similar. Current contaminant status ERC-Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	71.1	no data	17.0	24.5	82	18.2	23.3	83	no data	no data
2010	76.8	no data	15.4	22.0	84	17.0	24.0	88	no data	no data
Median	74.0	no data	16.1	23.7	82	18.0	23.4	85	no data	no data
Trend (absolute units per year)	1.1	no value	-0.3	-0.3	0.5	-0.2	0.0	1.3	no value	no value
Trend (% of median per year)	1.5	no value	-1.9	-1.2	0.6	-1.0	0.1	1.6	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

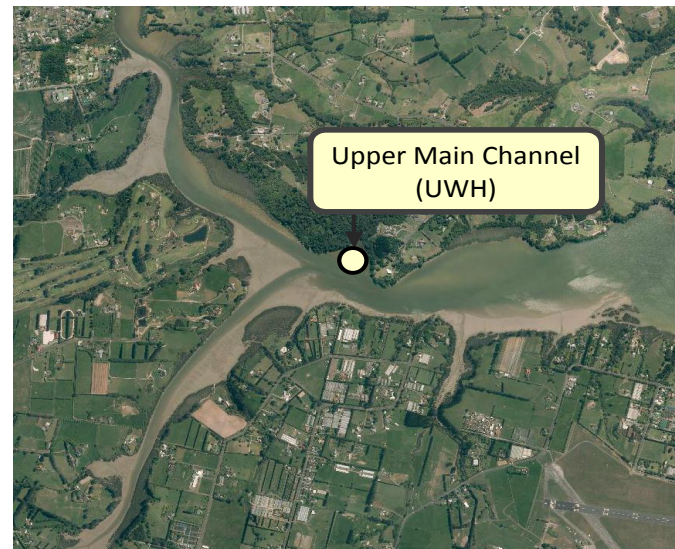
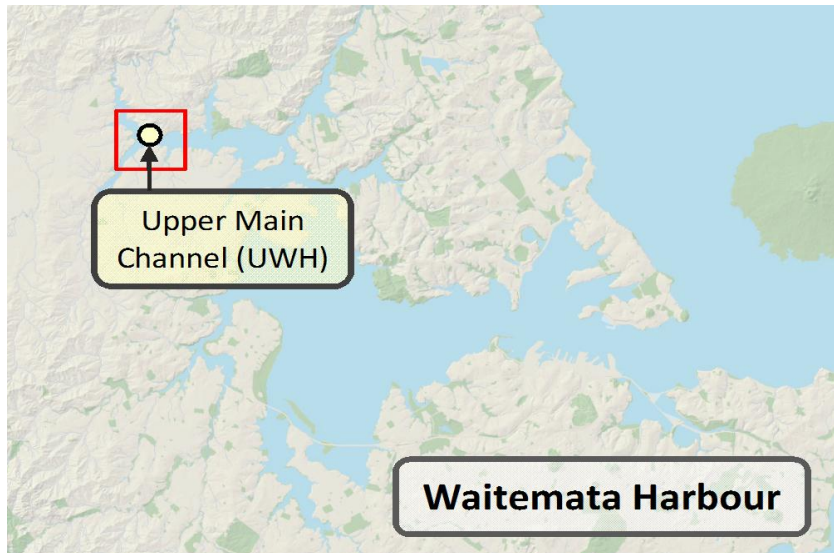
Trend Indicators

⇨ < ±1% ⇩⇧ ±1 - 2% ⇩⇧ > ±2%

Average annual rate of change, as % of median per year

1.27 Upper Main Channel (“MainU”, UWH)

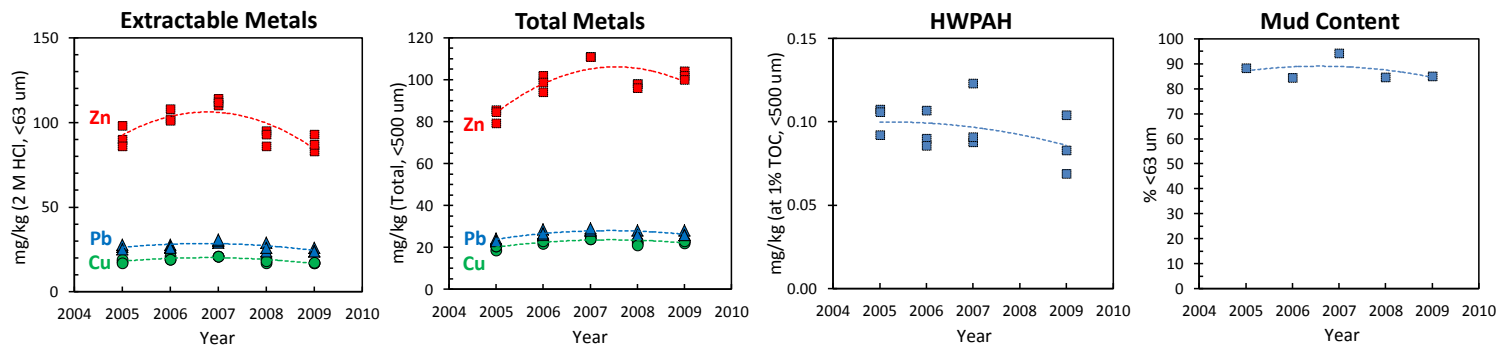
Site	Type	Description & Notes
Upper Main Channel (MainU) UWH	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper basin of the Upper Waitemata Harbour, opposite the mouth of Brighams Creek. Surrounding land use is largely rural, but the site may also be influenced by mixed land uses of the wider harbour. The sediment at MainU is soft deep mud.
Upper Waitemata Harbour	Rural/low density urban	



Additional Notes

Site	Description	ERC Status	Trends & Comments
Upper Main Channel (MainU) UWH	Muddy SZ site. Adjacent land use is rural, but wider Upper Waitemata Hbr may also be an influence.	<div style="display: flex; flex-wrap: wrap;"> <div style="margin: 2px;">Cu</div> <div style="margin: 2px;">Pb</div> <div style="margin: 2px;">Zn</div> <div style="margin: 2px;">PAH</div> </div>	<p>Short (4 year) monitoring period. Trends indicative only. ERC Green/amber contaminant levels (Cu borderline green/amber). Fairly consistent mud fraction metals, PAH, and mud content, with little overall trends.</p>
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Matter TOC (% <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	88.4	2.19	18.0	26.8	90	20.5	23.4	85	0.217	0.106
2006	84.5	2.37	19.0	26.7	102	23.0	26.6	99	0.221	0.090
2007	94.2	2.50	21.0	30.0	112	24.0	28.0	111	0.228	0.091
2008	84.7	2.20	18.3	26.0	93	22.0	26.0	98	no data	no data
2009	85.1	2.50	17.0	24.0	87	23.0	26.0	102	0.207	0.083
Median	85.1	2.30	19.0	26.7	95	23.0	26.0	99	0.219	0.091
Trend (absolute units per year)	-0.64	0.02	-0.34	-0.45	-1.97	0.50	0.59	3.68	-0.005	-0.004
Trend (% median per yr)	→ -0.7	→ 1.0	↘ -1.8	↘ -1.7	↓ -2.1	↑ 2.2	↑ 2.3	↑ 3.7	↓ -2.4	↓ -4.0

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fraction data. Settling Zones - the <500 µm fraction data

Trend Indicators

→ < ±1%

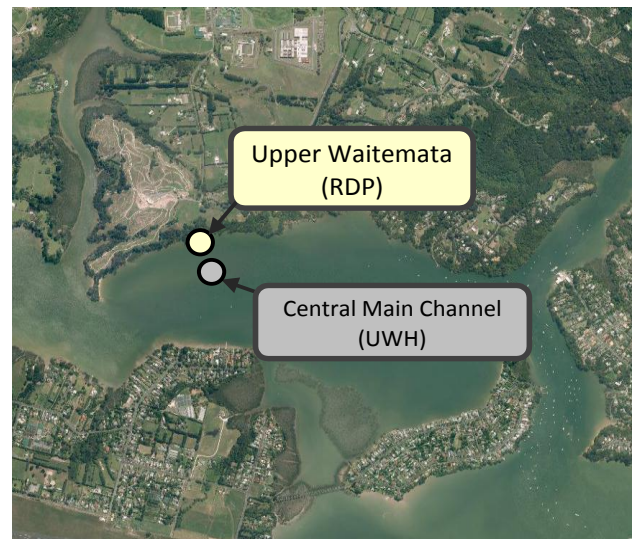
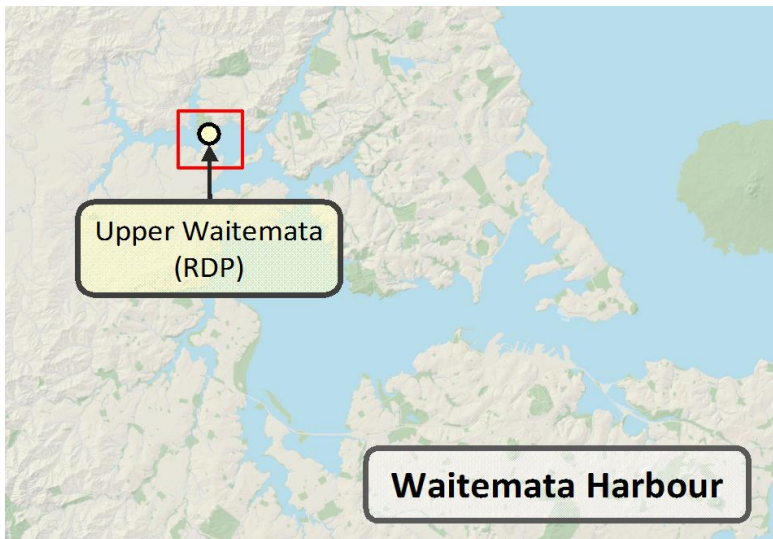
↔ ±1 - 2%

↑↓ > ±2%

Average annual rate of change, as % of median per year

1.28 Upper Waitemata (RDP)

Site	Type	Description & Notes
Upper Waitemata (RDP)	Muddy SZ	
Reporting Area	Land Use	Site is located in the upper reaches of the Waitemata Hbr. The upstream catchment and adjacent land use is largely rural but also includes low density residential and the township of Riverhead. The sediment here is mud.
Upper Waitemata Harbour	Mainly rural	

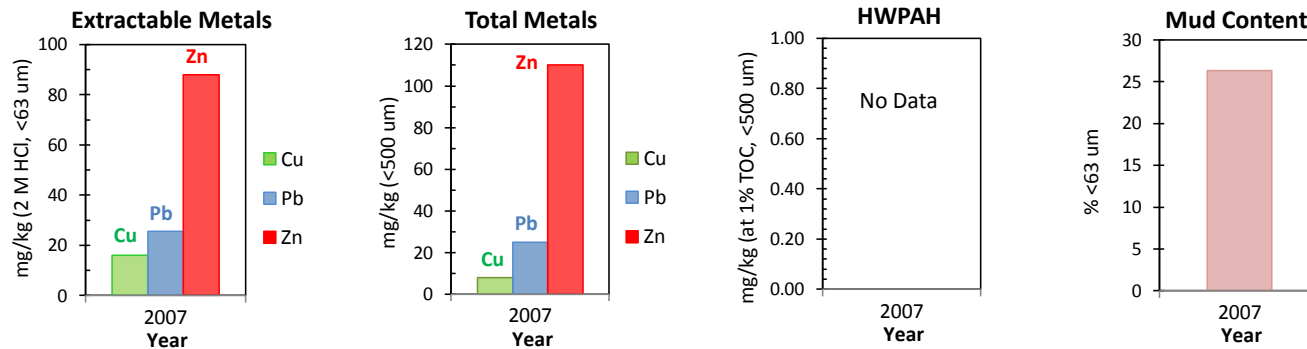


Additional Notes

Central Main Channel (MainC) UWH programme site, sampled annually from 2005, lies approximately 200 m offshore from the RDP site.

Site	Description	ERC Status	Trends & Comments
Upper Waitemata (RDP) Reporting Area Upper Waitemata Harbour	Muddy SZ site in main stem of UWH. Large mixed rural/urban catchment influences.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 5px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">PAH</div> </div>	1 year of monitoring only (2007). No trends can therefore be assessed. Current contaminant status ERC-Green. This site was replaced by "Central Main Channel" (MainC) site in the UWH programme, which is ca. 200 m towards LT channel from RDP site.

Sediment chemistry summary



Annual median concentrations. Colours refer to ERC (see footnotes).

Year	Mud Content % <63 µm	Organic Carbon TOC (% , <500 µm)	Extractable Metals (mg/kg, <63 µm)			Total Metals (mg/kg, <500 µm)			HWPAAH (mg/kg, <500 µm)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2007	26.3	no data	16.0	25.5	88	7.9	25.0	110	no data	no data
Trend (absolute units per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value
Trend (% of median per year)	no value	no value	no value	no value	no value	no value	no value	no value	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66

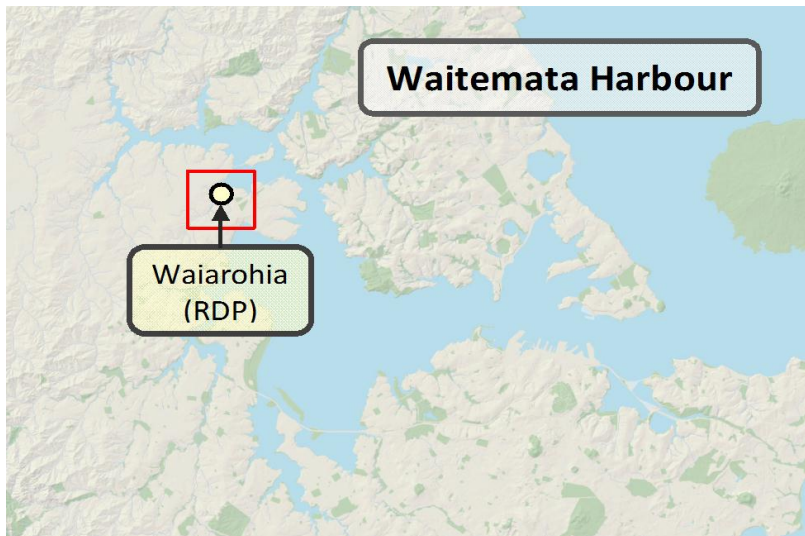
Cu 19–34 Pb 30–50 Zn 124–150 PAH 0.66–1.7

Cu >34 Pb >50 Zn >150 PAH >1.7

ERC: For Outer Zones - the greater of the <63 µm and <500 µm fractions. Settling Zones - the <500 µm fraction

1.29 Waiarohia

Site	Type	Description & Notes
Waiarohia (RDP site)	Muddy SZ	
Reporting Area	Land Use	Site is located in the middle reaches of the Waiarohia estuary. The upstream catchment is largely rural/low density residential, but major motorway development has also occurred. Whenuapai airforce base lies to the west. The sediment here is muddy.
Upper Waitemata Harbour	Rural	

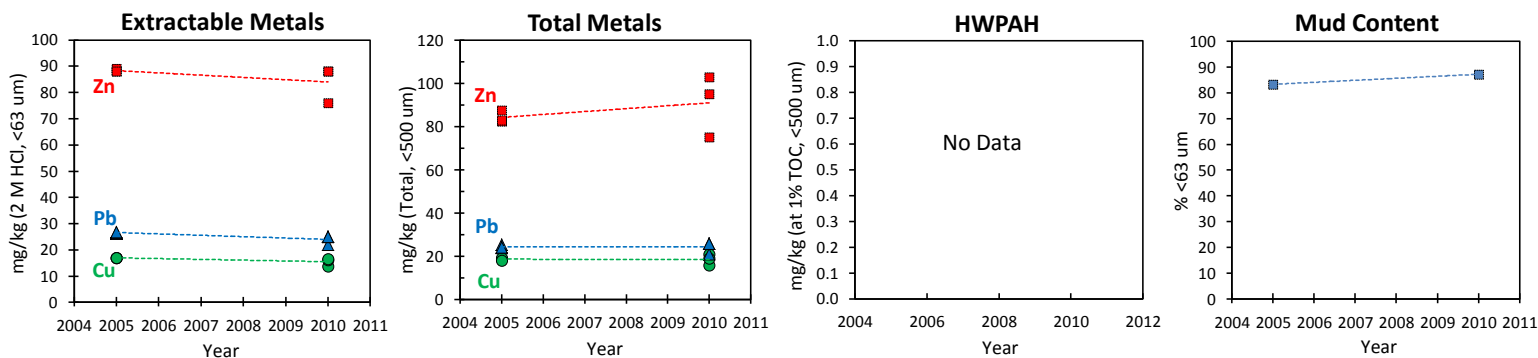


Additional Notes

The Herald Island Waiarohia (HIW) UWH programme site, and the Herald Island (RDP) site are located approximately 1.5 km downstream of the RDP site, off the southern shore of Herald Island.

Site	Description	ERC Status	Trends & Comments
Waiarohia (RDP site)	Muddy SZ site. Rural catchment. RDP site ca. 1 km upstream of UWH site.	<div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Cu</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Pb</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Zn</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">PAH</div> </div>	2 years of monitoring only. No trends can therefore be assessed, but 2005 & 2010 results are very similar. Current contaminant status ERC-Amber/Green.
Reporting Area			
Upper Waitemata Harbour			

Changes in sediment chemistry over monitoring period. "Line of best fit" (quadratic smoothing) shown.



Annual median concentrations & indicative trends (by linear regression). Colours refer to ERC (see footnotes).

Year	Mud Content % <63 um	Organic Carbon TOC (% <500 um)	Extractable Metals (mg/kg, <63 um)			Total Metals (mg/kg, <500 um)			HWPAAH (mg/kg, <500 um)	
			Cu	Pb	Zn	Cu	Pb	Zn	mg/kg	at 1% TOC
2005	83.3	no data	17.0	26.7	88	18.8	24.2	83	no data	no data
2010	87.2	no data	16.2	25.0	88	19.0	26.0	95	no data	no data
Median	85.2	no data	16.8	25.7	88	18.9	24.8	85	no data	no data
Trend (absolute units per year)	0.8	no value	-0.3	-0.5	-0.9	0.0	0.0	1.3	no value	no value
Trend (% of median per year)	0.9	no value	-1.8	-2.1	-1.0	-0.1	-0.1	1.6	no value	no value

Environmental Response Criteria (ERC)

Cu <19 Pb <30 Zn <124 PAH <0.66	Cu 19-34 Pb 30-50 Zn 124-150 PAH 0.66-1.7	Cu >34 Pb >50 Zn >150 PAH >1.7
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ERC: For Outer Zones - the greater of the <63 um and <500 um fraction data. Settling Zones - the <500 um fraction data

Trend Indicators

→ < ±1%	↔ ±1 - 2%	↕ > ±2%
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Average annual rate of change, as % of median per year