EPL233 Monitoring Report
Archer Waste Transfer Station

For annual reporting period ending 31 May 2023

City of Palmerston

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ACRONYMS

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BoM	Bureau of Meteorology
CoP	City of Palmerston
DO	dissolved oxygen
EC	electrical conductivity
EPL	Environment Protection Licence
LOR	limit of reporting
NATA	National Association of Testing Authorities
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
TBA	To be advised
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
WTS	Waste transfer station

1 INTRODUCTION

City of Palmerston (CoP) operate the Archer Waste Transfer Station (WTS) situated on Lot 11497, Town of Palmerston, Elrundie Avenue, Archer. CoP are authorised to 'store' waste at this facility under the NT Waste Management and Pollution Control Act in accordance with Environment Protection Licence (EPL233-02). Wastes stored at the facility prior to transport and disposal at the Shoal Bay Waste Management Facility comprise the following:

- Paper and cardboard
- Plastics
- Glass and aluminium
- General household waste
- Steel and metal
- Batteries
- Paint
- White goods and gas bottles.

Green waste is accepted and mulched onsite for sale to the general public. Refer to site layout in Figure 1-1.

Surface water monitoring is undertaken at the Archer WTS in accordance with Attachment 1 of EPL233-02 to ensure that operations do not impact any waterways downstream. Monitoring Reports are required annually, as per Condition 43 of EPL233-02. These must be prepared in accordance with the NT EPA 'Guideline for Reporting on Environmental Monitoring'. Each report must include all requirements as set out in EPL233-02 Condition 44.

This particular Monitoring Report covers all surface water quality monitoring undertaken for the reporting period 1 June 2022 to 31 May 2023 (herein referred to as the 'reporting period'). This is the third Monitoring Report since commencement of EPL233 on 19 December 2020.

1.1 Purpose and scope

This Monitoring Report is prepared in accordance with the following EPL233-02 conditions:

Condition 43

The licensee must complete and provide to the NT EPA a Monitoring Report, as prescribed by this licence, by 31 May each year.

Condition 44

The licensee must ensure that each Monitoring Report:

44.1 is prepared in accordance with the requirements of the NT EPA 'Guideline for Reporting on Environmental Monitoring';

44.2 includes a tabulation of all monitoring data required as a condition of this licence. Data must be provided electronically in Microsoft Excel format;

44.3 includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years (where the data is available). Data used in the analysis must be provided electronically in Microsoft Excel format; and

44.4 includes an assessment of environmental impact from the activity

Figure 1-1. Map of Archer WTS layout, surface water drainage and sample site locations

2 ENVIRONMENTAL SETTING

Palmerston has a tropical climate with a distinct dry season (May to October) and wet season (November to April). Typically, for this region, humidity, maximum and minimum temperatures are highest in the wet season, and annual evaporation far exceeds annual rainfall.

Climate data is sourced from the Bureau of Meteorology (BoM) weather monitoring station at Darwin Airport (station number 014015). Average annual rainfall at Darwin Airport (16 km northwest of the site) is 1,726.9 mm, with the highest rainfall occurring in January and the lowest in July.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave Rainfall (mm)	429.8	370.6	308.9	101.5	20.4	1.8	1.1	4.6	16.5	71.2	143.1	255.3	1726.9

The site is located on a relatively flat area, with a gradient of <3%. The area is well-drained with a combination of bitumen, compacted gravel/dirt, and grassed areas allowing for some infiltration but mostly surface water runoff. Existing constructed drains located on site collect and direct overland flows towards the eastern property boundary, where they enter an ephemeral stream (see Figure 1-1).

The stream captures stormwater from the neighbouring suburb of Bellamack before passing under Elrundie Avenue. It then passes the eastern boundary of the site and continues for approximately 1.5 km before entering a mangrove-lined creek in the Elizabeth River. Downstream of the site there is partially cleared land, a power transmission corridor, and a railway track.

2.1 Rainfall during reporting period

Figure 2-1 shows monthly rainfall totals for the reporting period taken from the Darwin Airport BoM station No.014015. Average monthly rainfall totals are also shown for comparison. Rainfall during October, November and December 2022 and February 2023 was above average, with December and October recording greater than double the average respective rainfall totals. January and March 2023 recorded significantly lower rainfall than average, with all other months recording close to average rainfall. However, it is observed that December recorded almost half of it's rainfall during the period between Christmas and New Year and that prior to this time in December there was in-sufficient rainfall to maintain stream flow to support sampling..

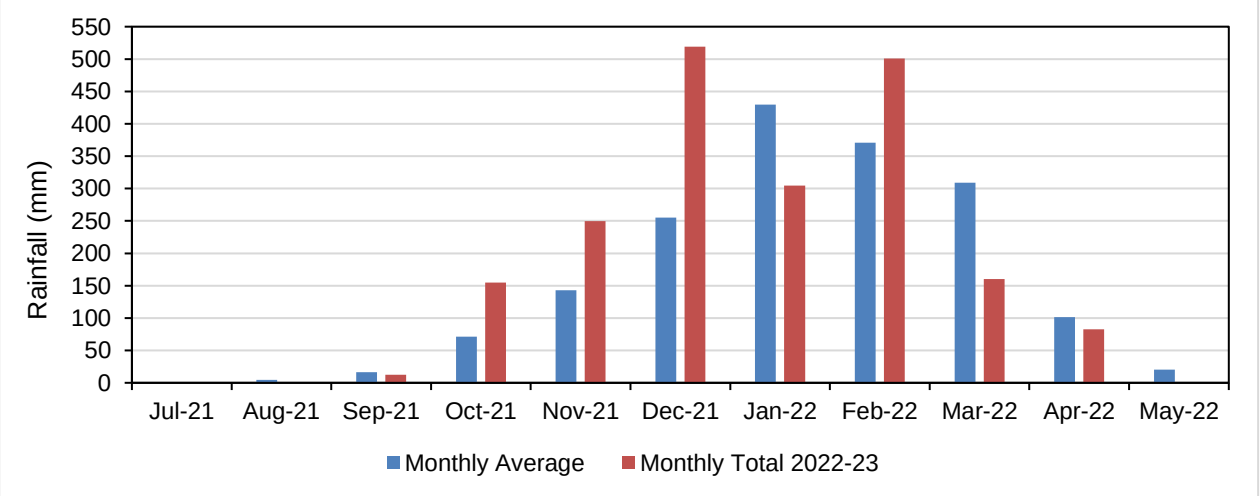


Figure 2-1. Monthly rainfall totals May 2022 to April 2023 (Darwin Airport BoM station No. 014015)

3 MONITORING UNDERTAKEN

During the reporting period, monitoring was undertaken as per EPL233-02, although the December sampling round did not take place until 5 January 2023. This was due to relatively low rainfall experienced in December and associated absence of stream flow and hence dry sampling locations. As per discussion in Section 2.1, high rainfall was experienced in late December however this coincided with the Christmas shutdown period (including closure of laboratories)when high rainfall was recorded. EPL233-02 monitoring requirements are summarised below.

3.1 Monitoring sites

Details for surface water monitoring sites as listed in EPL233-02 Attachment 1 are shown in Table 3-1.

Table 3-1. Surface water monitoring site details

Site ID	Context and purpose	GPS Coordinates	
		Latitude	Longitude
Surface Water Sites			
SW01	Upstream of site. Captures water quality of stream before impact of runoff from site.	715054	8615118
SW04	Minor drainage line at the southern boundary of site	714895	8614982
SW07	Downstream of confluence of ephemeral stream and runoff from site. Captures impact of runoff from site. Trigger values apply only to this site.	715031	8614965

3.2 Monitoring frequency, parameters, and trigger values

The parameters to be measured at each site, the sampling frequency, and trigger values currently specified in EPL233-02 Attachment 1 are shown in Table 3-2.

Table 3-2. Monitoring program and trigger values for surface water sites

Monitoring sites	Parameter	Units	Sampling frequency	Trigger value
SW01, SW04, SW07	Field measurement		4 time during the wet season (December, January, February, March)	-
	Flow	L/s		-
	pH	pH units		6 – 8.5[3]
	Electrical Conductivity (EC)	µS/cm		-
	Dissolved Oxygen (DO)	% saturation		80 -100[3]
	Temperature	°C		-
	Turbidity	NTU		-
	Metals/Metaloids	µg/mL		-
	Cadmium (Cd)			5.7[7]

Monitoring sites	Parameter	Units	Sampling frequency	Trigger value
	Chromium (Cr)[5]			4.4[6,7]
	Copper (Cu)			1.3[7]
	Lead (Pb)			4.4[7]
	Mercury (Hg)			0.4[7]
	Nickel (Ni)			70[7]
	Zinc (Zn)			15[7]
	Other	mg/L		
	Chemical Oxygen Demand			-
	Total Suspended Solids (TSS)			10[3]
	Total Dissolved Solids (TDS)			-
	Nutrients	µg/L		
	Ammonia (NH3as N)			20+3
	Total Nitrogen (TN)			300[3]
	Total Phosphorous (TP)			30[3]
	Hydrocarbons	µg/L		
	Total Recoverable Hydrocarbons (TRH)			-
	Benzene			700[7]
	Toluene			-
	Ethylbenzene			-
	Xylene			-
	Naphthalene			70[7]

1 – Trigger values only apply to monitoring location SW07

2 – Only during months December to March

3 – Based on Darwin Harbour Water Quality Objectives (Marine and Estuary Systems – Upper Estuary)

4 – Estimate the flow at time of sampling

5 – Analyse for Trivalent and Hexavalent Chromium if total chromium exceeds trigger value

6 – Based on Hexavalent Chromium 95% species protection ANZECC Water Quality Guidelines 2018 (ANZG 2018)

7 – Based on 95% species protection for marine water ANZECC Water Quality Guidelines 2018 (ANZG 2018)

3.3 Sampling procedures

All sampling is undertaken in accordance with the Archer WTS Water Quality Monitoring and Management Plan (EcOz 2018) and Archer WTS Sampling and Analysis Quality Plan (EcOz) 2018) and the following standards and guidelines:

Australian/New Zealand Standard on Water Quality Sampling - *Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998), Standards Australia, New South Wales.

Australian/New Zealand Standard on Water Quality Sampling - *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.

Australian Standard/New Zealand Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998), Standards Australia, New South Wales.

All water sampling was carried out by an EcOz Environmental Consultant well-experienced in water quality monitoring. Field parameters were measured in-situ with water quality meters that were calibrated immediately prior to field mobilisation. Laboratory samples were collected upstream of the location where in-situ field parameters were measured, to prevent contamination of samples.

All laboratory samples were collected into ALS Laboratory-supplied sample bottles/jars; some of which contain preservative where required. Once collected, these samples were kept cold in an esky with ice bricks until dispatched to the ALS shopfront on the same day as sampling in order to meet analytical holding time limits. The samples were analysed by a NATA accredited lab (ALS or Eurofins).

All surface water field parameters and observations were recorded on a dedicated *Field Data Sheet*. Information included who collected the sample, date and time, flow rate, field parameters measurements, and any items of interest such as presence of algae, animals or potential contaminants that may affect the water quality.

Field and laboratory results are stored in an Excel database updated and maintained by EcOz.

All field data sheets (scanned copies) and laboratory documentation are stored in an online filing system maintained by EcOz (M-Files). CoP also maintain copies of all laboratory documentation.

3.4 Monitoring undertaken during the reporting period

Table 3-3 outlines the monitoring undertaken during the reporting period against EPL233-02 monitoring requirements.

Table 3-3. Monitoring undertaken during the reporting period

Site ID	Frequency required	Dates sampled	Comment(s)
SW01	Monthly during reporting period (December, January, February, March)	05/01/2023 25/01/2023 22/02/2023 17/03/2023	Due to insufficient rainfall during the month of December (notwithstanding high rainfall recorded during the Christmas shutdown period (i.e., closed laboratories) sampling could not be undertaken due to lack of surface water flow. As per EPL233-02 Condition 33, December sampling requirement was achieved on the 5/01/2023
SW04	Monthly during reporting period (December, January, February, March)	17/03/2023	No samples collected until the March sampling event. Insufficient water during other events prevented sampling.
SW07	Monthly during reporting period (December, January, February, March)	05/01/2023 25/01/2023 22/02/2023 17/03/2023	Due to insufficient rainfall during the month of December (notwithstanding high rainfall recorded during the Christmas shutdown period (i.e.,

			closed laboratories) sampling could not be undertaken due to lack of surface water flow. As per EPL233-02 Condition 33, the December sampling requirement was achieved on the 5/01/2023

4 RESULTS AND DISCUSSION

4.1 Reporting period trigger value exceedances

Field and laboratory results for the 2022-2023 wet season are presented in Table 4-1 and Table 4-2 compared against the EPL233-02 trigger values. Note that the trigger values apply only to the downstream compliance point SW07.

Trigger values exceedances occurred at SW07 during the reporting period for DO, TSS, Copper, Lead, Ammonia, TP and TN. Only these parameters which exceeded the trigger values are discussed below.

DO was below the 80% saturation trigger value for all sampling events. It is noted that SW01 only achieved a DO% greater than the trigger value once, on the 5 January, with all other events recording DO values below the trigger value. The 80% saturation trigger value comes from data collected in the open tidal waters of Darwin Harbour.

TSS values exceeded the trigger values during each sampling event at SW07, with SW01 also recording exceedances for the late January and February rounds.

Dissolved copper exceeded the trigger values at SW07 during the early January and February rounds. It is noted that SW01 also exceeded the trigger values in the early January round, indicating elevated background concentrations before any input from site runoff enters the ephemeral stream.

Lead exceeded the trigger values at SW07 during the early January round. All other sampling event recorded lead values below the trigger value and LOR.

Ammonia recorded values greater than the trigger value at SW07 for all sampling events. SW01 also exceeded the trigger values in the February and March sampling events.

TP exceeded the trigger values at all sites in all sampling events. It is noted that SW01 recorded values far lesser than the SW04 and SW07 values, indicating that the contamination was originating on site before runoff carried nutrient rich water into the stream.

TN exceeded the trigger values at all sites during all sampling events (with the exception of SW01 in late January and March).

4.2 Trends since 2018

Trend analysis graphs for key parameters, displaying trends in data from 2018 to 2023 are provided in Appendix B. A complete summary of water quality data since monitoring started in 2018 is provided in Appendix A.

There is no obvious overall trend in TSS concentrations since 2018.

Dissolved copper, ammonia and TP concentrations appear to be declining since 2018, but further years of monitoring are required to confirm this.

The trend of the number of exceedances reducing towards the end of each wet season shows that there is a limited amount of contaminants on site available to mobilise into the receiving environment. The weak trend of lowering concentrations of dissolved metals and nutrients since 2018 supports the view that management measures implemented on site are improving runoff water quality.

Table 4-1. Water sampling results 2022-2023 - physical parameters and dissolved metals

Concentrations in breach of EPL233 trigger values at the SW07 compliance point are highlighted

		Field parameters										Dissolved Metals							
Site ID	Date	Temp	Dissolved Oxygen	EC	TDS	Salinity	pH	ORP	Turbidity	TDS	TSS	Arsenic As V	Cadmium Cd	Chromium	Copper Cu	Lead Pb	Mercury (inorganic)	Nickel Ni	Zinc Zn
		°C	%	µS/cm	mg/L	ppt		mV	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Darwin Harbour WQO 2010 - up		-	80 - 100	-	-	-	6-8.5	-	-	-	10	-	-	-	-	-		-	-
Darwin Harbour WQO 2010 - fre		-	50-100	200	-	-	6-7.5	-	20	-	5	-	-	-	-	-		-	-
ANZG 2018 freshwater - 95% sp		-	-	-	-	-	-	-	-	-	-	0.013	0.0002	0.0044	0.0014	0.0034	0.0006	0.011	0.008
EPL233-02 trigger values		-	80-100	-	-	-	6-8.5	-	-	-	10	-	0.0055	0.0044	0.0013	0.0044	0.0004	0.07	0.015
SW01	5/01/2023	28.5	80.3	101.7	66.2	0.1	5.79	209	7.56	-	<5	0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.008
SW07	5/01/2023	28.3	54.3	626	403.1	0.3	6.3	187	1000+	-	106	0.004	<0.0001	<0.001	0.005	0.005	<0.0001	0.002	0.015
SW01	25/01/2023	28.1	43.3	99.9	59.15	0.04	6.2	133.8	5.98	-	6	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW07	25/01/2023	27.7	19.2	1291	838.5	0.64	6.55	150.2	78.7	-	28	0.002	<0.0001	<0.001	0.001	<0.001	<0.0001	<0.001	0.013
SW01	22/02/2023	27.65	40.1	57	28	0.02	6.4	64.6	26.3	-	15	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006
SW07	22/02/2023	25.9	34.9	186	91	0.09	6.86	88.5	1000+	-	558	0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	<0.005
SW01	17/03/2023	29.42	72.8	54	25	0.02	7.21	139.9	18.2	-	<5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW04	17/03/2023	29.73	31.3	500	229	0.22	6.75	148.8	512	-	244	0.002	<0.0001	<0.001	<0.001	0.002	<0.0001	0.002	<0.005
SW07	17/03/2023	29.39	56.1	535	247	0.24	7.03	162	404	-	63	0.002	<0.0001	0.001	<0.001	0.002	<0.0001	0.002	<0.005

Table 4-2. Water sampling results 2022-2023 – nutrients

Concentrations in breach of EPL233 trigger values at the SW07 compliance point are highlighted

Site ID	Date	Nutrients					
		Ammonia	Total Phosphorus	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen	Total Nitrogen as N	COD
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Darwin Harbour WQO 2010 - up		0.02	0.03	-	-	-	-
Darwin Harbour WQO 2010 - fre		-	0.01	-	-	-	-
ANZG 2018 freshwater - 95% sp		0.9	-	-	-	-	-
EPL233-02 trigger values		0.02	0.03	-	-	0.3	-
SW01	5/01/2023	0.02	0.13	0.12	0.3	0.4	43
SW07	5/01/2023	0.61	1.15	0.21	4.3	4.5	133
SW01	25/01/2023	<0.01	0.25	<0.01	0.3	0.3	<10
SW07	25/01/2023	0.37	0.52	<0.01	2.1	2.1	57
SW01	22/02/2023	0.08	0.04	0.02	0.4	0.4	28
SW07	22/02/2023	0.15	0.83	0.33	3.7	4	72
SW01	17/03/2023	0.04	0.08	0.05	0.2	0.2	<10
SW04	17/03/2023	0.29	0.53	0.59	2	2.6	112
SW07	17/03/2023	0.65	0.57	0.87	2.6	3.5	105

5 CONCLUSIONS

The monitoring schedule was undertaken as per EPL233-02 Attachment 1 – Surface Water Monitoring Program requirements (noting that the December sampling round occurred in early January due to absence of streamflow except for the Christmas shutdown period (including laboratory closure).. Prior experience with sampling at Archer Waste has demonstrated a minimum of 20mm of rainfall to collect samples at the beginning of the wet season, as the ground will absorb the water until saturated. As the wet season progresses less and less rainfall is required to sample.

Trigger value exceedances occurred at the compliance point (SW07) during the reporting period for DO, TSS, dissolved copper, ammonia, TP, and TN on one or more occasions and were reported at that time in accordance with Condition 42 of EPL 233-02. It is also noted that trigger value exceedances were also observed at the upstream site SW01, which shows the trigger value can be exceeded before any impact from the WTS. Having regard to TSS trigger value exceedances, there is an opportunity to use appropriately located mulch windrows as sediment filters to mitigate sediment movement from the green waste and mulch earthen hardstand.

The balance of water quality monitoring results conformed with trigger values.

6 REFERENCES

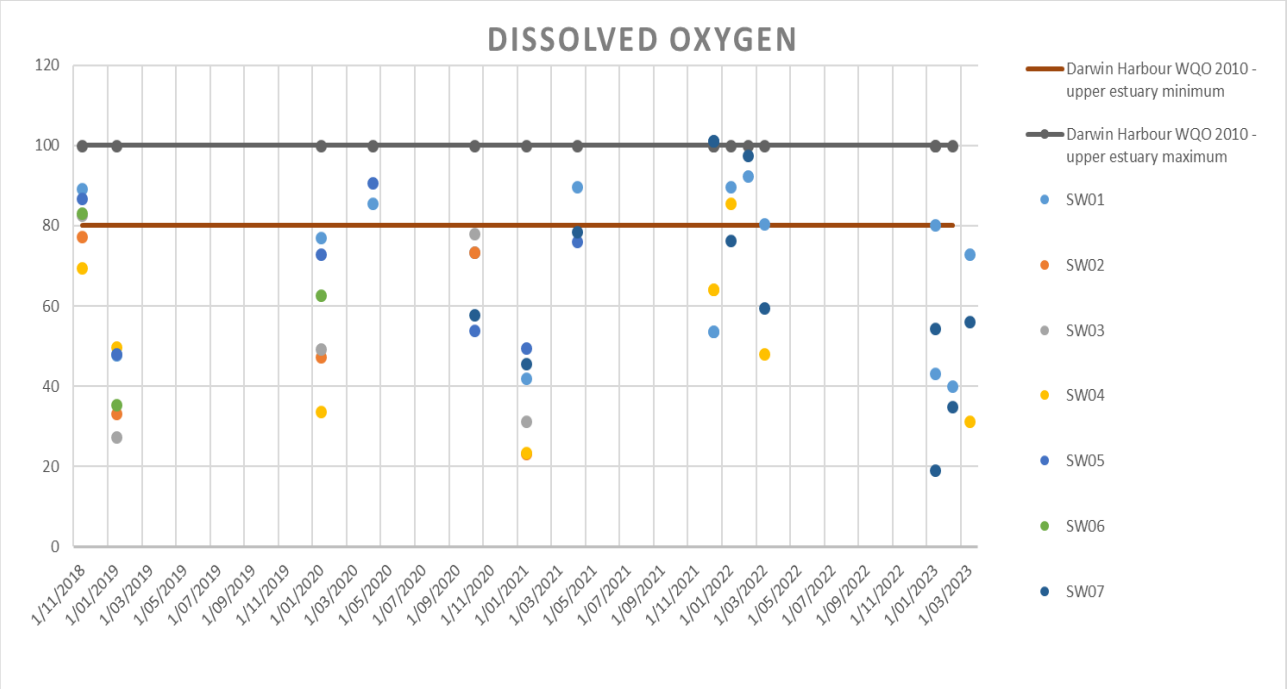
ANZG 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

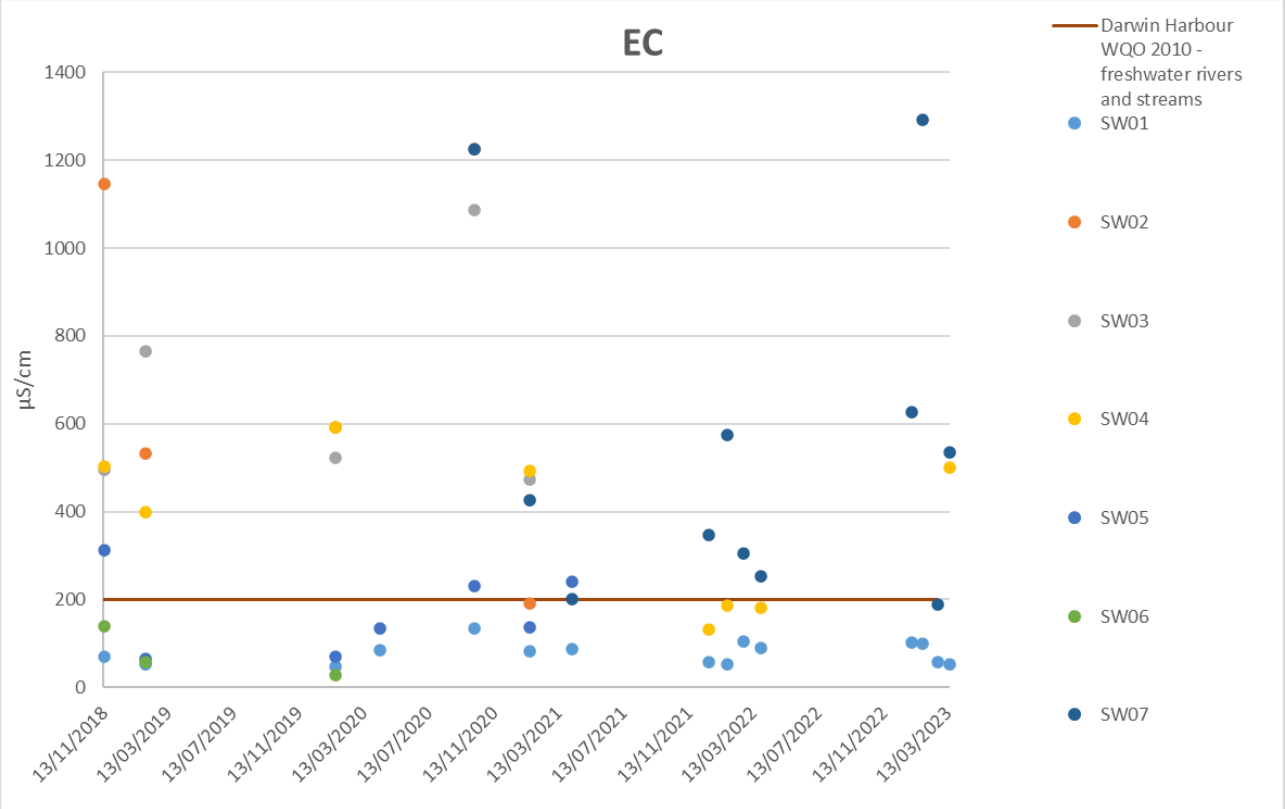
Northern Territory Government (2010) *Water Quality Objectives for the Darwin Harbour Region for marine and estuarine systems.*

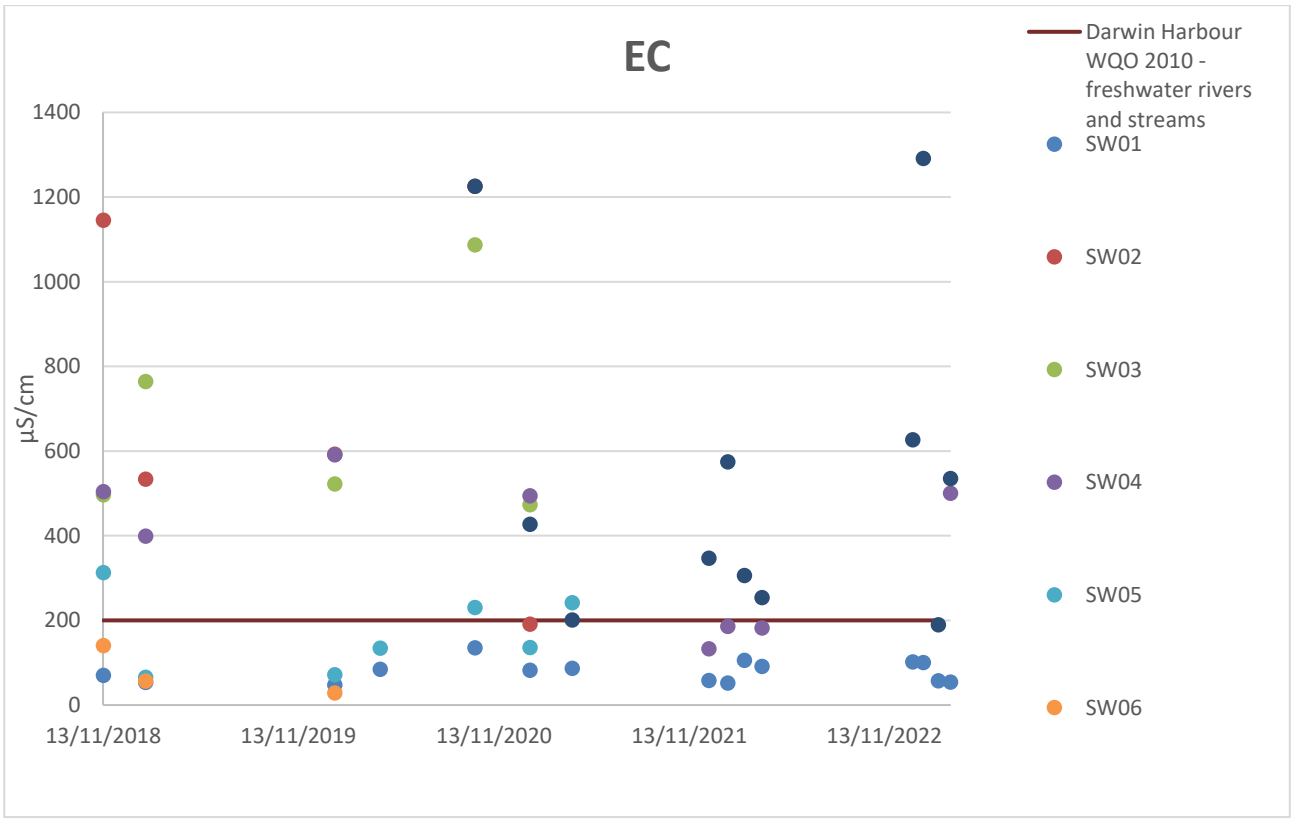
APPENDIX A COMPLETE WATER QUALITY DATASET

The water quality data collected by EcOz from 2018 to 2023 are provided in an Excel database forwarded as separate file titled Archer Waste Data 2018 to 2023

APPENDIX B TREND ANALYSIS GRAPHS



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200
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13/11/2018
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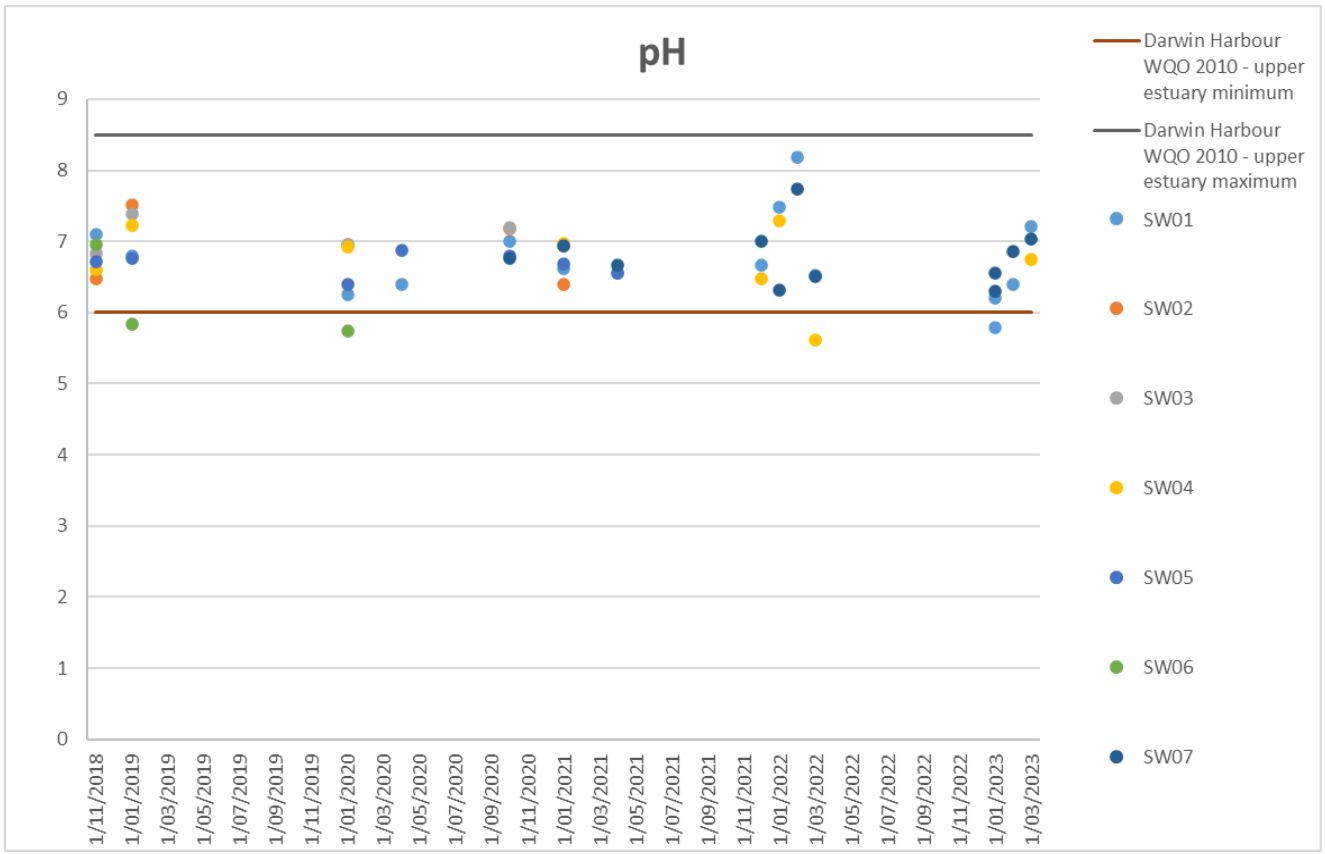
13/11/2022
Darwin Harbour WQO 2010 - freshwater rivers and streams
SW01
SW02
SW03
SW04
SW05
SW06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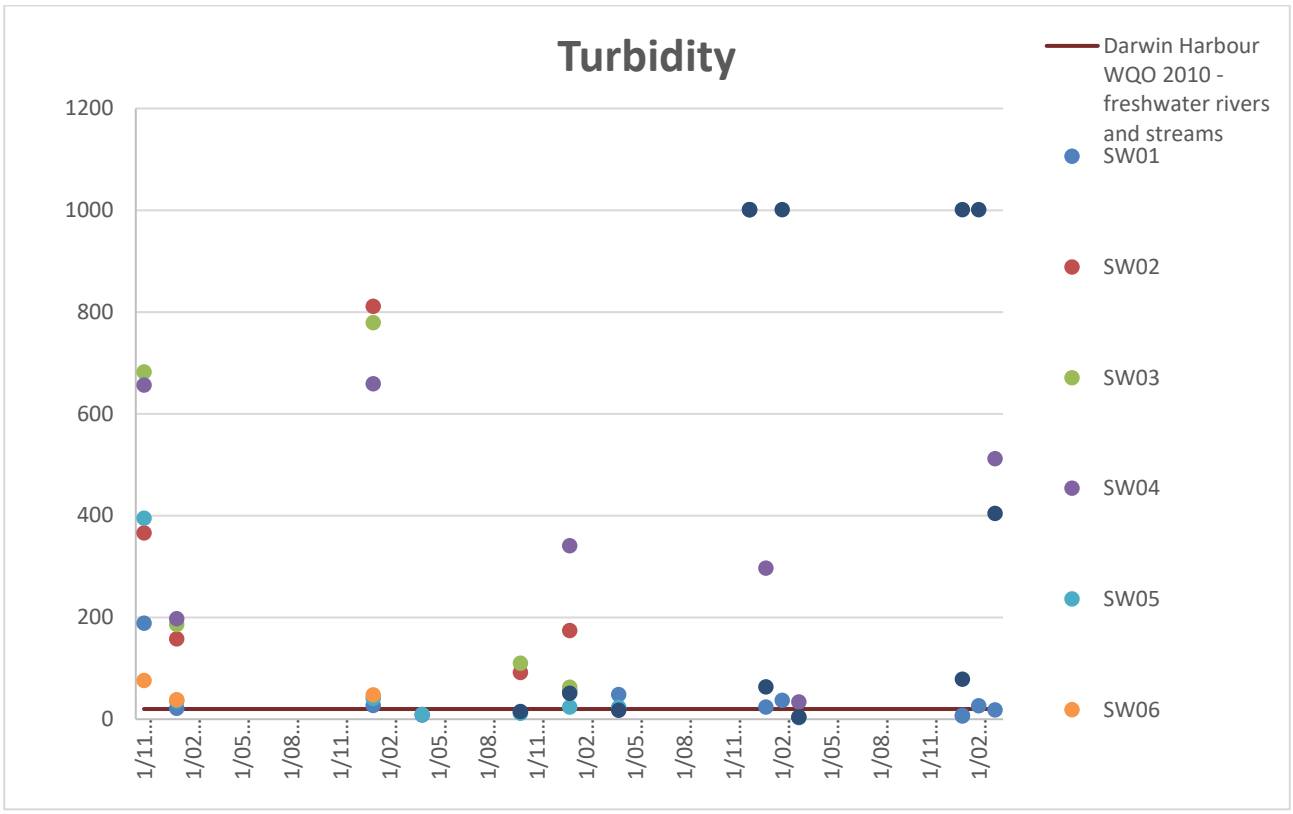
1/01/2023
1/03/2023
Darwin Harbour WQO 2010 - upper estuary minimum
Darwin Harbour WQO 2010 - upper estuary maximum
SW01
SW02
SW03
SW04
SW05
SW06
SW07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SW03
SW04
SW05
SW06
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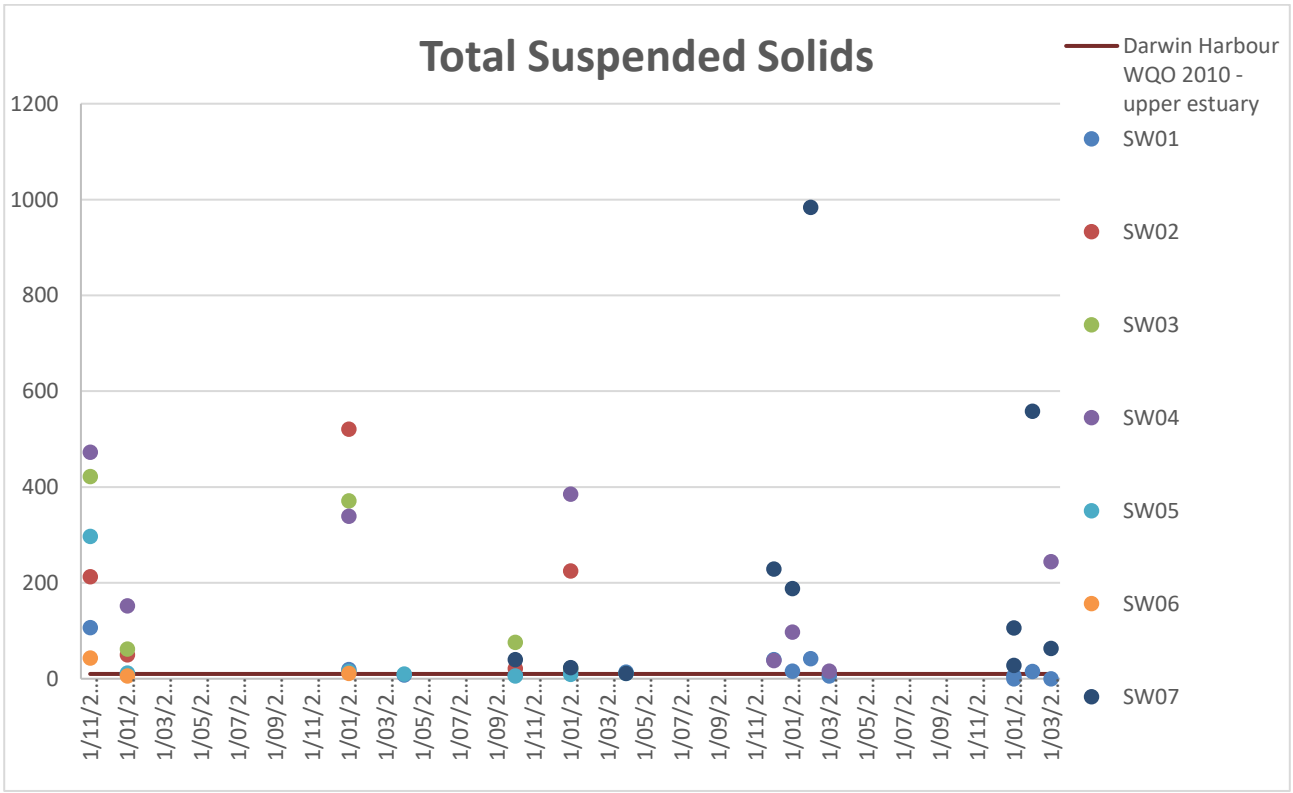
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SW02
SW03
SW04
SW05
SW06
SW07
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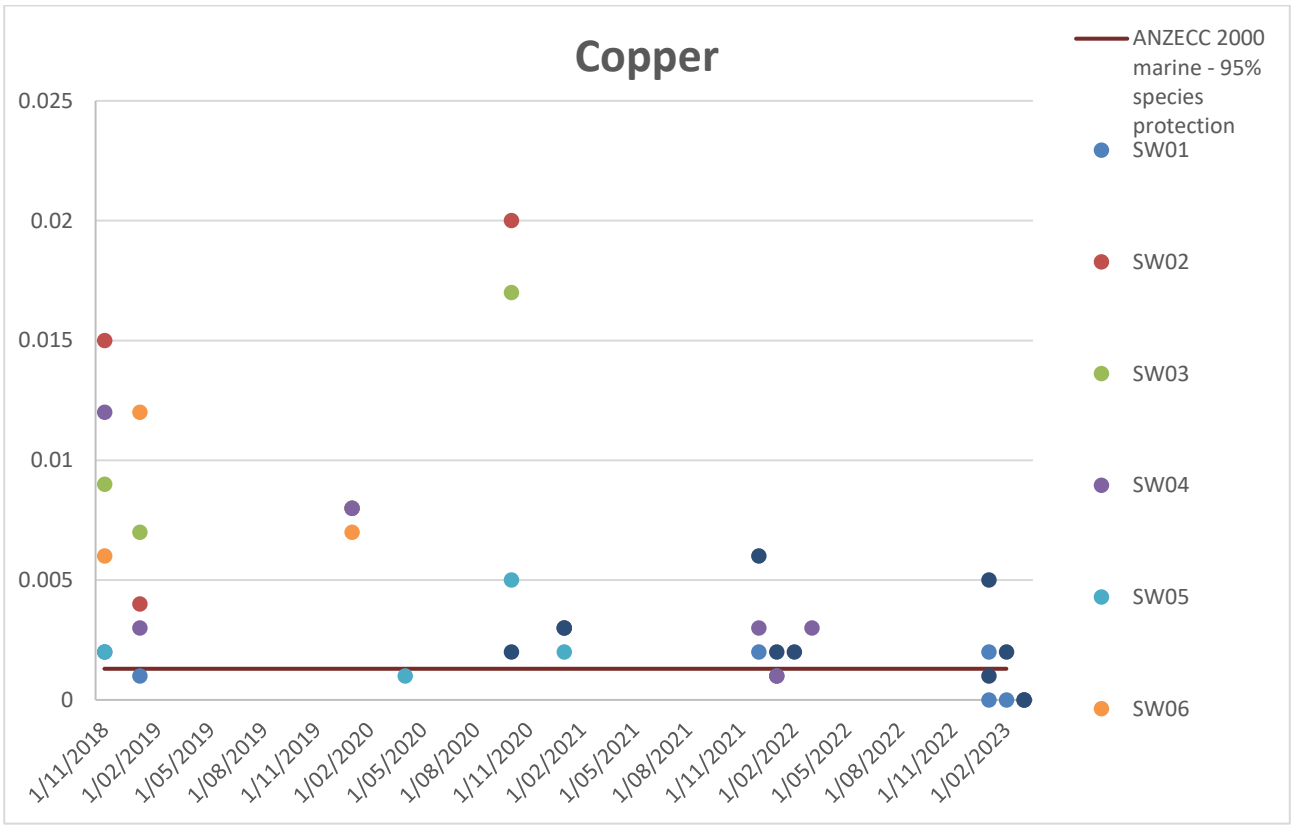
400
200
0


Copper
ANZECC 2000 marine - 95% species protection
SW01
SW02
SW03
SW04
SW05
SW06
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0.02
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1/11/2018
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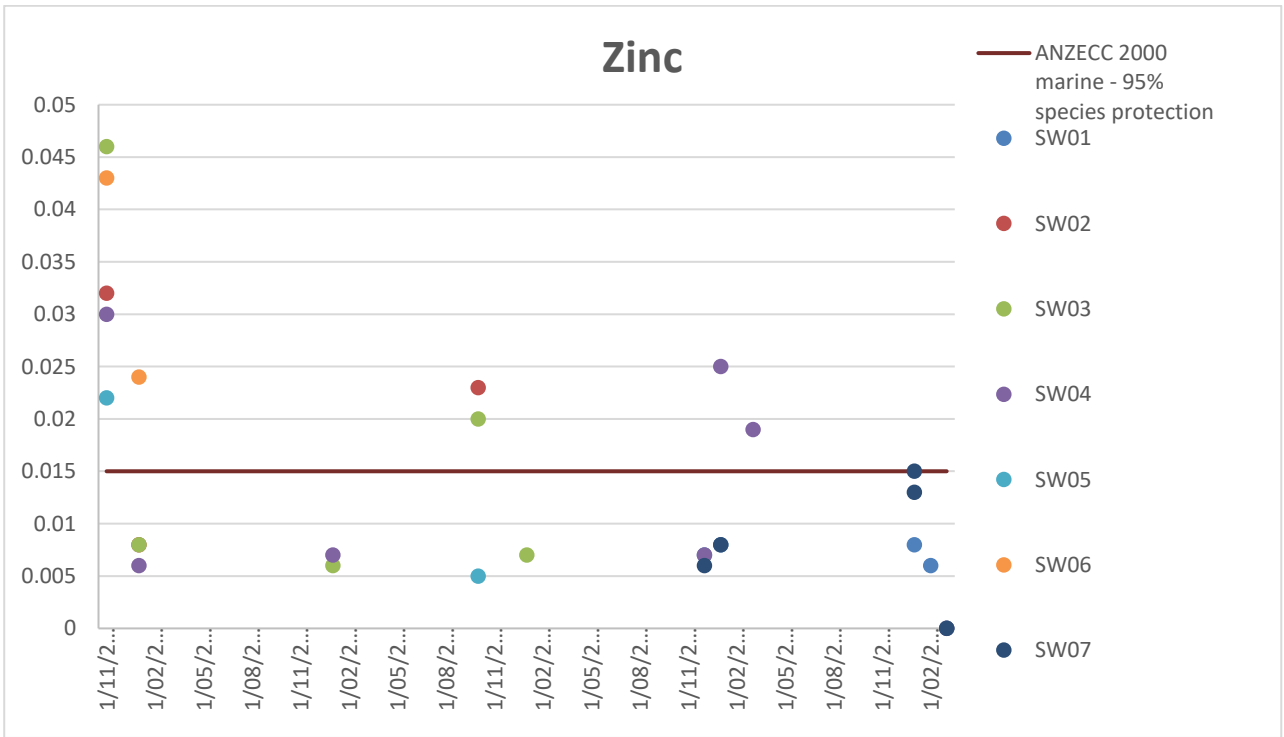
Zinc
ANZECC 2000 marine - 95% species protection
SW01
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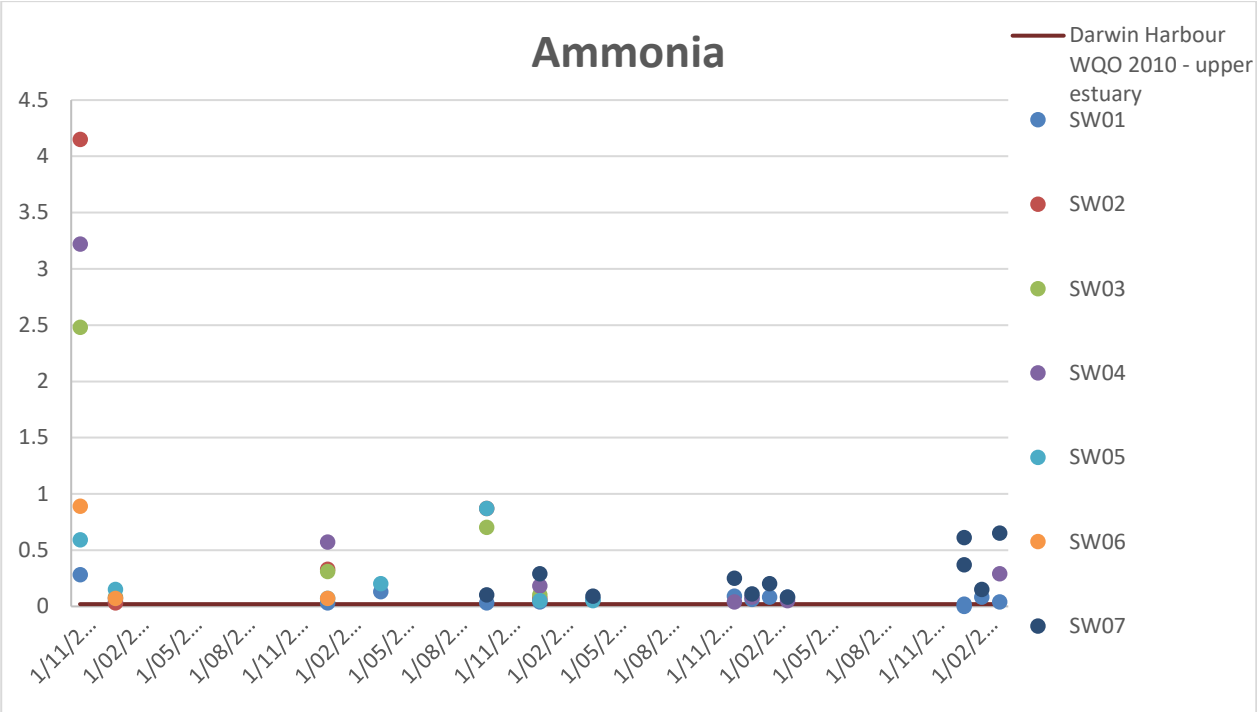
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SW03
SW04
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0.5
0
1/11/2...
1/02/2...
1/05/2...
1/08/2...
1/11/2...
1/02/2...
1/05/2...
1/08/2...
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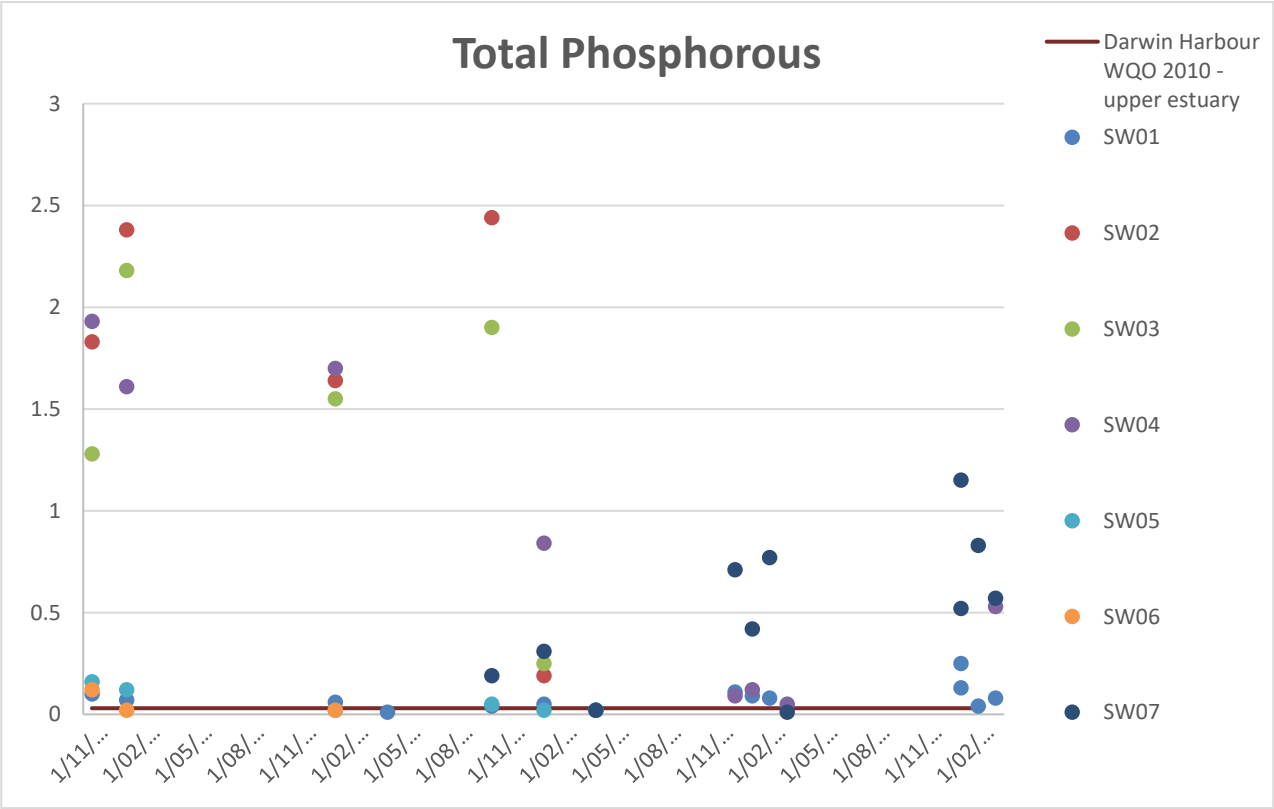
1/08/2...
1/11/2...
1/02/2...


Total Phosphorous
Darwin Harbour WQO 2010 - upper estuary
SW01
SW02
SW03
SW04
SW05
SW06
SW07
3
2.5
2
1.5
1
0.5
0
1/11/...
1/02/...
1/05/...
1/08/...
1/11/...
1/02/...
1/05/...
1/08/...
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1/05/...
1/08/...
1/11/...
1/02/...

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