

Water quality of surface waters in Whangateau Harbour – Stage One



Prepared for Watercare Services Ltd

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1. INTRODUCTION

Watercare Services Ltd (Watercare) is in the process of preparing an Assessment of Environmental Effects (AEE) for renewal of their consent for operation of the Omaha Wastewater Treatment Plant. The existing consent expired in May 2014 and a replacement application was lodged in October and placed on hold.

A number of reports have been prepared on the monitoring programmes for the existing Omaha plant and the receiving environments (see Diffuse Sources 2007, 2008, Kelly 2009, URS 2012, 2013). A recent review of the existing information on the receiving environments (James 2014) identified a number of gaps in knowledge and some areas that would require further work before a more detailed consent application is lodged. This was further refined following discussions with the Consultative Group and an Investigation Plan is being reviewed by the Auckland Council (AC).

Potential gaps in knowledge that were identified as requiring more work for a robust AEE included:

1. Monitoring of water quality for the Waikokopu Arm (*Watercare have underway*).
2. Surveying and monitoring of surface waters between the irrigation fields and the Harbour.
3. Collating and reviewing data/information on the benthic environment of the Harbour with a focus on the Waikokopu Arm and then if required carrying out some further groundtruthing of habitat maps and comparing with earlier maps.
4. Collating and reviewing data/information on the bird and fish life with a focus on the Waikokopu Arm.

As part of an information and data gathering exercise Watercare have asked AES to undertake Stage One components of the workstreams under 1-4 above.

Separate brief reports/memos have been prepared on the Benthic environment (Townsend et al 2015), Shore birds found in the Waikokopu Arm of the Whangateau Harbour (Goldwater 2015) and a memo has been prepared updating information on fish populations in the Harbour.

This brief report provides an update on the Stage One components of the workstream on water quality (Items 1 & 2) above which is specifically to:

- Collate, analyse, graph and report on the dataset for Ti Point (1991-) and for the causeway (since July 2014). The data is to be assessed for trophic state and comparisons made between Ti Point and the causeway to see how representative the Ti Point location is and whether there are differences in the Waikokopu Arm.
- Initiate a survey of water quality in surface drains between the irrigation areas and the Harbour to be carried out monthly monitoring. The sites to be sampled are provided in Figure 1 plus there will be a sample site at the mouth of where the Waikokopu Creek enters the Harbour.

2. BACKGROUND

The Whangateau Harbour is highly regarded regionally, and in some cases nationally, as one of the highest quality estuaries. The estuary contains valued Kahikatea Forest/wetland, mudflats, mangrove forests, tidal channels, intertidal and subtidal habitats for wading and migrating birds. The Harbour is also highly valued regionally for shellfish gathering and as a fish nursery for the wider Hauraki Gulf.

Kelly (2009) provides a general description of the physical characteristics of the Harbour including its history, land development and classification. Diffuse Sources (2008) provides a more focused assessment of the areas potentially impacted by discharge onto land from the Omaha Wastewater Treatment Plant. The Whangateau Harbourcare website provides a good background to the Harbour environment and summarises their concerns for the future of the Harbour. Detailed descriptions of the aquatic ecology of the Harbour are also provided in Kelly (2009).

The potential impacts of the irrigation of treated wastewater on nutrient processes in soils, surface and groundwater and wetlands/forest is a key issue to be considered for the AEE. There is information available on potential nutrient transformations and loss processes but little verification or actual measurements and very little information available on water quality of surface waters.

Measurements of water quality in the Harbour are presently limited to the monthly AC surveys at Ti Point. There has been some discussion over the effect of the causeway on hydrodynamics and exchange processes. Thus Watercare will need more robust information for this part of the Harbour as part of its AEE. An important question is whether the site at Ti Point is representative of the inner Harbour, in particular the Waikokopu Arm, and the degree of interchange between the Arm, the main Harbour and offshore. Issues with surface and groundwater inputs that may reach the Harbour are of concern. There is a comprehensive programme underway to assess and model groundwater flows and this will be extended to surface flows. Nutrients in the surface waters will be assessed as part of the Water quality workstream and are reported here.

3. TI POINT AND CAUSEWAY DATA

Ti Point data from 1991 was obtained from the Auckland Council. The samples are collected monthly on the outgoing tide.

Data for nitrate-N (NO_3N), soluble reactive phosphorus (SRP), total phosphorus (TP) and chlorophyll a (chl a) for monthly sampling at Ti Point is shown in Figure 2. Concerns were raised by Scarsbrook (2008) that total phosphorus and chlorophyll a had increased significantly between 1991 and 2007 however since 2007 TP has decreased to less than 0.03 mg/L with an average of 0.014 mg/L. Likewise the mean chl a from 1998-2007 was 1.74 ug/L and from 2007 to 2014 was 1.67 ug/L thus there appears to be a reversing of the trend prior to 2007.

Since July 2014 AC have been collecting samples from a site at the Causeway at the same time that samples are collected from Ti Point. The data for Ti Point and the Causeway are shown in Table 1a,b. Examination of this data shows that nutrient levels and E.coli have been the same or very similar at both locations.

The AC 2013 annual report on marine water quality described the Ti Point site as “Good” in both 2012 and 2013 based on a water quality index for DO, pH, turbidity, ammonia, TSS, TP and nitrate+nitrite. The 2014 report is yet to be completed but the quality will be either “Good” or possibly “Excellent” based on the data provided. The Causeway site will have a similar rating. E.coli levels have been consistently below detection.

4. MONITORING DRAINS AND STREAMS

A monthly monitoring programme has been initiated by Watercare with samples analysed using standard and accredited procedures by Watercare Laboratory Services. The sites are shown in Figure 1. Sites were selected following a site visit with the Consultative Group:

- Sites 1, 2, 6 and 15 are in the Jones Rd drain downstream of the irrigated area.
- Sites 3, 4 and 5 are control sites well away from any influence of the wastewater treatment
- Sites 7-10 are where surface waters flow into the Waikokopu Arm
- Sites 11 and 14 are major stream inputs at the head of the Arm
- Sites 12 and 13 are a stream which drains the kahikatea Forest/wetlands.

Water samples are collected monthly with the following parameters analysed:

- Temperature, pH, TSS, turbidity
- Nutrients (ammonia, nitrate and nitrite-nitrogen, dissolved reactive phosphorus, total nitrogen, total phosphorus).
- Dissolved organic carbon
- Faecal coliforms, *E.coli*

Initially sampling will run for 3 months and the data be assessed before any long-term sampling is recommended.

The first set of samples were collected on 20/01/2015 and preliminary results show nutrient concentrations were low at Sites 7, 10, 11, 12, 14 and 15. Concentrations of ammonia and TP were high at Site 6 (>0.1 and 0.5 mg/L respectively), and TP at Sites 5 and 8 (>0.1 mg/L). TSS were high (>25 mg/L) at Sites 5, 8, 11 and 12 and very high at Site 6. The very low DO and pH at Sites 4, 6, and 8 suggest these were probably stagnant pools. There was no water in the drains at Sites 1, 2, 3 and 9 at the time of sampling. Future sampling will include comments on whether water is flowing at the time.

5. REFERENCES

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James, M.R. (2014). Existing state of knowledge and potential gaps for receiving waters for the discharge of wastewater from the Omaha Wastewater Treatment Plant. Report prepared for Watercare Services Ltd.

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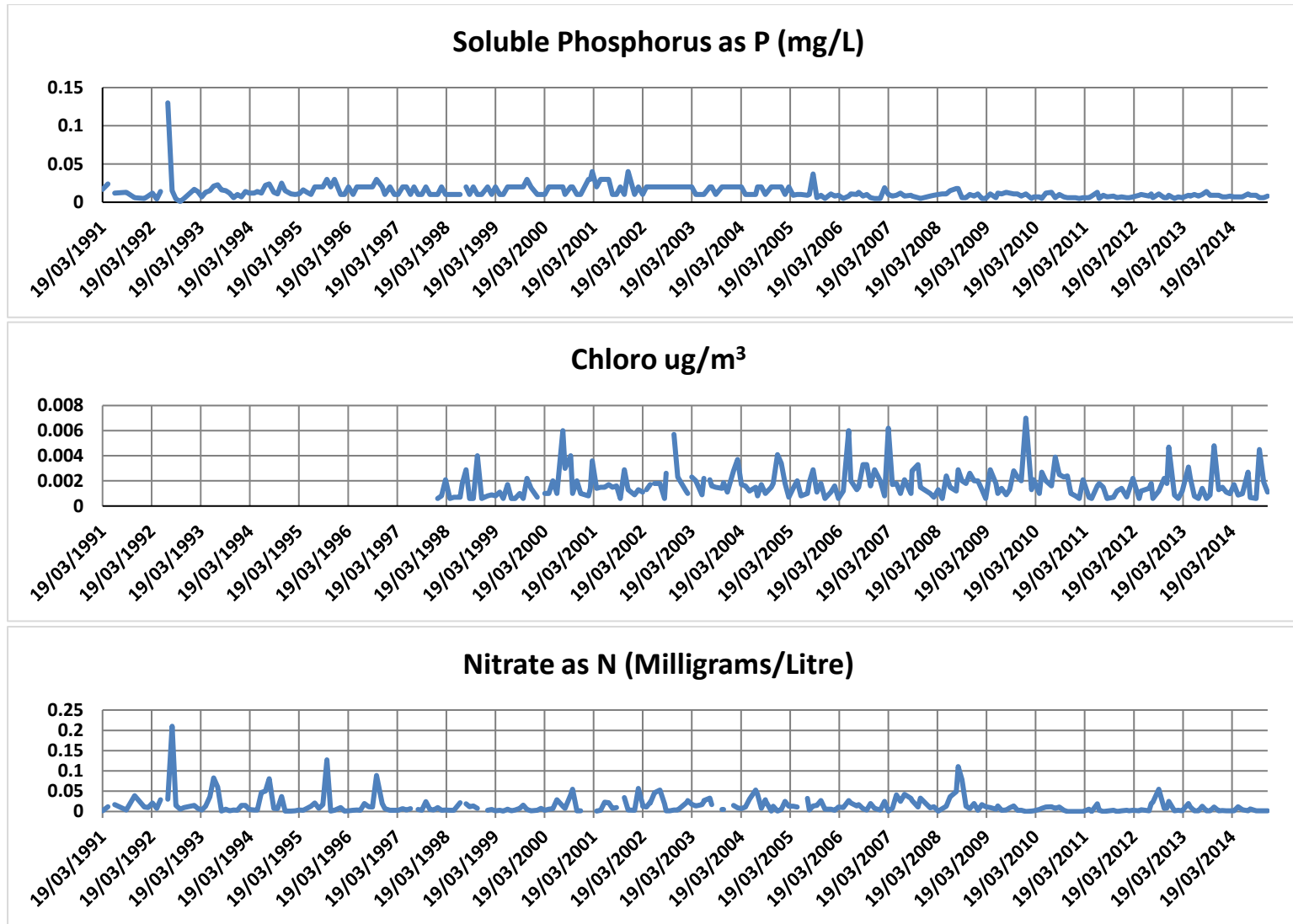
URS. 2012 Annual Performance Report Northern Area Wastewater Treatment Plants. Report prepared for Watercare Services Ltd.

URS (2013). 2013 Annual Performance Report Northern Area Wastewater Treatment Plants. Report prepared for Watercare Services Ltd.

Figure 1. Map showing sampling locations for surface water quality.



Figure 2. Nutrient and chl a concentrations at Ti Point from 1991-2014 (date supplied by AC).



Total Phosphorus as P (Milligrams/Litre)

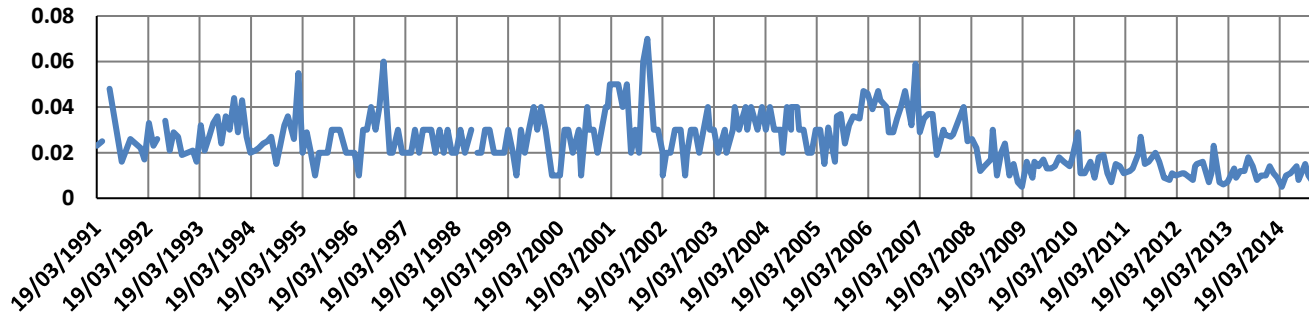


Table 1. Water quality for samples from the Causeway Site (A) and a comparison of Ti Point and Causeway Sites (B).

(A)

Date	DO Conc	DO%	Temp	SpCond	Salinity	pH	Nitrate	Nitrite	Ammonia	TN	TON	DRP	TP	EC	CHL	TSS	Turbidity
D/M/Y	mg/L	%	C	mS/cm	ppt		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Cfu/100ml	mg/L	mg/L	NTU
31/07/2014	8.21	98.5	13.928	52.593	34.63	8.09	0.0036	0.0026	0.005	<0.02		0.008	0.011	<10	0.0018	6.1	0.72
31/07/2014	8.22	98.6	13.967	52.3508	34.46	8.1											
15/09/2014	8.29	100.6	14.528	52.38	34.5	8.19	<0.002	<0.002	<0.005	<0.01	<0.002	0.003	0.007	<10	<0.0006	12	0.4
15/09/2014	8.3	101.5	14.949	52.1325	34.33	8.19											
9/10/2014	8.44	103.5	14.679	53.8441	35.58	8.05	<0.002	<0.002	0.013	<0.01	<0.002	0.006	0.012	<10	0.002	3.6	0.35
9/10/2014	8.41	103.1	14.665	53.9207	35.64	8.08											
10/11/2014	8.52	107.9	16.425	53.3577	35.26	8.08	<0.002	<0.002	<0.005	<0.01	<0.002	0.008	0.008	<10	0.00068	5	0.7
10/11/2014	8.31	106.4	16.956	53.3982	35.3	8.06											
8/12/2014	7.94	103.4	17.393	55.4888	36.86	8	<0.002	<0.002	0.0074	<0.01	<0.002	0.007	0.012	<10	0.00078	2.3	0.5
8/12/2014	7.84	103	17.832	55.803	37.1	8.01											

(B)

	Nitrate	mg/L	Nitrite	mg/L	Ammonia	mg/L	DRP	mg/L	TP	mg/L	CHL	mg/L
Date	Causeway	Ti Point	Causeway	Ti Point	Causeway	Ti Point	Causeway	Ti Point	Causeway	Ti Point	Causeway	Ti Point
31/07/2014	0.0036		0.0026		0.005*		0.008		0.011		0.0018	
15/09/2014	0.002*	0.002*	0.002*	0.002*	0.005*	0.005*	0.003	0.009	0.007	0.01	0.0006	0.0006
9/10/2014	0.002*	0.002*	0.002*	0.002*	0.013	0.005*	0.006	0.006	0.012	0.01	0.002	0.0045
10/11/2014	0.002*	0.002*	0.002*	0.002*	0.005*	0.005*	0.008	0.006	0.008	0.007	0.00068	0.0019
8/12/2014	0.002*	0.002*	0.002*	0.002*	0.0074	0.008*	0.007	0.008	0.012	0.012	0.00078	0.0011

*limit of detection