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Port of Brisbane - Water Quality Monitoring Report 2013

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Port of Brisbane - Water Quality Monitoring Report 2013

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Synopsis: **A report on the 2013 water quality monitoring program at the Port of Brisbane.**

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Executive Summary

The Port of Brisbane encompasses port facilities within the lower Brisbane River area, and is responsible for maintaining navigable depths within Moreton Bay. PBPL has initiated an environmental monitoring program to assess its potential impacts on adjacent estuarine and marine environments. Routine water quality monitoring is a component of the PBPL environmental monitoring program.

The aim of the water quality monitoring program is to assess the physico-chemical conditions of marine and estuarine waters in the Port of Brisbane area, and on the basis of this information, identify any gross impacts that may be caused by port-related activities. Sampling was carried out at 12 monitoring sites within the Brisbane River, Moreton Bay and the Mud Island Dredged Material Placement Area. The present report considers the findings of sampling carried out in August 2013.

The results of the present study indicate that there were spatial gradients in the physio-chemical character of waters across the study area. Consistent with the South-east Queensland Environmental Health Monitoring Program, the lower Brisbane River estuary was found to have generally poor water quality, with turbidity, dissolved oxygen, pH, total phosphorus, nitrate and copper all exceeding recent water quality guideline values. Sites in Waterloo Bay tended to have better water quality, although some exceedances of guideline values were noted. There is no evidence to suggest that port activities were causing gross scale changes in the receiving environment water quality at the time of sampling.

The only toxicants detected in the present study were a variety of metals and metalloids. Copper was the only metal that had concentrations that exceeded the ANZECC water quality guideline values for the 95% protection of species. The cause of the elevated copper concentration is not known. Although it is a known contaminant of concern in Brisbane River sediments, previous water quality monitoring studies have not recorded copper at such high levels within the study area. The copper results should at this stage be considered to be suspect.

It is important to note that the present study represents a snap-shot of water quality at one time only. Most water quality parameters show great variation over a range of time-scales, changing between different stages of the tidal cycle, daily, seasonally and in response to rainfall patterns. Therefore, the results of the present study should be considered as indicative only, and would require further sampling to assess the generality of patterns at other times.

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1 Introduction

1.1 Background

The Port of Brisbane Proprietary Limited (PBPL) is the manager and operator of the Port of Brisbane. The Port of Brisbane encompasses port facilities within the lower Brisbane River area, and is responsible for maintaining navigable depths within Moreton Bay (Figure 1-1).

Water quality is a key driver of aquatic ecosystem health. The South East Queensland Environmental Health Monitoring Program (EHMP) demonstrates that different parts of the port area and surrounds are under different levels of water quality stress. Waterloo Bay is considered to be in relatively good condition (high seagrass cover, low pollutant levels), whereas Bramble Bay to the north of the port, together with the lower Brisbane River, experiences significant water quality stress.

Water quality in western Moreton Bay and the lower Brisbane River is primarily affected by pollutants from catchment runoff and discharges of treated sewage (EHMP 2006). At a local scale, stormwater runoff from port lands also represents a potential source of pollutants in the marine environment.

PBPL has initiated an environmental monitoring program to assess its potential impacts on adjacent estuarine and marine environments. The monitoring program includes the assessment of a range of physio-chemical and biological indicators to achieve the following primary aims:

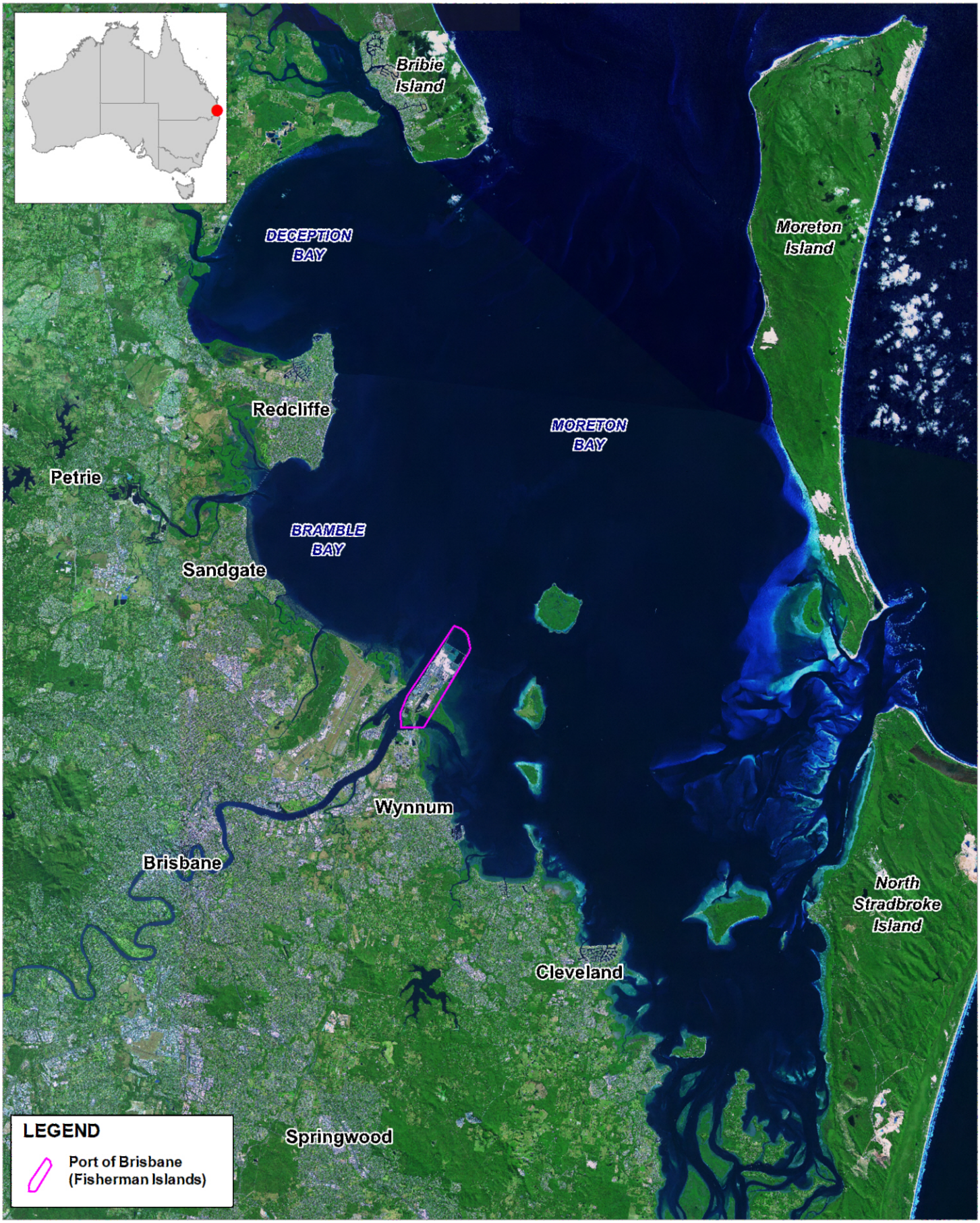
- To assess the health and long term trends in the condition of the environment to determine potential impacts of the port; and
- Provide information that supports and informs port planning and management activities.

Routine water quality monitoring is a component of the PBPL environmental monitoring program. This water quality monitoring program, which is the subject of the present report, provides local-scale data that complements broader scale, more intensive monitoring carried out under the EHMP. Together, these data provide a basis for assessing trends in water quality within the port area and the wider western Moreton Bay.

1.2 Aims and Objectives

The aim of the water quality monitoring program is to assess the physico-chemical conditions of marine and estuarine waters in the Port of Brisbane area, and on the basis of this information, identify any gross impacts that may be caused by port-related activities. The specific objectives of this monitoring program are to:

- Quantify and describe spatial trends in the physico-chemical properties of waters adjacent to port infrastructure, with a focus on potential contaminants of concern and other ecosystem stressors; and
- Determine the status of the physico-chemical properties of waters with reference to defined water quality objectives and relevant guideline values.



Title:
Locality Plan

Figure: 1-1

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2 Methodology

2.1 Timing

The field program for the August 2013 monitoring event was conducted over a one day period on the 19th August. Sampling was carried out between 08:00 hours and 13:00 hours, during an ebbing tide.

2.2 Survey Vessel and Positioning

All sampling was carried out from the PBPL vessel 'Port Watch' (Figure 2-1). Location and navigation to the sampling sites was undertaken using a real time differential Global Positioning System (dGPS) to provide position-fixing accuracy's of ±1m.

Figure 2-1 Photograph of 'Port Watch 1'

2.3 Monitoring Sites

The program in 2013 included sampling of 12 monitoring sites selected by PBPL within the Brisbane River, Moreton Bay and the Mud Island Dredged Material Placement Area (MIDMPA) (Table 2-1). Monitoring sites were selected on the basis of the following considerations:

- Representative examples of the range of estuarine and marine waters found in the vicinity of the port.
- Representative examples of waterbodies outside the direct zone of influence of the port, which could be used as background or control sites in future activity-based water quality monitoring programmes.

Sites were grouped into four broad areas: Brisbane River (i.e. sites upstream of river mouth), Outer Bar (i.e. sites located in the navigation channel seaward of the river mouth), Waterloo Bay and sites within the MIDMPA (Table 2-1). The position of monitoring sites is shown in Figure 2-2.

Table 2-1 Port of Brisbane water quality monitoring sites

Location	Site	EPP Schedule	Easting	Northing
Brisbane River	Site 1	Enclosed Coastal Lower Estuary (Brisbane River estuary) - SMD	514333.8	6967598
Brisbane River	Site 2		515105.2	6970389
Brisbane River	Site 12		515932.2	6969267
Outer Bar	Site 3	Enclosed Coastal Lower Estuary (W2) - SMD	517628.6	6974266
Outer Bar	Site 4		518335.3	6975398
Outer Bar	Site 11		516381.2	6972397
Waterloo Bay	Site 5		519992.5	6974456
Waterloo Bay	Site 6		519365.7	6972629
Waterloo Bay	Site 7		516473	6969854
Waterloo Bay	Site 8	Enclosed Coastal Lower Estuary (W1) - HEV	518754.7	6968230
MIDMPA	Site 9	Open Coastal (C1) - SMD	522872	6974873
MIDMPA	Site 10		522028	6976971

2.4 Sampling Approach

Sampling was undertaken in accordance with Australian Standard AS/NZS 5667.1:1998, and DEHP (2013).

2.4.1 *In-situ* Sampling

The parameters listed in Table 2-2 were measured *in situ* at each site. *In situ* measurements were taken using a YSI 6600 water quality instrument (Figure 2-2). The instrument was slowly lowered through the water column and measurements were taken at one metre intervals to the seabed. Data were logged by the instrument and downloaded upon return to base.

This instrument was calibrated in prior to the site visit and the calibration was checked again once at site using appropriate calibration solutions.

Title:

Location of water quality monitoring sites

Figure: 2-2

Rev: A

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Table 2-2 Water quality parameters measured *in-situ* through the water column

Parameter	Units
pH	pH units
Electrical conductivity (EC)	mS/cm
Water temperature	°C
Oxidation reduction potential (ORP)	mV
Turbidity	NTU
Dissolved oxygen (DO)	mg/l; % saturation

Figure 2-3 YSI 6600 Water Quality Instrument

2.4.2 Grab Sampling

2.4.2.1 Collection of Samples for Laboratory Analyses

Surface water samples were collected at each site from a water depth of two metres below the water surface using a spring-loaded 2L van-Dorn water sampler. Water samples were collected at least one metre from any river bank or wharf.

Table 2-3 provides an overview of the number of samples collected for this study component. One primary sample was collected at each site. A range of additional samples were also collected for QC purposes to assess the repeatability and precision of laboratory results, and consisted of the following:

- Intra-laboratory duplicates – water samples were split into two duplicate sub-samples and tested as separate (blind) samples by the primary laboratory (Symbio Alliance). Intra-laboratory duplicates were collected at 10% of monitoring sites (i.e. two sites).
- Triplicate samples – triplicate (3) samples collected at 5% of locations (one site).

Table 2-3 Water Quality Sample Numbers Including QA/QC Samples

Sample type	Number of samples
Primary samples	12
Duplicates (two sites)	2
Triplicates (one site)	2
Total	16

Water samples collected for laboratory analyses were stored and transported in clean, sterile sample containers supplied by NATA accredited Symbio Alliance in Brisbane. Samples requiring field filtration (i.e. dissolved metals/metalloids and DOC) were filtered at each monitoring site using a syringe and 0.45µm filter cartridges.

Water samples were kept chilled (and in the dark) in the field using insulated portable containers with ice bricks, and then transported direct to the laboratory in insulated portable containers with ice bricks.

2.4.2.2 Laboratory Analyses

The following parameters were measured in the laboratory by Symbio Alliance:

- Total and dissolved metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, manganese, mercury, nickel, selenium, lead, zinc).
- Total and dissolved nutrients (total nitrogen, total phosphorus, ammonia, nitrate, nitrite).
- Total Suspended Solids.
- Benzene, toluene, ethylbenzene and xylene (BTEX).
- Polyaromatic Hydrocarbons (PAHs).
- Tributyltin (TBT).
- Organochlorine pesticides.

Details on the laboratory analysis methods are provided in Appendix A.

2.4.3 Quality Assurance/Quality Control

2.4.3.1 Sample Collection, Handling, Storage and Transport

To ensure good quality data was collected during the field program, a number of quality assurance (QA) and quality control (QC) procedures were adhered to during all field work. These included the following:

- Appropriately trained field staff undertook sampling and data entry.

- Use and maintenance of appropriate sampling equipment, and implementation of appropriate calibration procedures (including use of controlled standard solution supplied by Symbio in Brisbane).
- Sampling techniques were in accordance with relevant water and sediment quality sampling guidelines and standards (e.g. AS/NZS 5667.1:1998 and AS/NZS 5667.12:1999).
- Sample containers were clearly and accurately labelled and a log of collected samples was maintained and updated.
- Chain of custody forms were maintained and included with samples.
- Data validation included cross check by a second scientist after entry into the database.
- Water sample preservation and handling procedures were followed and samples were supplied to the laboratory within nominated holding times.

2.4.3.2 Laboratory Quality Control Measures

Symbio Alliance is NATA accredited and as such has strict quality assurance and quality control procedures in place.

BMT WBM reviewed QA/QC documentation supplied by the primary laboratory in order to identify any potential issues. QA/QC checks are provided in Section 3.5, and Appendix D has laboratory QC data.

2.5 Comparison of Data to Water Quality Objectives and Guideline Values

The results of the water quality sampling were compared against the following water quality objectives:

- ANZECC/ARMCANZ (2000) guidelines for slightly to moderately disturbed ecosystems at the 95% species protection levels for marine waters.
- Queensland Water Quality Guidelines (2009) for south east Queensland region enclosed coastal waters – subregion western bays.

It should be noted that the Queensland Water Quality Guidelines (2009) indicate that the annual median should be used in comparisons to water quality objectives. Therefore, the comparison of this snap-shot data to guideline value should be considered as indicative rather than representative of long term patterns.

3 Results

3.1 Environmental Conditions

At the time of sampling, weather conditions were clear and there was a 6km/h wind from the south. In the one month period leading up to the sampling event, 87.6 mm of rainfall was recorded at Brisbane Airport (BoM 2013). The previous two month period was characterised by low rainfall that was below respective monthly long-term averages.

No oil slicks, algal blooms, noxious odours or other unusual water discolouration (except the typical high turbidity at the Brisbane River sites) were observed during the survey.

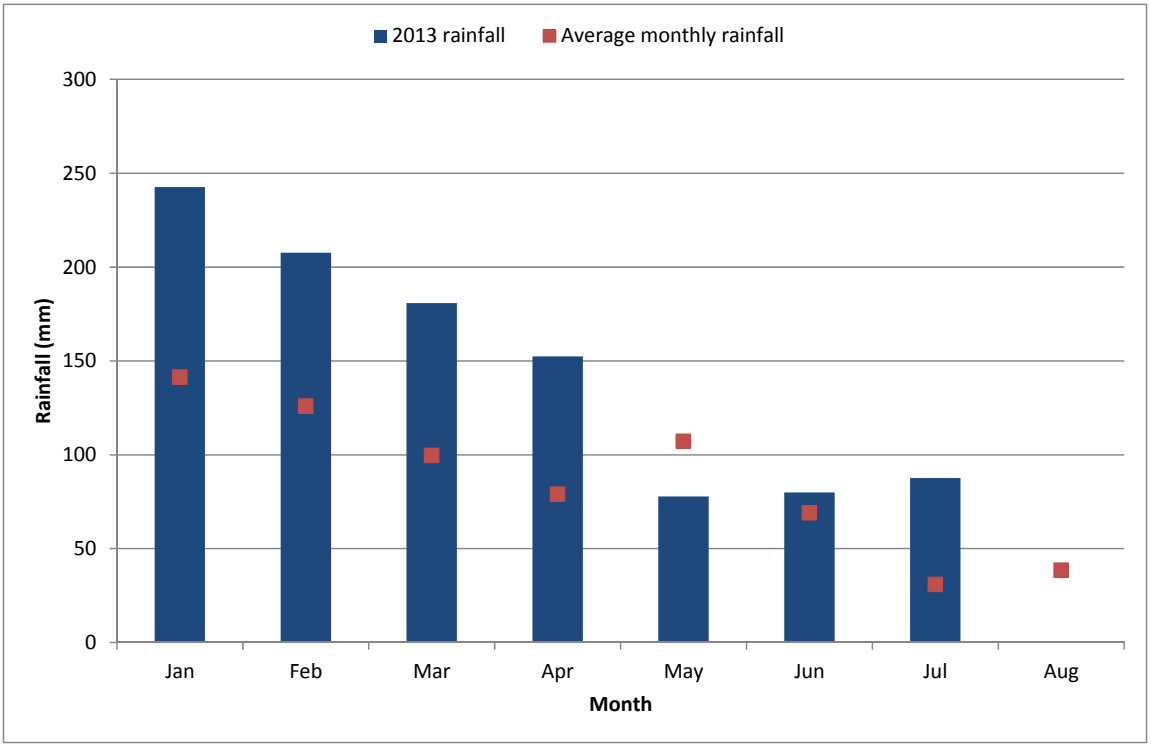


Figure 3-1 Total monthly rainfall in 2013 and long term average monthly rainfall for the period 1994 to present (Bureau of Meteorology Station 40842)

3.2 *In-situ* Measurements

Results of physico-chemical parameters measured *in situ* are presented in Appendix A, and are summarised in Figure 3-2 to Figure 3-5.

From these results, the following observations can be made:

- There were no consistent differences in water temperature among the four broad locations (Figure 3-3). Site 12 (Boat Passage) had the warmest water temperatures (21.1 to 22.4°C) while Site 7 (Boat Passage) had the coolest water temperatures (17.1 to 19.4 °C). There were only slight reductions changes in water temperature through the water column (Figure 3-4). Such changes were not indicative of strong stratification.

- Turbidity at Waterloo Bay and MIDMPA sites was generally lower than sites in the Brisbane River and the Outer Bar. The exception to this pattern was site 7, located at the mouth of Aquarium Passage, which had similar turbidity to adjacent Brisbane River sites. Waterloo Bay sites (sites 5-8) and site 4 in the Outer Bar met QWQG values, whereas all other sites exceeded the guideline values. Little to no change was observed in the turbidity level throughout the water column at Moreton Bay sites. In contrast, Brisbane River sites were generally more turbid with turbidity levels increasing with water depth.
- Electrical conductivity was only slightly lower at the Brisbane River sites (43 mS/cm) than at sites in Moreton Bay (Figure 3-2). There were only slight changes in electrical conductivity through the water column, but such changes did not indicate stratification (Figure 3-4).
- pH was within the QWQG (DEHP 2009) acceptable range of 8.1 to 8.4 at most sites, except the Outer Bar sites (sites 4, 3, 11) and 1 in the Brisbane River which had pH values of 7.9 to 8.0. pH showed little variability throughout the water column within sites.
- Oxidation-Reduction Potential (ORP) ranged from 136 mV to 203 mV, which is indicative of well mixed and oxygenated waters. The Outer Bar sites had slightly greater oxidation potential compared with other sites, consistent with spatial patterns in pH. pH and redox potential were negatively correlated (r = 0.782, p<0.001; Table 3-1).
- Dissolved oxygen (DO) concentrations were higher in the Brisbane River than other sites (Figure 3-3). These three Brisbane River sites had super-saturated dissolved oxygen concentrations that slightly exceeded the upper QWQG guideline value of 105 % saturation (DEHP 2009). Slight changes in DO concentrations were recorded through the water column, although there was no consistent trend suggesting a decline with increasing depth (Figure 3-5).

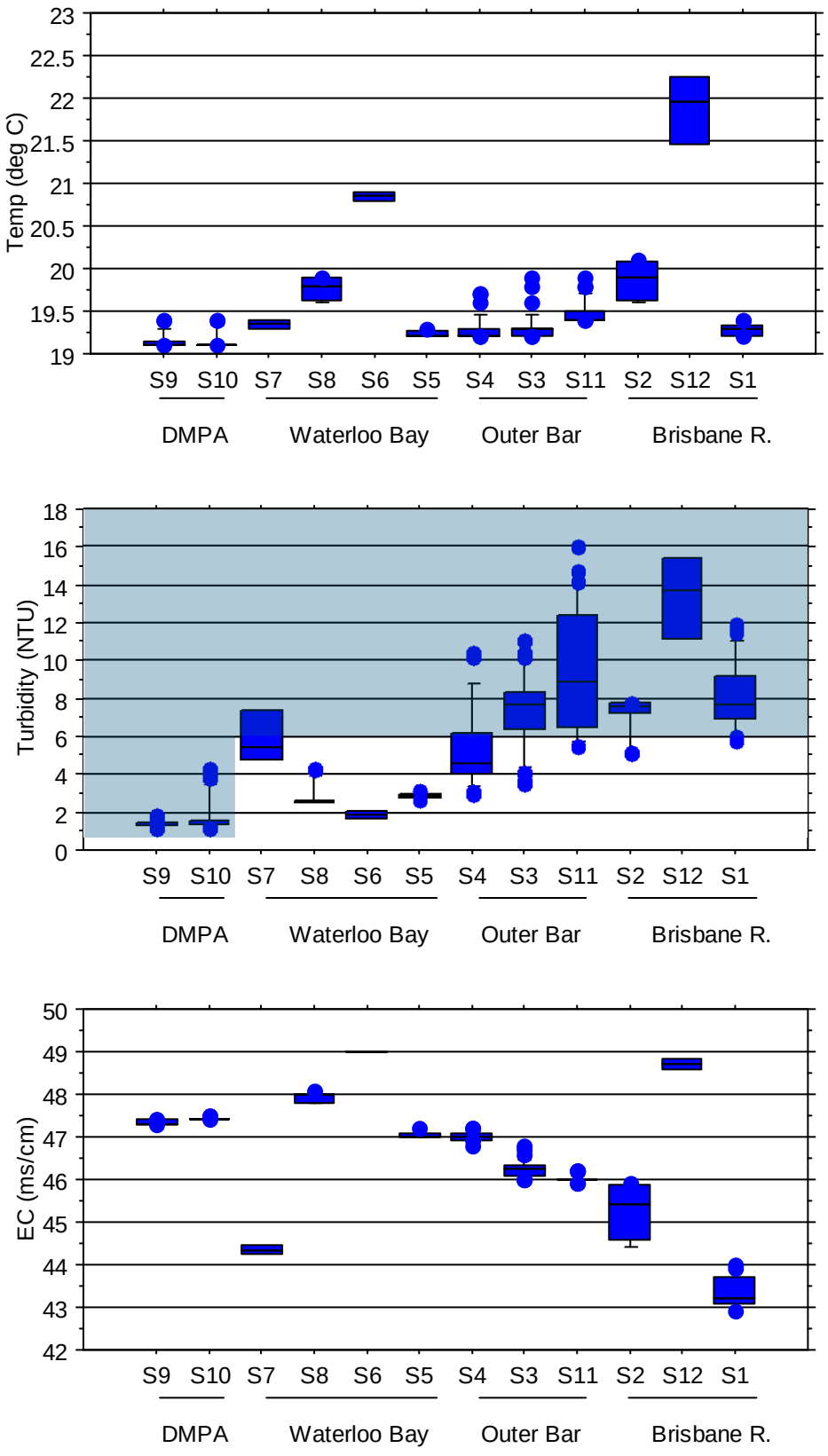


Figure 3-2 Box plot showing differences in water temperature, turbidity and electrical conductivity among sites. Shaded = does not meet QWQG value

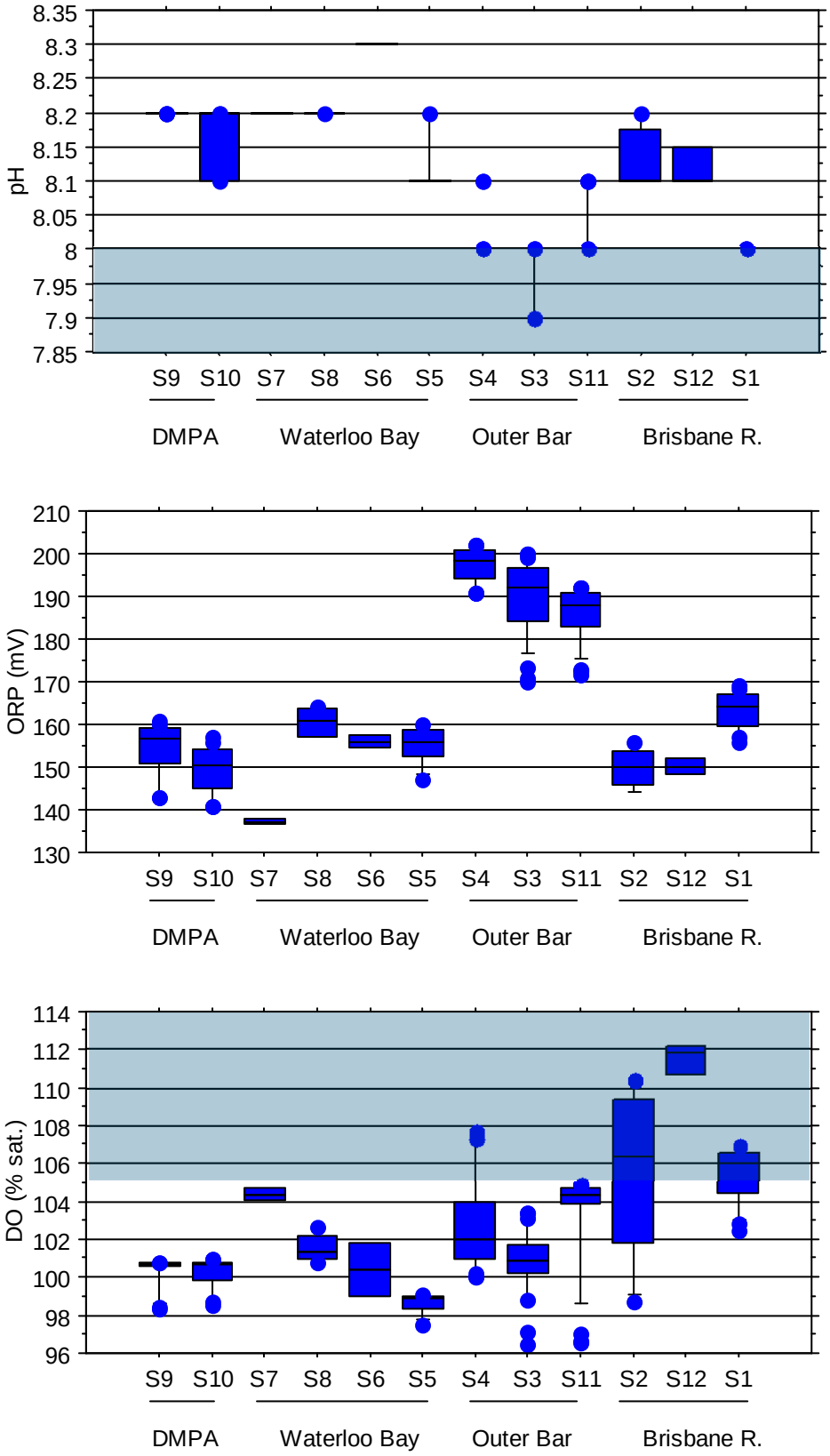


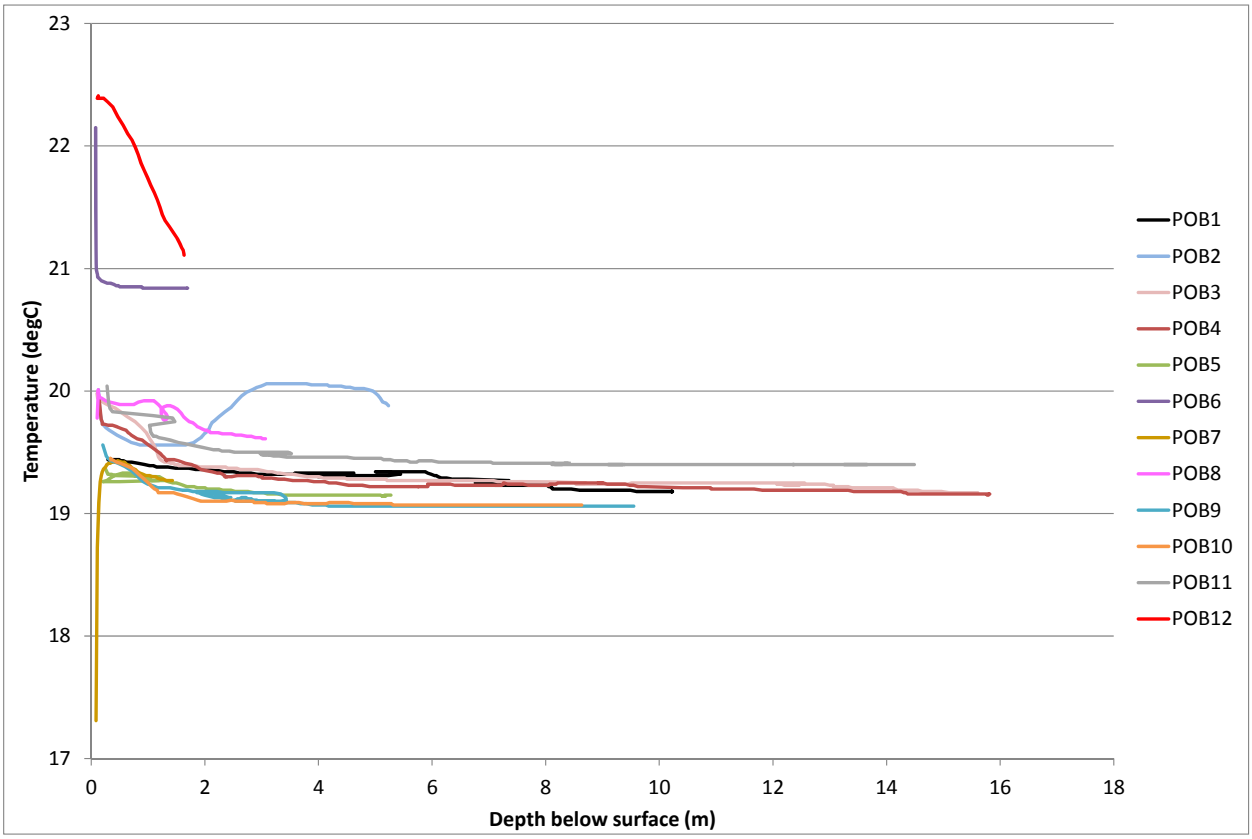
Figure 3-3 Box plot showing differences in pH, oxidation-redox potential and dissolved oxygen among sites. Shaded = does not meet QWQG value

Table 3-1 Pearson Product-Moment correlation coefficients for *in situ* parameters

Correlation Analysis

	Correlation	P-Value	95% Lower	95% Upper
Depth, Temp (deg C)	-.376	<.0001	-.491	-.248
Depth, EC (ms/cm)	-.009	.8963	-.150	.132
Depth, pH	-.534	<.0001	-.628	-.425
Depth, ORP (mV)	.679	<.0001	.595	.748
Depth, Turbidity (NTU)	.511	<.0001	.399	.608
Depth, DO (% sat)	-.009	.9064	-.149	.133
Temp (deg C), EC (ms/cm)	.247	.0005	.110	.375
Temp (deg C), pH	.235	.0009	.098	.364
Temp (deg C), ORP (mV)	-.222	.0018	-.352	-.084
Temp (deg C), Turbidity (NTU)	.245	.0005	.108	.373
Temp (deg C), DO (% sat)	.124	.0860	-.018	.260
EC (ms/cm), pH	.401	<.0001	.276	.513
EC (ms/cm), ORP (mV)	.019	.7974	-.123	.159
EC (ms/cm), Turbidity (NTU)	-.403	<.0001	-.515	-.278
EC (ms/cm), DO (% sat)	-.620	<.0001	-.700	-.525
pH, ORP (mV)	-.782	<.0001	-.831	-.720
pH, Turbidity (NTU)	-.588	<.0001	-.673	-.488
pH, DO (% sat)	-.303	<.0001	-.425	-.169
ORP (mV), Turbidity (NTU)	.447	<.0001	.326	.553
ORP (mV), DO (% sat)	.060	.4078	-.082	.199
Turbidity (NTU), DO (% sat)	.445	<.0001	.325	.552

194 observations were used in this computation.



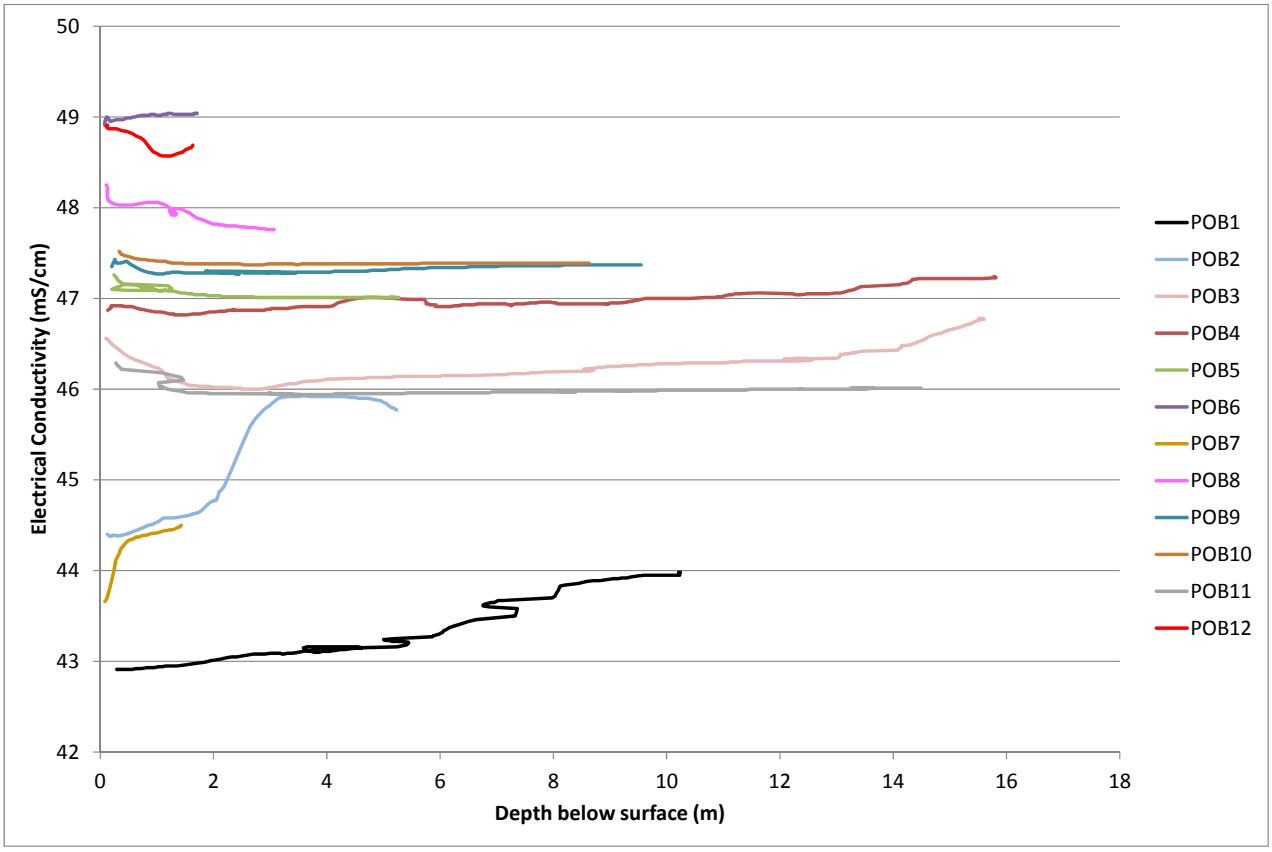
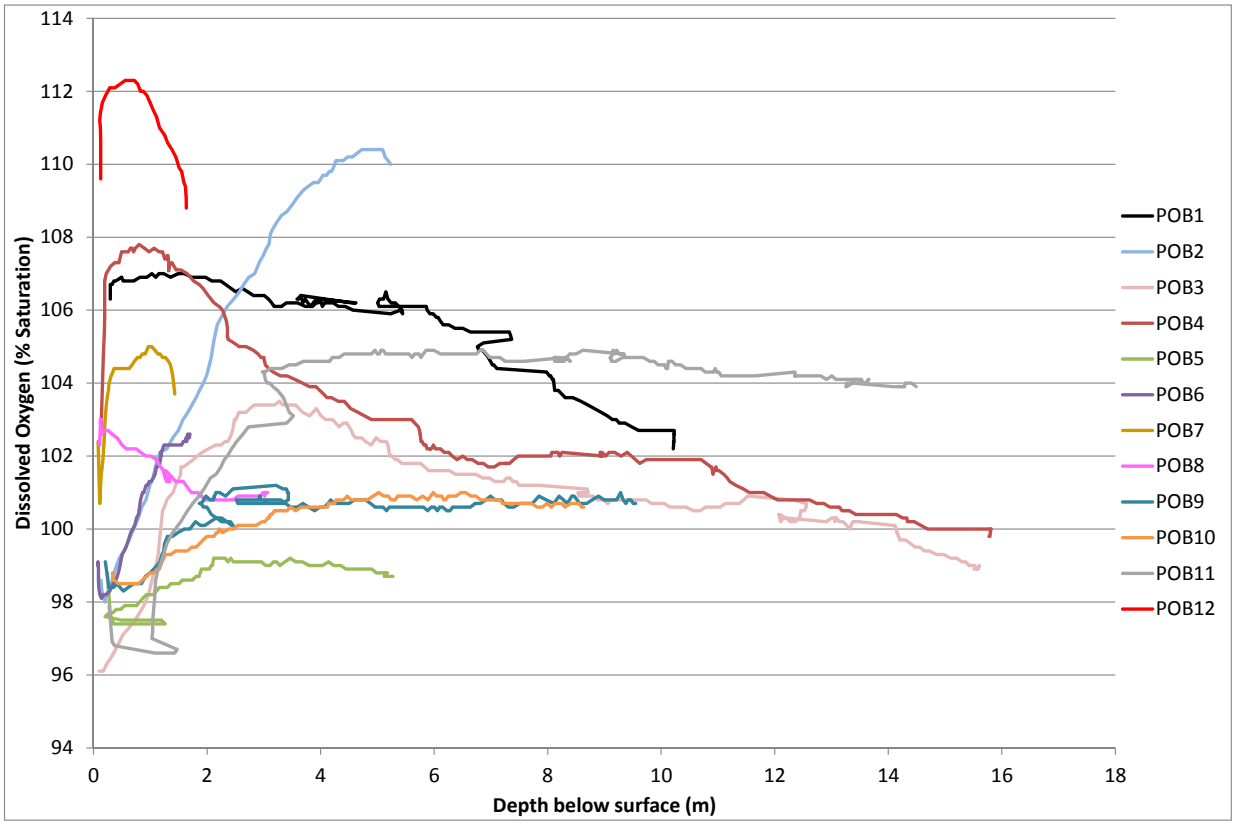


Figure 3-4 Changes in water temperature (°C) and electrical conductivity with depth at each site



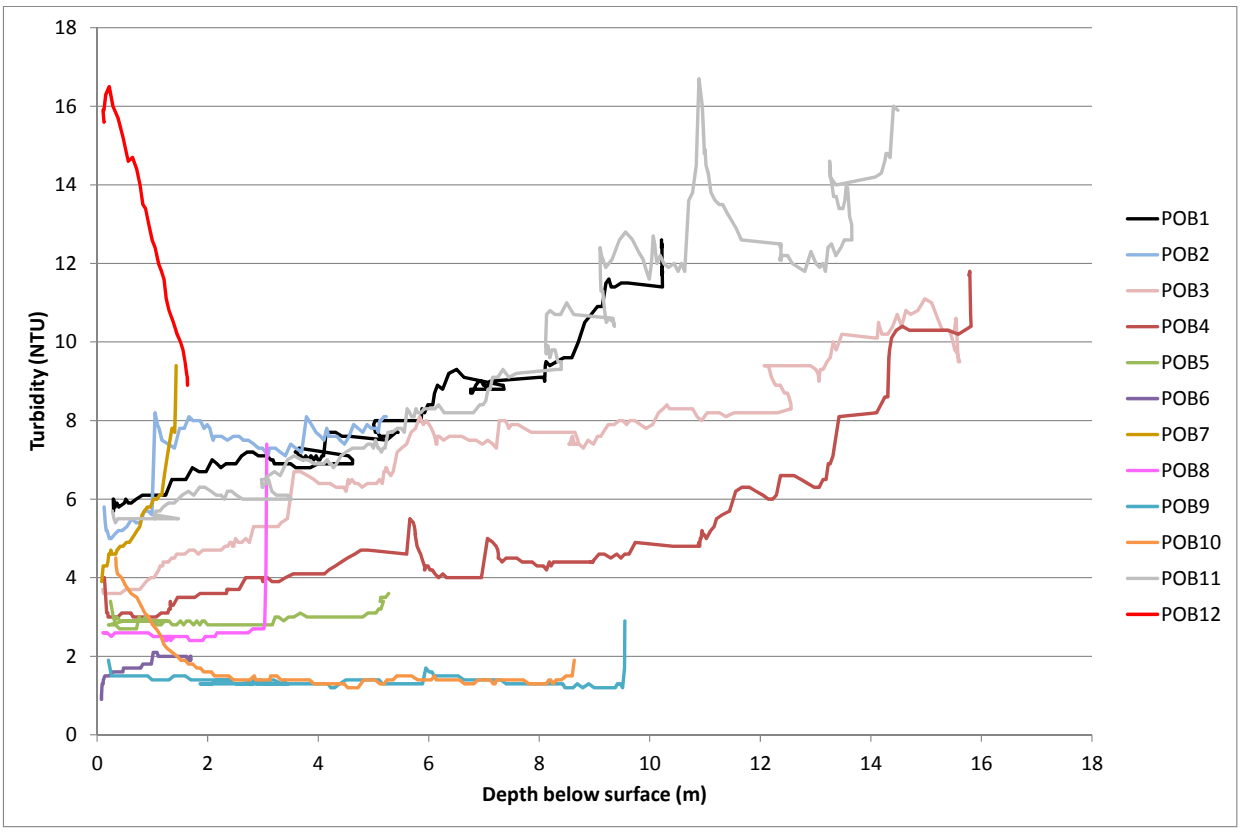


Figure 3-5 Changes in dissolved oxygen (percent saturation) and turbidity (NTU) with depth at each site

3.3 Nutrients

Table 3-2 presents nutrient monitoring results and exceedances of relevant QWGG values.

Table 3-2 Nutrient and total suspended solid concentrations (mg/l) at each site

Location	Site	Total P	Ammonia	Nitrate	Nitrite	Total N	TSS
Enclosed coastal/lower estuary							
QWQG		0.02	0.008	0.003	0.003	0.2	10
Brisbane River	Site 1	0.1	<0.002	0.036	<0.002	0.14	18
	Site 2A	0.09	<0.002	0.017	<0.002	0.09	6
	Site 2B	0.09	<0.002	0.01	<0.002	0.08	4
	Site 12A	0.08	<0.002	0.004	<0.002	0.06	6
	Site 12B	0.1	<0.002	0.009	<0.002	0.08	24
Outer Bar	Site 3A	0.09	<0.002	0.012	<0.002	<0.05	<2
	Site 3B	0.08	<0.002	0.008	<0.002	<0.05	2
	Site 4	0.08	<0.002	0.004	<0.002	<0.05	6
	Site 11	0.11	<0.002	0.015	<0.002	0.06	8
Waterloo Bay	Site 5	0.05	<0.002	<0.002	<0.002	<0.05	2
	Site 6	0.04	<0.002	<0.002	<0.002	<0.05	<2
	Site 7	0.08	<0.002	0.003	<0.002	0.08	3
	Site 8	0.05	<0.002	0.003	<0.002	<0.05	<2
Open Coastal							
QWQG		0.02	0.006	0.003	0.003	0.14	15
MIDMPA	Site 9	0.05	<0.002	<0.002	<0.002	<0.05	<2
	Site 10	0.05	<0.002	<0.002	<0.002	<0.05	<2

Note: Pink cells indicate an exceedance of QWGQ

Based on the Table 3-2 the following trends are noted:

- All sites had total phosphorus (TP) concentrations that exceeded the Queensland Water Quality Guideline value (QWQG 2009) of 0.02 mg/l. Waterloo Bay and MIDMPA sites typically had lower TP concentrations than other sites. The exception to this was site 7 at the mouth of Aquarium Passage, which had a TP concentration that was similar to Brisbane River sites.
- All sites had total nitrogen concentrations that met applicable Queensland Water Quality Guideline values (QWQG 2009). Similar to spatial patterns in TP, Brisbane River sites had greater TN than other sites. The exception to this was site 7 at the mouth of Aquarium Passage, which had a TN concentration that was similar to Brisbane River sites.
- Ammonia concentrations were below the levels of detection (<0.002 mg/l) and met the QWQG guideline value of 0.008 mg/l.
- All sites had concentrations of nitrite that were below the detection limits. Nitrate concentration was the dominant nitrogen oxide present within the study area. No guideline values are

provided for nitrite and nitrate concentrations however the concentration of nitrate was higher than the water quality guidelines specified for NOx (i.e. nitrate + nitrite) at all Brisbane River and Outer Bar sites.

3.4 Metals/Metalloids and other Toxicants

Results for total and dissolved metals and metalloids are presented in Table 3-3 and Table 3-4 respectively. Key trends are as follows:

- Highest metal concentrations were generally recorded at sites 1 and 2 located at the mouth of Brisbane River and sites 12, 7 and 8 located along Boat Passage. Many of these sites also had higher TSS than others sites (Table 3-2).
- Total copper concentrations exceeded the ANZECC guideline value for 95% protection of species at Brisbane River sites 2 and 12, site 7 and 8 in Waterloo Bay (Table 3-3). Dissolved copper concentrations also exceeded the ANZECC guideline value at site 7 and 8 in Waterloo Bay (Table 3-4).
- All other metals generally met relevant ANZECC guideline values. Dissolved zinc at site 7 (0.020 mg/l) was slightly greater than the guideline of 0.015 mg/l, however this value was greater than the total zinc value at this site. The dissolved zinc concentration at this site was therefore considered suspect.
- All other measured parameters (TBT, pesticides, PAHs, BTEX etc.) had concentrations below detection limits and relevant guideline values (Appendix B).

Table 3-3 Total trace metal/metalloids and total suspended solid concentrations (mg/l) at each site

	Site	Al	As	Cd	Cr	Co	Cu**	Pb	Hg	Mn	Ni	Fe	Se	Zn
Guideline		ND	ND	0.0055	0.0044	0.001	0.0013	0.0044	0.0004	ND	0.07	ND	ND	0.015
Brisbane River	Site 1	0.18	0.001	<0.0001	<0.0003	0.0004	-	<0.0001	0.00012	0.02	0.001	0.27	<0.001	0.008
	Site 2A	0.12	0.001	<0.0001	<0.0003	0.0004	0.0011	0.0001	<0.0001	0.02	0.0008	0.16	<0.001	0.004
	Site 2B	0.17	0.001	<0.0001	<0.0003	0.0004	0.002	<0.0001	<0.0001	0.02	0.0008	0.23	<0.001	0.003
	Site 12A	0.22	0.001	<0.0001	<0.0003	0.0004	0.002	0.0002	<0.0001	0.03	0.0008	0.31	<0.001	0.005
	Site 12B	0.52	0.001	<0.0001	0.0006	0.0007	0.002	0.0005	<0.0001	0.06	0.001	0.81	<0.001	0.005
Outer Bar	Site 3A	0.1	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0001	<0.0001	0.01	0.0006	0.13	<0.001	0.005
	Site 3B	0.12	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0001	<0.0001	0.01	0.0006	0.15	<0.001	0.004
	Site 4	0.08	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0001	<0.0001	0.01	0.0006	0.10	<0.001	0.007
	Site 11	0.1	0.001	<0.0001	<0.0003	0.0003	0.001	0.0001	<0.0001	0.02	0.0005	0.13	<0.001	0.003
Waterloo Bay	Site 5	0.05	0.001	<0.0001	<0.0003	0.0001	0.0012	<0.0001	<0.0001	0.007	<0.0004	0.06	<0.001	0.003
	Site 6	0.04	0.001	<0.0001	<0.0003	<0.0001	0.0011	<0.0001	<0.0001	0.007	0.0006	0.06	<0.001	0.010
	Site 7	0.13	0.001	<0.0001	<0.0003	0.0003	0.0041	0.0001	<0.0001	0.02	0.001	0.18	<0.001	0.010
	Site 8	0.06	0.001	<0.0001	<0.0003	0.0002	0.0024	<0.0001	<0.0001	0.01	0.0005	0.08	<0.001	0.005
MIDMPA	Site 9	0.02	0.001	<0.0001	<0.0003	<0.0001	0.0012	<0.0001	<0.0001	0.006	<0.0004	0.03	<0.001	0.004
	Site 10	0.03	0.001	<0.0001	<0.0003	<0.0001	0.0013	<0.0001	<0.0001	0.007	<0.0004	0.03	<0.001	0.005

Note: Pink highlighted cells indicate exceedance of the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/AMRCANZ 2000) guidelines for slightly to moderately disturbed ecosystems at the 95% species protection levels. ND indicates no data available for a guideline value.
** based on sample re-analysis results presented in Appendix C

Table 3-4 Dissolved trace metals/metalloid concentrations (mg/l) at each site

	Site	Al	As	Cd	Cr	Co	Cu**	Pb	Hg	Mn	Ni	Fe	Se	Zn
ANZECC		ND	ND	0.0055	0.0044	0.001	0.0013	0.0044	0.0004	ND	0.07	ND	ND	0.015
Brisbane River	Site 1	0.002	0.001	<0.0001	<0.0003	0.0002	-	<0.0005	<0.0001	0.009	0.0006	<0.0001	<0.001	0.006
	Site 2A	0.002	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0005	<0.0001	0.009	0.0005	<0.0001	<0.001	0.006
	Site 2B	0.003	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0005	<0.0001	0.009	0.0004	<0.0001	<0.001	0.005
	Site 12A	0.003	0.001	<0.0001	<0.0003	0.0002	0.0011	<0.0005	<0.0001	0.02	<0.0004	<0.0001	<0.001	0.005
	Site 12B	0.003	0.001	<0.0001	<0.0003	0.0003	0.0010	<0.0005	<0.0001	0.03	<0.0004	<0.0001	<0.001	0.006
Outer Bar	Site 3A	0.002	0.001	<0.0001	<0.0003	0.0001	0.0011	<0.0005	<0.0001	0.007	<0.0004	<0.0001	<0.001	0.005
	Site 3B	0.002	0.001	<0.0001	<0.0003	0.0002	0.001	<0.0005	<0.0001	0.008	<0.0004	<0.0001	<0.001	0.006
	Site 4	0.002	0.001	<0.0001	<0.0003	0.0001	0.0009	<0.0005	<0.0001	0.006	<0.0004	<0.0001	<0.001	0.005
	Site 11	0.002	0.001	<0.0001	<0.0003	0.0002	0.0008	<0.0005	<0.0001	0.01	<0.0004	<0.0001	<0.001	0.005
Waterloo Bay	Site 5	0.002	0.001	<0.0001	<0.0003	<0.0001	0.0006	<0.0005	<0.0001	0.003	<0.0004	<0.0001	<0.001	0.005
	Site 6	0.002	0.001	<0.0001	<0.0003	<0.0001	0.0006	<0.0005	<0.0001	0.005	<0.0004	<0.0001	<0.001	0.006
	Site 7	0.002	0.001	<0.0001	<0.0003	0.0002	0.0018	<0.0005	<0.0001	0.01	0.0007	<0.0001	<0.001	0.020*
	Site 8	0.003	0.001	<0.0001	<0.0003	0.0002	0.0021	<0.0005	<0.0001	0.008	0.0005	<0.0001	<0.001	0.006
MIDMPA	Site 9	0.003	0.001	<0.0001	<0.0003	<0.0001	0.0004	<0.0005	<0.0001	0.004	<0.0004	<0.0001	<0.001	0.004
	Site 10	0.002	0.001	<0.0001	<0.0003	<0.0001	0.0005	<0.0005	<0.0001	0.004	<0.0004	<0.0001	<0.001	0.005

Note: Pink highlighted cells indicate exceedance of the Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/AMRCANZ 2000) guidelines for slightly to moderately disturbed ecosystems at the 95% species protection levels. ND indicates no data available for a guideline value. *suspect value – greater than total value; ** based on sample re-analysis results presented in Appendix C

3.5 Quality Control Results and Analyses

As discussed in Section 2.4.3, quality control (QC) samples were collected during the August 2013 monitoring event. These QC samples consisted of intra-laboratory and inter-laboratory samples. The duplicate samples were analysed for the same parameters as the primary samples.

3.5.1 Relative Percent Difference (RPD)

To assess whether laboratory results from primary and duplicate samples were within an acceptable range, the relative percent difference (RPD) between samples was determined. RPD was calculated using the following equation:

$$RPD(\%) = \frac{|X_1 - X_2|}{\overline{X}} \times 100$$

where: X1 = primary sample

X2 = duplicate sample

$\overline{X}$ = mean of results

An acceptable RPD varies depending on how close the concentration is to the laboratory limit of reporting (LOR). The closer to the LOR, the more variability is expected between results. Therefore, RPD acceptability was deemed as being:

- 0-100% when concentration is less than 5 times the LOR.
- 0-75% when concentration is 5 to 10 times the LOR.
- 0-50% when concentration is greater than 10 times the LOR.

Results of the RPD analysis on field sub-samples are provided in Table 3-5.

Most primary samples and duplicates were within the acceptable RPD range. The exceptions to this were the samples for site 12 for the metals aluminium, iron and manganese. These were the three most abundant metals, and had highest concentrations at site 12. These metals can show great variation at small spatial scales (i.e. between samples) due to the presence of metal bearing particulate material. It is therefore likely that the differences between sub-samples reflected actual changes in concentrations rather than a laboratory error.

Results of RPD analysis on laboratory sub-samples are provided in Appendix D. All results were within the acceptable range reported above.

Therefore, based on the RPD analysis, the data for the August 2013 monitoring period presented in this report can be considered to be of acceptable quality.

Table 3-5 Relative Percent Difference (Field Duplicates)

Parameter	Site 2	Site 3	Site 12
Total Phosphorus	0.0	11.8	21.1
Nitrate-Nitrogen	51.9	40.0	BDL
Total Nitrogen	11.8	BDL	25.0
Solids (Suspended)	40.0	BDL	75.0
Aluminium Total	34.5	18.2	96.8
Aluminium Dissolved	40.0	0.0	0.0
Arsenic Total	0.0	0.0	0.0
Arsenic Dissolved	0.0	0.0	0.0
Cobalt Dissolved	0.0	66.7	50.0
Cobalt Total	0.0	0.0	66.7
Copper Total	0.0	0.0	0.0
Copper Dissolved	0.0	22.2	33.3
Iron Total	35.9	14.3	106.4
Manganese Dissolved	0.0	13.3	54.1
Manganese Total	0.0	0.0	85.7
Nickel Total	0.0	0.0	25.0
Nickel Dissolved	22.2	BDL	BDL
Lead Total	BDL	BDL	60.0
Zinc Total	28.6	22.2	0.0
Zinc Dissolved	18.2	18.2	18.2

BDL = below detection limit; pink = exceedance of criteria.

3.5.2 Holding Times

Holding times for parameters analysed by the laboratory refers to the recommended timeframe between sampling and analysis. Holding times for all parameters were met during the August 2013 monitoring event.

4 Discussion and Conclusion

4.1 Waterway Health

Study area waterways are under pressure from a range of pollutant types. Several parameters exceeded relevant water quality guideline values, including turbidity, dissolved oxygen, pH, total phosphorus, nitrate and copper. In most cases, guideline exceedances were more commonly observed at Brisbane River sites and to a lesser extent sites in the adjacent Outer Bar, but western Moreton Bay sites also exceeded guideline values for copper, nutrients and turbidity.

These findings are consistent with results of the south-east Queensland Environmental Health Monitoring Program (EHMP). Figure 4-1 shows that the lower Brisbane River estuary (and the adjacent Bramble Bay had consistently poor ecosystem health between 2000 and 2012[1]. The 2012 monitoring episode indicated that Brisbane River estuary had:

- High levels of compliance (100%) in terms of water quality objectives for chlorophyll *a*.
- Low to moderate levels of compliance in terms of water quality objectives for turbidity and dissolved oxygen.
- No, to low levels of, compliance in terms of water quality objectives for total nitrogen and total phosphorus.

These same water quality parameters were observed to exceed guideline levels in the present study, and in past years by EHMP (2013).

Waterloo Bay was found by EHMP (2013) to have excellent aquatic ecosystem condition, with an A+ grade recorded in 2012.

The 2012 monitoring episode indicated that Bramble Bay had:

- 100% compliance of water quality objectives for water clarity (secchi depth), total nitrogen, chlorophyll a and the indicator for the toxic blue green alga *Lyngbya*.
- High levels of compliance for sewage plume mapping.
- Seagrass Depth Range and occurrence of corals remained stable.

Figure 4-1 shows that water quality (and aquatic ecosystem health generally) grades have remained relatively stable since the commencement of the program in 2000. The most notable exception to this was at Waterloo Bay, where grades changed from an A in 2008 to D+ in 2009, a B in 2010 and B+ in 2011. In 2008-2009, the catchments of South East Queensland received significant rainfall, which was the highest rainfall in the last decade. The receiving waters of the estuaries and Moreton Bay took the impact of this diffuse source pollution loading, and showed significant declines in ecosystem health across the area. Interestingly, the EHMP found that major flooding in 2011 did not result in a major decline in aquatic ecosystem health grades at Waterloo Bay, Bramble Bay or Brisbane River estuary in 2012 (Figure 4-1).

[1] 2012 is the most recent publically available sampling episode at the time of reporting

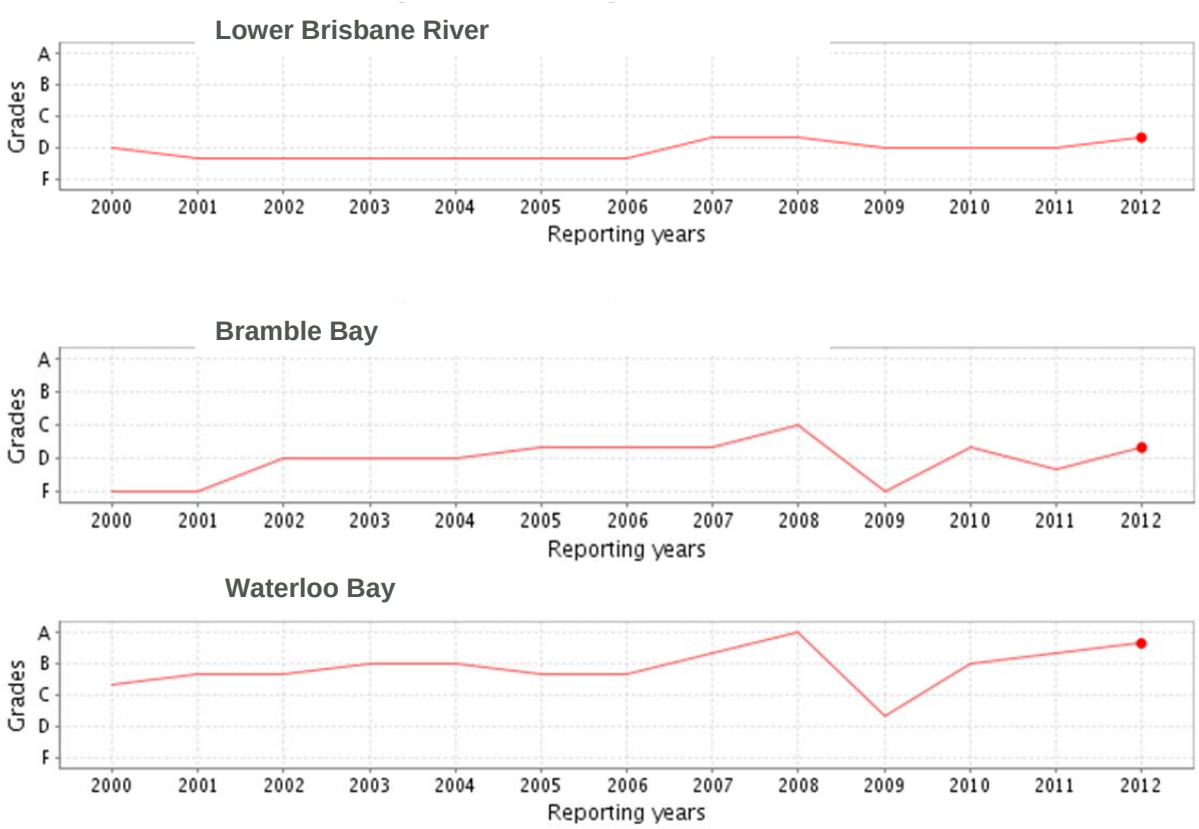


Figure 4-1 Changes in EHMP grades over time (Source: EHMP 2013)

It is important to note that the present study represents a snap-shot of water quality at one time only. Most water quality parameters show great variation over a range of time-scales, changing between different stages of the tidal cycle, daily, seasonally and in response to rainfall patterns. It should also be noted that comparisons to guideline levels and water quality objectives are only valid when appropriate temporally replicated data are collected. Therefore, the results of the present study should be considered as indicative only, and would require further sampling to assess the generality of patterns at other times.

4.2 Key Water Quality Drivers

The results of the present study indicate that there were spatial gradients in the physio-chemical character of waters across the study area. Sites in the Brisbane River were more turbid, and had higher nutrient and in most cases trace metal concentrations than sites in western Moreton Bay. There was also a tendency for some Brisbane River sites to have slightly lower electrical conductivity (salinity), but higher dissolved oxygen concentrations, than sites in western Moreton Bay.

These broad-scale patterns in water quality are a consequence of several physio-chemical and biological processes (Cox 1998a, b). The lower Brisbane River estuary is the receiving waters of fluvial sediments from the wider Brisbane River catchment. Ongoing agricultural practices and land degradation from in the upper and middle Brisbane River catchment, together with urbanisation and a range of activities in the lower Brisbane River, are key sources of sediments and other pollutants in this area (Capelin et al. 1998; Healthy Waterways 2013). Sediments and associated

pollutants are continually resuspended by tidal and to a lesser extent wave processes (Cox 1998b; Brisbane River Committee 1989). Figure 4-2 is a conceptual model of these processes.

Fluvial sediments (and associated contaminants) are flushed into western Moreton Bay by tidal processes. Tidal processes promote flushing and the exchange of riverine waters with cleaner marine waters. Some of this fluvial sediment settles out of suspension, as a result of the higher salinity of marine waters. As observed in the present study, there tends to be a spatial gradient in turbidity from the Brisbane River to the adjacent western Moreton Bay (Cox 1998a). This gradient is even more pronounced travelling further into eastern Moreton Bay (Dennison and Abal 1998).

Tidal processes also promote mixing through the water column, as evidenced by the lack of strong stratification in the present study. The present survey was undertaken during the dry season, and therefore was not greatly affected by fluvial flows. During wetter periods, more buoyant layers of freshwater can sit over denser saline waters, resulting in stratification of the estuary (Cox 1998b).

4.3 Potential Contaminants and Other Pollutant Sources

In addition to the above mentioned broad-scale processes and pollutant sources, there are several known pollutant sources within the study area. Two Wastewater Treatment Plants (WWTP), Luggage Point and Gibson Island, are located at and adjacent to the study area in the lower Brisbane River estuary. These WWTPs, particularly Luggage Point WWTP, are a key external source of nutrients (particularly nitrogen) in the lower Brisbane River area. Both WWTPs have been upgraded to advanced waste water treatment plants (operational in 2008-09), which has greatly improved the capacity to remove nutrients from discharges. However, since the upgrades there have been several flood events, which have tended to mask some of the improvements in water quality resulting from WWTP upgrades (Healthy Waterways 2009).

Several potential contaminants have been previously recorded in the study area. For example, sediment quality sampling carried out by the PBPL detected elevated levels of several metals/metalloids (cadmium, copper, lead, zinc), TBT and organochlorine pesticides, with generally greater concentrations in the upstream sectors of the lower estuary. However, following the 2011 floods, concentrations of many of the contaminants declined within surficial sediments of the port area (BMT WBM 2013). Dieldrin, DDE and PAHs have also been recorded at levels of concern in the study area (Healthy Waterways 2013).

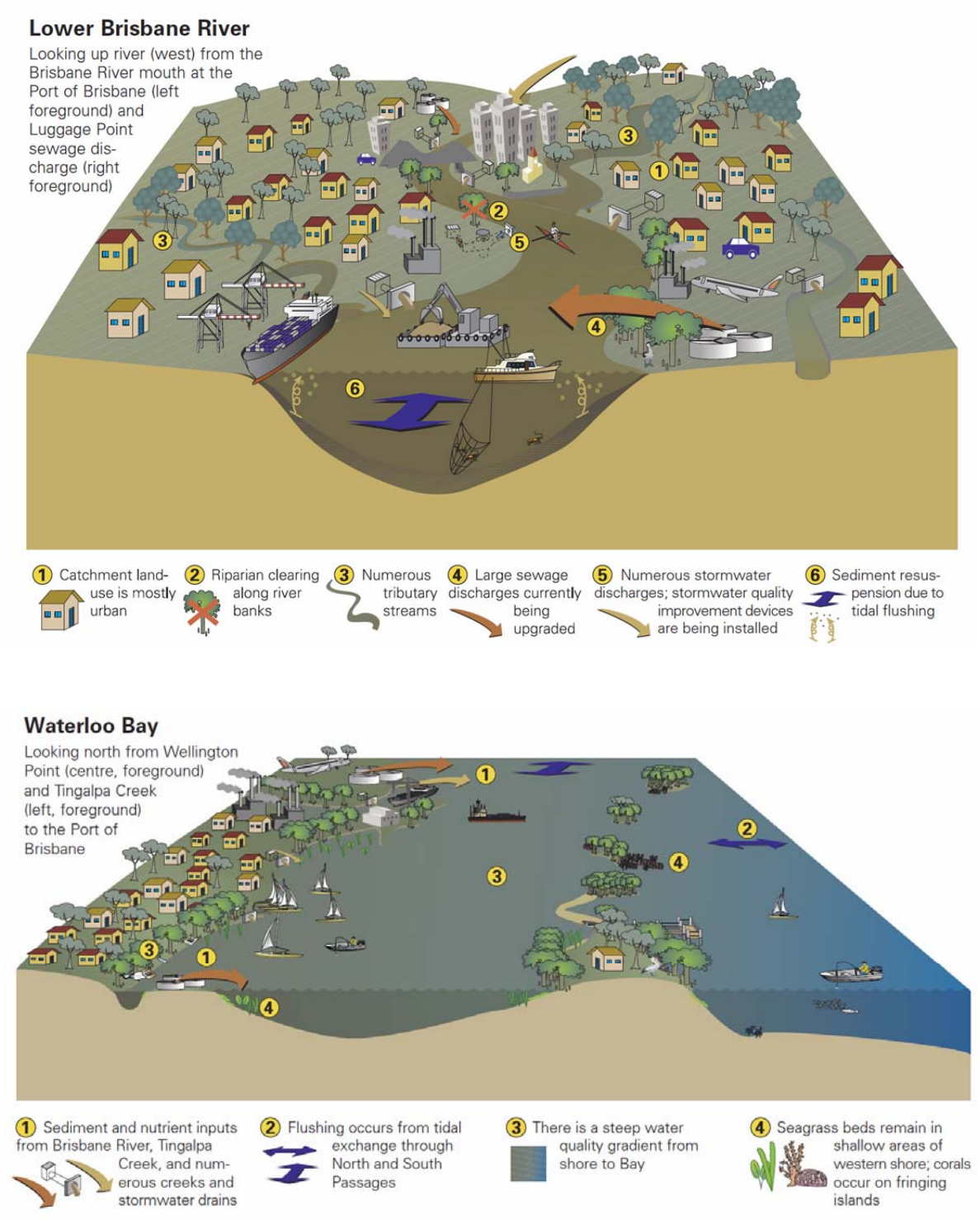


Figure 4-2 Conceptual model illustrating key water quality processes operating in the lower Brisbane River and Waterloo Bay (Source: Healthy Waterways 2013)

The only toxicants detected in the present study were a variety of metals and metalloids. Copper was the only metal that had concentrations that exceeded the ANZECC water quality guideline values for the 95% protection of species. Copper is commonly found in runoff from urbanised catchments, and can be toxic to marine life. In the present study it was found to be mostly in a sediment-bound form, which may not be as bio-available or bio-accessible as dissolved fractions.

However, two sites had dissolved copper concentrations of approximately 0.002 mg/l, which exceeded the ANZECC water quality guideline value of 0.0013 mg/l: site 7 (Outer Bar) and site 8 (Waterloo Bay).

The cause of the elevated copper concentration is not known. Although it is a known contaminant of concern in Brisbane River sediments (BMT WBM 2013), previous water quality monitoring studies have not recorded copper at such high levels within the study area. Laboratory QA/QC documentation does not suggest that laboratory errors were the cause of elevated copper, and re-analysis of water samples by the laboratory produced similar results (see Appendix C). While appropriate sample handling and storage procedures were followed, it is possible that the elevated copper concentrations were due to sampling error. The copper results should at this stage be considered to be suspect.

4.4 Conclusions

The present study demonstrated that there is great spatial variation in water quality within and adjacent to the port area. Consistent with the broader EHMP, the lower Brisbane River estuary was found to have generally poor water quality, with turbidity, dissolved oxygen, pH, total phosphorus, nitrate and copper all exceeding recent water quality guideline values. Sites in Waterloo Bay tended to have better water quality, although some exceedances of guideline values were noted. Further sampling would be required to assess the generality of these patterns over time.

5 References

ANZECC/ARMCANZ. (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Vol. 4). Canberra: Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand.

BMT WBM (2013) Port of Brisbane Maintenance Dredging - Sediment Sampling and Analysis Plan 2013.

Brisbane River Committee (1989). Turbidity in the Brisbane River - Causes and Management Strategies.

Capelin, M., Kohn, P., & Hoffenberg, P. (1998). Land Use, Land Cover and Land Degradation in the Catchment of Moreton Bay. In I. R. Tibbetts, N. J. Hall & W. C. Dennison (Eds.), Moreton Bay and Catchment (pp. 55-66). Brisbane: School of Marine Science, University of Queensland.

Cox, M.E. (1998a). Chemical and Turbidity Character of the Tidal Brisbane River, Moreton Bay. In I. R. Tibbetts, N. J. Hall & W. C. Dennison (Eds.), Moreton Bay and Catchment (pp. 175-184). Brisbane: School of Marine Science, University of Queensland.

Cox, M.E. (1998b). Distribution of Salinity and Other Physico-Chemical Parameters in the Brisbane River Estuary, Moreton Bay. In I. R. Tibbetts, N. J. Hall & W. C. Dennison (Eds.), Moreton Bay and Catchment (pp. 185-202). Brisbane: School of Marine Science, University of Queensland.

Dennison, W.C., Abal, E.G. (1999). Moreton Bay Study. A scientific basis for the healthy waterways campaign. Brisbane: South-East Queensland Regional Water Quality Management Strategy.

Department of Environment and Resource Management. (2010). Queensland Water Quality Guidelines, Version 3. (3 ed., pp. 175). Brisbane: Queensland Department of Environment and Resource Management.

EHMP (2006). EHMP 2005-2006 Annual Technical Report (pp. 156). Brisbane: South East Queensland Healthy Waterways Partnership.

EHMP (2013). EHMP 2013 Report Card. Brisbane: South East Queensland Healthy Waterways Partnership.
http://www.healthywaterways.org/EcosystemHealthMonitoringProgram/2010ReportCardResults/CatchmentResults.aspx

Healthy Waterways (2013) http://www.healthywaterways.org/ScienceandInnovation/ConceptualDiagrams.aspx . Accessed 28/10/213.

Queensland Department of Environment and Heritage (2013). Monitoring and Sampling Manual 2009. Environmental Protection (Water) Policy 2009. Version 2 September 2010 (July 2013 format edits) (pp. 193). Brisbane: Queensland DEHP.

Appendix A In-situ Measurement Data

Site	Depth (m)	Temp °C	Cond mS/cm	pH	ORP mV	Turbidity+ NTU	DO % SAT	DO mg/L
Site 7	0.3	19.4	44.2	8.2	137.0	4.6	104.3	7.9
	0.5	19.4	44.3	8.2	136.0	4.9	104.4	7.9
	1.0	19.3	44.4	8.2	137.0	6.0	105.0	8.0
	1.5	19.3	44.5	8.2	139.0	8.9	103.8	7.9
	Average	*19.4*	*44.4*	*8.2*	*137.3*	*6.1*	*104.4*	*7.9*
Site 8	0.3	19.9	48.0	8.2	157.0	2.6	102.7	7.6
	0.5	19.9	48.0	8.2	157.0	2.6	102.3	7.6
	1.0	19.9	48.1	8.2	158.0	2.6	102.0	7.5
	1.5	19.8	48.0	8.2	161.0	2.5	101.3	7.5
	2.0	19.7	47.8	8.2	162.4	2.5	100.8	7.5
	2.5	19.6	47.8	8.2	164.0	2.6	100.9	7.5
	3.0	19.6	47.8	8.2	164.0	4.3	101.0	7.5
	Average	*19.8*	*47.9*	*8.2*	*160.5*	*2.8*	*101.5*	*7.5*
Site 6	0.3	20.9	49.0	8.3	154.0	1.6	98.6	7.2
	0.5	20.9	49.0	8.3	155.0	1.7	99.4	7.2
	1.0	20.8	49.0	8.3	157.0	2.1	101.4	7.4
	1.5	20.8	49.0	8.3	158.3	2.0	102.3	7.4
	Average	*20.9*	*49.0*	*8.3*	*156.1*	*1.9*	*100.4*	*7.3*
Site 5	0.3	19.3	47.2	8.2	147.0	3.0	97.5	7.3
	0.5	19.3	47.2	8.2	149.5	2.7	97.9	7.3
	1.0	19.3	47.1	8.1	152.0	2.8	98.3	7.4
	1.5	19.2	47.1	8.1	153.5	2.9	98.6	7.4
	2.0	19.2	47.0	8.1	155.0	2.8	99.0	7.4
	2.5	19.2	47.0	8.1	156.0	2.8	99.1	7.4
	3.0	19.2	47.0	8.1	157.0	2.8	99.0	7.4
	3.5	19.2	47.0	8.1	158.0	3.0	99.1	7.5
	4.0	19.2	47.0	8.1	159.0	3.0	99.0	7.4
	4.5	19.2	47.0	8.1	159.0	3.0	98.9	7.4
	5.0	19.2	47.0	8.1	160.0	3.2	98.8	7.4
	Average	*19.2*	*47.1*	*8.1*	*155.1*	*2.9*	*98.6*	*7.4*
Site 9	0.3	19.4	47.4	8.2	143.0	1.5	98.4	7.4
	0.5	19.4	47.4	8.2	143.0	1.5	98.3	7.4
	1.0	19.2	47.3	8.2	144.0	1.4	98.9	7.4

Site	Depth	Temp	Cond	pH	ORP	Turbidity+	DO	DO
	1.5	19.2	47.3	8.2	146.0	1.5	100.0	7.5
	2.0	19.2	47.3	8.2	149.7	1.3	100.8	7.6
	2.5	19.1	47.3	8.2	152.0	1.3	100.8	7.6
	3.0	19.1	47.3	8.2	154.3	1.3	100.8	7.6
	3.5	19.1	47.3	8.2	155.0	1.3	100.6	7.6
	4.0	19.1	47.3	8.2	156.0	1.3	100.6	7.6
	4.5	19.1	47.3	8.2	156.0	1.4	100.7	7.6
	5.0	19.1	47.3	8.2	157.0	1.4	100.6	7.6
	5.5	19.1	47.3	8.2	157.0	1.3	100.6	7.6
	6.0	19.1	47.3	8.2	158.0	1.6	100.6	7.6
	6.5	19.1	47.4	8.2	158.0	1.5	100.6	7.6
	7.0	19.1	47.4	8.2	159.0	1.4	100.8	7.6
	7.5	19.1	47.4	8.2	159.0	1.3	100.7	7.6
	8.0	19.1	47.4	8.2	159.5	1.3	100.8	7.6
	8.5	19.1	47.4	8.2	160.0	1.2	100.8	7.6
	9.0	19.1	47.4	8.2	160.0	1.2	100.8	7.6
	9.5	19.1	47.4	8.2	161.0	1.9	100.7	7.6
	Average	*19.1*	*47.3*	*8.2*	*154.4*	*1.4*	*100.3*	*7.5*
Site 10	0.3	19.4	47.5	8.2	141.0	4.3	98.7	7.4
	0.5	19.4	47.5	8.2	141.0	3.8	98.5	7.4
	1.0	19.2	47.4	8.2	141.5	2.8	98.8	7.4
	1.5	19.2	47.4	8.2	143.0	1.9	99.4	7.5
	2.0	19.1	47.4	8.2	145.0	1.6	99.8	7.5
	2.5	19.1	47.4	8.2	146.0	1.4	100.1	7.5
	3.0	19.1	47.4	8.2	147.0	1.4	100.3	7.5
	3.5	19.1	47.4	8.2	149.0	1.4	100.5	7.6
	4.0	19.1	47.4	8.2	150.0	1.3	100.6	7.6
	4.5	19.1	47.4	8.2	151.0	1.2	100.8	7.6
	5.0	19.1	47.4	8.2	151.0	1.4	101.0	7.6
	5.5	19.1	47.4	8.2	152.0	1.5	100.9	7.6
	6.0	19.1	47.4	8.2	153.0	1.4	101.0	7.6
	6.5	19.1	47.4	8.1	154.0	1.4	101.0	7.6
	7.0	19.1	47.4	8.1	155.0	1.4	100.8	7.6
	7.5	19.1	47.4	8.1	155.0	1.4	100.7	7.6
	8.0	19.1	47.4	8.1	156.0	1.3	100.7	7.6
	8.5	19.1	47.4	8.1	157.0	1.5	100.7	7.6

Site	Depth	Temp	Cond	pH	ORP	Turbidity+	DO	DO
	Average	*19.1*	*47.4*	*8.2*	*149.3*	*1.8*	*100.2*	*7.5*
Site 4	0.3	19.7	46.9	8.1	191.0	3.0	107.3	8.0
	0.5	19.7	46.9	8.1	191.0	3.1	107.6	8.0
	1.0	19.6	46.9	8.0	191.0	3.0	107.7	8.1
	1.5	19.4	46.8	8.0	191.5	3.5	107.1	8.0
	2.0	19.4	46.9	8.0	192.0	3.6	106.5	8.0
	2.5	19.3	46.9	8.0	193.0	3.7	105.1	7.9
	3.0	19.3	46.9	8.0	193.3	4.0	104.6	7.9
	3.5	19.3	46.9	8.0	194.0	4.1	104.1	7.8
	4.0	19.3	46.9	8.0	194.0	4.1	103.8	7.8
	4.5	19.2	47.0	8.0	195.0	4.5	103.3	7.8
	5.0	19.2	47.0	8.0	195.0	4.7	103.0	7.7
	5.5	19.2	47.0	8.0	195.0	4.6	103.0	7.7
	6.0	19.2	46.9	8.0	197.0	4.2	102.2	7.7
	6.5	19.2	46.9	8.0	197.0	4.0	102.0	7.7
	7.0	19.2	46.9	8.0	197.0	4.5	101.7	7.6
	7.5	19.2	46.9	8.0	198.0	4.5	102.0	7.7
	8.0	19.2	46.9	8.0	199.0	4.3	102.0	7.7
	8.5	19.3	46.9	8.0	199.0	4.4	102.1	7.7
	9.0	19.2	47.0	8.0	199.0	4.6	102.1	7.7
	9.5	19.2	47.0	8.0	200.0	4.6	101.9	7.7
	10.0	19.2	47.0	8.0	200.0	4.9	101.9	7.7
	10.5	19.2	47.0	8.0	200.0	4.8	101.9	7.7
	11.0	19.2	47.0	8.0	200.0	5.1	101.6	7.6
	11.5	19.2	47.1	8.0	201.0	6.2	101.0	7.6
	12.0	19.2	47.1	8.0	201.0	6.2	100.9	7.6
	12.5	19.2	47.1	8.0	201.0	6.6	100.8	7.6
	13.0	19.2	47.1	8.0	202.0	6.3	100.6	7.6
	13.5	19.2	47.1	8.0	202.0	8.1	100.4	7.5
	14.0	19.2	47.2	8.0	202.0	8.2	100.4	7.5
	14.5	19.2	47.2	8.0	202.0	10.4	100.2	7.5
	15.0	19.2	47.2	8.0	202.0	10.3	100.0	7.5
	15.5	19.2	47.2	8.0	202.0	10.2	100.0	7.5
	Average	*19.3*	*47.0*	*8.0*	*197.4*	*5.3*	*102.8*	*7.7*
Site 3	0.3	19.9	46.4	8.0	170.0	3.6	96.5	7.2
	0.5	19.8	46.4	8.0	171.0	3.7	97.1	7.3

Site	Depth	Temp	Cond	pH	ORP	Turbidity+	DO	DO
	1.0	19.6	46.2	8.0	173.5	4.1	98.8	7.4
	1.5	19.4	46.1	8.0	178.0	4.6	101.5	7.6
	2.0	19.4	46.0	7.9	179.0	4.7	102.2	7.7
	2.5	19.4	46.0	7.9	181.5	5.0	103.1	7.8
	3.0	19.3	46.0	7.9	182.5	5.3	103.4	7.8
	3.5	19.3	46.1	7.9	184.0	6.7	103.4	7.8
	4.0	19.3	46.1	7.9	184.0	6.4	103.1	7.8
	4.5	19.3	46.1	7.9	185.3	6.4	102.7	7.7
	5.0	19.3	46.1	7.9	187.0	6.4	102.5	7.7
	5.5	19.3	46.1	7.9	188.0	7.3	101.8	7.7
	6.0	19.3	46.1	7.9	189.3	7.8	101.6	7.7
	6.5	19.3	46.2	7.9	191.0	7.6	101.5	7.7
	7.0	19.3	46.2	7.9	191.0	7.5	101.4	7.6
	7.5	19.3	46.2	7.9	192.0	7.9	101.2	7.6
	8.0	19.3	46.2	7.9	192.0	7.7	101.2	7.6
	8.5	19.2	46.2	7.9	193.0	7.4	101.0	7.6
	9.0	19.2	46.3	7.9	194.0	7.5	100.8	7.6
	9.5	19.3	46.3	7.9	195.0	8.0	100.8	7.6
	10.0	19.3	46.3	7.9	195.0	7.9	100.7	7.6
	10.5	19.3	46.3	7.9	196.0	8.3	100.5	7.6
	11.0	19.3	46.3	7.9	196.0	8.1	100.6	7.6
	11.5	19.3	46.3	7.9	196.0	8.2	100.9	7.6
	12.0	19.2	46.3	7.9	198.0	9.4	100.4	7.6
	12.5	19.2	46.3	7.9	197.0	8.4	100.6	7.6
	13.0	19.2	46.4	7.9	198.0	9.1	100.3	7.6
	13.5	19.2	46.4	7.9	199.0	10.2	100.2	7.6
	14.0	19.2	46.4	7.9	199.0	10.1	100.1	7.5
	14.5	19.2	46.6	7.9	199.0	10.4	99.5	7.5
	15.0	19.2	46.7	7.9	200.0	11.1	99.3	7.5
	15.5	19.2	46.8	7.9	200.0	10.1	98.9	7.4
	Average	*19.3*	*46.3*	*7.9*	*189.8*	*7.4*	*100.8*	*7.6*
Site 11	0.3	19.9	46.2	8.0	171.7	5.5	97.0	7.3
	0.5	19.8	46.2	8.1	172.5	5.5	96.7	7.2
	1.0	19.8	46.2	8.1	173.0	5.5	96.6	7.2
	1.5	19.6	46.0	8.1	178.0	6.1	100.2	7.5
	2.0	19.5	46.0	8.1	179.0	6.2	101.4	7.6

Site	Depth	Temp	Cond	pH	ORP	Turbidity+	DO	DO
	2.5	19.5	46.0	8.1	180.0	6.1	102.4	7.7
	3.0	19.5	46.0	8.1	183.0	6.5	104.3	7.8
	3.5	19.5	45.9	8.1	181.0	6.0	103.1	7.8
	4.0	19.5	45.9	8.0	184.0	6.9	104.6	7.9
	4.5	19.5	46.0	8.0	185.0	7.2	104.8	7.9
	5.0	19.5	46.0	8.0	186.0	7.4	104.9	7.9
	5.5	19.4	46.0	8.0	186.5	7.8	104.8	7.9
	6.0	19.4	46.0	8.0	187.0	8.3	104.9	7.9
	6.5	19.4	46.0	8.0	187.0	8.2	104.8	7.9
	7.0	19.4	46.0	8.0	188.0	8.7	104.7	7.9
	7.5	19.4	46.0	8.0	188.0	9.2	104.6	7.9
	8.0	19.4	46.0	8.0	189.0	9.8	104.6	7.9
	8.5	19.4	46.0	8.0	189.0	10.9	104.9	7.9
	9.0	19.4	46.0	8.0	190.0	12.4	104.7	7.9
	9.5	19.4	46.0	8.0	190.0	12.8	104.7	7.9
	10.0	19.4	46.0	8.0	190.0	12.2	104.5	7.9
	10.5	19.4	46.0	8.0	190.5	11.9	104.4	7.9
	11.0	19.4	46.0	8.0	191.0	14.7	104.3	7.9
	11.5	19.4	46.0	8.0	191.0	12.9	104.2	7.8
	12.0	19.4	46.0	8.0	191.0	12.6	104.3	7.8
	12.5	19.4	46.0	8.0	191.0	12.0	104.2	7.8
	13.0	19.4	46.0	8.0	191.0	12.0	104.2	7.8
	13.5	19.4	46.0	8.0	192.0	14.0	104.0	7.8
	14.0	19.4	46.0	8.0	192.0	14.2	103.9	7.8
	14.5	19.4	46.0	8.0	192.0	16.0	104.0	7.8
	Average	*19.5*	*46.0*	*8.0*	*186.0*	*9.6*	*103.3*	*7.8*
Site 12	0.3	22.3	48.9	8.2	148.0	15.9	112.1	8.0
	0.5	22.2	48.8	8.1	149.0	14.9	112.3	8.0
	1.0	21.7	48.6	8.1	151.0	12.5	111.6	8.0
	1.5	21.2	48.6	8.1	153.0	9.9	109.9	8.0
	Average	*21.9*	*48.7*	*8.1*	*150.3*	*13.3*	*111.5*	*8.0*
Site 1	0.3	19.4	42.9	8.0	156.0	5.8	106.8	8.2
	0.5	19.4	42.9	8.0	157.0	6.0	106.8	8.2
	1.0	19.4	42.9	8.0	158.0	6.1	107.0	8.2
	1.5	19.4	43.0	8.0	158.0	6.5	107.0	8.2
	2.0	19.4	43.0	8.0	159.0	6.9	106.9	8.2

In-situ Measurement Data

Site	Depth	Temp	Cond	pH	ORP	Turbidity+	DO	DO
	2.5	19.3	43.1	8.0	160.0	6.9	106.5	8.1
	3.0	19.3	43.1	8.0	160.0	7.1	106.4	8.1
	3.5	19.3	43.1	8.0	161.0	6.9	106.2	8.1
	4.0	19.3	43.1	8.0	162.0	6.9	106.3	8.1
	4.5	19.3	43.2	8.0	164.0	7.6	106.0	8.1
	5.0	19.3	43.2	8.0	164.3	7.8	106.3	8.1
	5.5	19.3	43.2	8.0	164.0	7.7	106.0	8.1
	6.0	19.3	43.3	8.0	165.0	8.4	105.8	8.1
	6.5	19.3	43.4	8.0	166.0	9.3	105.5	8.1
	7.0	19.2	43.7	8.0	167.0	8.9	104.5	8.0
	7.5	19.3	43.5	8.0	166.0	8.9	105.4	8.0
	8.0	19.2	43.8	8.0	167.0	9.1	104.2	7.9
	8.5	19.2	43.9	8.0	168.0	9.6	103.5	7.9
	9.0	19.2	43.9	8.0	168.0	10.8	103.2	7.9
	9.5	19.2	43.9	8.0	168.5	11.5	102.8	7.8
	10.0	19.2	44.0	8.0	169.0	11.9	102.5	7.8
	Average	*19.3*	*43.3*	*8.0*	*163.2*	*8.1*	*105.5*	*8.1*
Site 2	0.3	19.7	44.4	8.2	144.0	5.2	98.7	7.5
	0.5	19.6	44.4	8.2	144.0	5.3	99.4	7.5
	1.0	19.6	44.6	8.2	145.3	7.2	101.4	7.7
	1.5	19.6	44.6	8.1	147.0	7.8	102.9	7.8
	2.0	19.7	44.8	8.1	148.3	7.8	104.5	7.9
	2.5	19.9	45.4	8.1	150.0	7.6	106.4	8.0
	3.0	20.1	45.8	8.1	151.7	7.2	107.7	8.0
	3.5	20.1	45.9	8.1	153.0	7.4	109.0	8.1
	4.0	20.1	45.9	8.1	154.0	7.7	109.6	8.2
	4.5	20.0	45.9	8.1	155.0	7.6	110.2	8.2
	5.0	20.0	45.8	8.1	156.0	7.8	110.4	8.3
	Average	*19.8*	*45.2*	*8.1*	*149.8*	*7.1*	*105.5*	*7.9*

Appendix B Laboratory Results Data

CERTIFICATE NO.: 248739 **REVISION NO.:** 00
ISSUE DATE: 6/09/13 This certificate supersedes any previous revisions

CLIENT DETAILS: Markus Billerbeck
BMT WBM Pty Ltd
Level 8
200 Creek Street
Brisbane QLD 4000

CLIENT REF:
DATE RECEIVED: 20/08/2013
DATE SAMPLED: 19/08/2013
TEST DATE: Sample tested between date received and reported.

CONDITIONS OF SAMPLE: Receipt Temperature: Chilled (0 ~ 5 °C)
Storage Temperature: Refrigerated

RESULTS OF ANALYSIS:

Sample Description Time Sampled Test	Code	Unit	248739-1 Site 1 Brisbane R 1400hr	248739-2 Site 2A Brisbane R 1500hr	248739-3 Site 2B Brisbane R 1500hr	248739-4 Site 3A Brisbane R 1220
Total Phosphorus	EFF029.1	mg/L	0.10	0.09	0.09	0.09
Ammonia-Nitrogen	EFF044	mg/L	<0.002	<0.002	<0.002	<0.002
Nitrate-Nitrogen	EFF004.1	mg/L	0.036	0.017	0.010	0.012
Nitrite-Nitrogen	EFF005.1	mg/L	<0.002	<0.002	<0.002	<0.002
Total Nitrogen	EFF029.1	mg/L	0.14	0.09	0.08	<0.05
Solids (Suspended)	EFF009	mg/L	18	6	4	<2
Tributyltin	EFF235	ng/L	<2.00	<2.00	<2.00	<2.00
Aldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
a-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
b-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
d-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Lindane (gamma-BHC)	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDD p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDE p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDT p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dicofol	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-alpha	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-beta	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-sulphate	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
HCB	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Benzene	ENV105	µg/L	<1	<1	<1	<1
Ethylbenzene	ENV105	µg/L	<1	<1	<1	<1

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-1 Site 1 Brisbane R 1400hr	248739-2 Site 2A Brisbane R 1500hr	248739-3 Site 2B Brisbane R 1500hr	248739-4 Site 3A Brisbane R 1220
Toluene	ENV105	µg/L	<1	<1	<1	<1
ortho-Xylenes	ENV105	µg/L	<2	<2	<2	<2
meta- & para-Xylenes	ENV105	µg/L	<2	<2	<2	<2
Surrogate 1,2-dichlorobenzene-d4	ENV105	%	106.0	101.0	110.0	106.0
Surrogate Chlorobenzene-d5	ENV105	%	97.0	89.0	104.0	92.0
Surrogate Fluorobenzene	ENV105	%	114.0	103.0	113.0	103.0
Naphthalene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthylene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthene	ENV103	µg/L	<1	<1	<1	<1
Fluorene	ENV103	µg/L	<1	<1	<1	<1
Phenanthrene	ENV103	µg/L	<1	<1	<1	<1
Anthracene	ENV103	µg/L	<1	<1	<1	<1
Fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Pyrene	ENV103	µg/L	<1	<1	<1	<1
Benz(a)anthracene	ENV103	µg/L	<1	<1	<1	<1
Chrysene	ENV103	µg/L	<1	<1	<1	<1
Benzo(b)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(k)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(a)pyrene	ENV103	µg/L	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	ENV103	µg/L	<1	<1	<1	<1
Dibenz(a,h)anthracene	ENV103	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	ENV103	µg/L	<1	<1	<1	<1
Surrogate Nitrobenzene-d5	ENV103	%	99.0	106.0	94.0	98.0
Surrogate 2-fluorobiphenyl	ENV103	%	127.0	130.0	128.0	120.0
Surrogate Phenanthrene-d10	ENV103	%	123.0	112.0	123.0	118.0
Surrogate 4-terphenyl-d14	ENV103	%	115.0	110.0	127.0	116.0
Aluminium Total	EFF261	mg/L	0.18	0.12	0.17	0.10
Aluminium Dissolved	EFF261	mg/L	0.002	0.002	0.003	0.002
Arsenic Total	EFF261	mg/L	0.001	0.001	0.001	0.001
Arsenic Dissolved	EFF261	mg/L	0.001	0.001	0.001	0.001
Cadmium Total	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium Total	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Chromium Dissolved	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt Dissolved	EFF261	mg/L	0.0002	0.0002	0.0002	0.0001
Cobalt Total	EFF261	mg/L	0.0004	0.0004	0.0004	0.0002
Copper Total	EFF261	mg/L	0.005	0.002	0.002	0.001
Copper Dissolved	EFF261	mg/L	0.002	0.001	0.001	0.0008
Iron Total	EFF261	mg/L	0.27	0.16	0.23	0.13
Iron Dissolved	EFF261	mg/L	<0.0005	<0.0005	<0.0005	<0.0005

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-1 Site 1 Brisbane R 1400hr	248739-2 Site 2A Brisbane R 1500hr	248739-3 Site 2B Brisbane R 1500hr	248739-4 Site 3A Brisbane R 1220
Mercury Total	EFF261	ug/L	0.12	<0.1	<0.1	<0.1
Mercury Dissolved	EFF261	ug/L	<0.1	<0.1	<0.1	<0.1
Manganese Dissolved	EFF261	mg/L	0.009	0.009	0.009	0.007
Manganese Total	EFF261	mg/L	0.02	0.02	0.02	0.01
Nickel Total	EFF261	mg/L	0.001	0.0008	0.0008	0.0006
Nickel Dissolved	EFF261	mg/L	0.0006	0.0005	0.0004	<0.0004
Lead Total	EFF261	mg/L	<0.0001	0.0001	<0.0001	<0.0001
Lead Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Selenium Dissolved	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium Total	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Zinc Total	EFF261	mg/L	0.008	0.004	0.003	0.005
Zinc Dissolved	EFF261	mg/L	0.006	0.006	0.005	0.005

Sample Description Time Sampled Test	Code	Unit	248739-5 Site 3B Brisbane R 1220	248739-6 Site 4 Brisbane R 11:45	248739-7 Site 5 Moreton Bay 10:45	248739-8 Site 6 Moreton Bay 10:30
Total Phosphorus	EFF029.1	mg/L	0.08	0.08	0.05	0.04
Ammonia-Nitrogen	EFF044	mg/L	<0.002	<0.002	<0.002	<0.002
Nitrate-Nitrogen	EFF004.1	mg/L	0.008	0.004	<0.002	<0.002
Nitrite-Nitrogen	EFF005.1	mg/L	<0.002	<0.002	<0.002	<0.002
Total Nitrogen	EFF029.1	mg/L	<0.05	<0.05	<0.05	<0.05
Solids (Suspended)	EFF009	mg/L	2	6	2	<2
Tributyltin	EFF235	ng/L	<2.00	<2.00	<2.00	<2.00
Aldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
a-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
b-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
d-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Lindane (gamma-BHC)	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDD p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDE p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDT p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dicofol	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-alpha	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-beta	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-sulphate	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
HCB	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-5 Site 3B Brisbane R 1220	248739-6 Site 4 Brisbane R 11:45	248739-7 Site 5 Moreton Bay 10:45	248739-8 Site 6 Moreton Bay 10:30
Benzene	ENV105	µg/L	<1	<1	<1	<1
Ethylbenzene	ENV105	µg/L	<1	<1	<1	<1
Toluene	ENV105	µg/L	<1	<1	<1	<1
ortho-Xylenes	ENV105	µg/L	<2	<2	<2	<2
meta- & para-Xylenes	ENV105	µg/L	<2	<2	<2	<2
Surrogate 1,2-dichlorobenzene-d4	ENV105	%	112.0	106.0	115.0	85.0
Surrogate Chlorobenzene-d5	ENV105	%	105.0	99.0	103.0	87.0
Surrogate Fluorobenzene	ENV105	%	110.0	103.0	100.0	86.0
Naphthalene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthylene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthene	ENV103	µg/L	<1	<1	<1	<1
Fluorene	ENV103	µg/L	<1	<1	<1	<1
Phenanthrene	ENV103	µg/L	<1	<1	<1	<1
Anthracene	ENV103	µg/L	<1	<1	<1	<1
Fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Pyrene	ENV103	µg/L	<1	<1	<1	<1
Benz(a)anthracene	ENV103	µg/L	<1	<1	<1	<1
Chrysene	ENV103	µg/L	<1	<1	<1	<1
Benzo(b)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(k)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(a)pyrene	ENV103	µg/L	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	ENV103	µg/L	<1	<1	<1	<1
Dibenz(a,h)anthracene	ENV103	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	ENV103	µg/L	<1	<1	<1	<1
Surrogate Nitrobenzene-d5	ENV103	%	86.0	91.0	89.0	85.0
Surrogate 2-fluorobiphenyl	ENV103	%	120.0	119.0	115.0	125.0
Surrogate Phenanthrene-d10	ENV103	%	114.0	121.0	127.0	116.0
Surrogate 4-terphenyl-d14	ENV103	%	121.0	129.0	114.0	120.0
Aluminium Total	EFF261	mg/L	0.12	0.08	0.05	0.04
Aluminium Dissolved	EFF261	mg/L	0.002	0.002	0.002	0.002
Arsenic Total	EFF261	mg/L	0.001	0.001	0.001	0.001
Arsenic Dissolved	EFF261	mg/L	0.001	0.001	0.001	0.001
Cadmium Total	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium Total	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Chromium Dissolved	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt Dissolved	EFF261	mg/L	0.0002	0.0001	<0.0001	<0.0001
Cobalt Total	EFF261	mg/L	0.0002	0.0002	0.0001	<0.0001
Copper Total	EFF261	mg/L	0.001	0.002	0.001	0.002
Copper Dissolved	EFF261	mg/L	0.001	0.0007	0.0005	0.0004

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-5 Site 3B Brisbane R 1220	248739-6 Site 4 Brisbane R 11:45	248739-7 Site 5 Moreton Bay 10:45	248739-8 Site 6 Moreton Bay 10:30
Iron Total	EFF261	mg/L	0.15	0.10	0.06	0.06
Iron Dissolved	EFF261	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Mercury Total	EFF261	ug/L	<0.1	<0.1	<0.1	<0.1
Mercury Dissolved	EFF261	ug/L	<0.1	<0.1	<0.1	<0.1
Manganese Dissolved	EFF261	mg/L	0.008	0.006	0.003	0.005
Manganese Total	EFF261	mg/L	0.01	0.01	0.007	0.007
Nickel Total	EFF261	mg/L	0.0006	0.0006	<0.0004	0.0006
Nickel Dissolved	EFF261	mg/L	<0.0004	<0.0004	<0.0004	<0.0004
Lead Total	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Lead Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Selenium Dissolved	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium Total	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Zinc Total	EFF261	mg/L	0.004	0.007	0.003	0.01
Zinc Dissolved	EFF261	mg/L	0.006	0.005	0.005	0.006

Sample Description Time Sampled Test	Code	Unit	248739-9 Site 7 Passage 9:30	248739-10 Site 8 Passage 10:00	248739-11 Site 9 Moreton Bay 11:00	248739-12 Site 10 Moreton Bay 11:30
Total Phosphorus	EFF029.1	mg/L	0.08	0.05	0.05	0.05
Ammonia-Nitrogen	EFF044	mg/L	<0.002	<0.002	<0.002	<0.002
Nitrate-Nitrogen	EFF004.1	mg/L	0.003	0.003	<0.002	<0.002
Nitrite-Nitrogen	EFF005.1	mg/L	<0.002	<0.002	<0.002	<0.002
Total Nitrogen	EFF029.1	mg/L	0.08	<0.05	<0.05	<0.05
Solids (Suspended)	EFF009	mg/L	3	<2	<2	3
Tributyltin	EFF235	ng/L	<2.00	<2.00	<2.00	<2.00
Aldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dieldrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
a-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
b-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
d-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Lindane (gamma-BHC)	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDD p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDE p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
DDT p,p	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Dicofol	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-alpha	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-beta	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endosulfan-sulphate	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Endrin	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
HCB	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Heptachlor	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-9 Site 7 Passage 9:30	248739-10 Site 8 Passage 10:00	248739-11 Site 9 Moreton Bay 11:00	248739-12 Site 10 Moreton Bay 11:30
Heptachlor epoxide	CR003.4	ug/L	<0.1	<0.1	<0.1	<0.1
Benzene	ENV105	µg/L	<1	<1	<1	<1
Ethylbenzene	ENV105	µg/L	<1	<1	<1	<1
Toluene	ENV105	µg/L	<1	<1	<1	<1
ortho-Xylenes	ENV105	µg/L	<2	<2	<2	<2
meta- & para-Xylenes	ENV105	µg/L	<2	<2	<2	<2
Surrogate 1,2-dichlorobenzene-d4	ENV105	%	117.0	106.0	118.0	91.0
Surrogate Chlorobenzene-d5	ENV105	%	109.0	98.0	110.0	88.0
Surrogate Fluorobenzene	ENV105	%	113.0	91.0	113.0	97.0
Naphthalene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthylene	ENV103	µg/L	<1	<1	<1	<1
Acenaphthene	ENV103	µg/L	<1	<1	<1	<1
Fluorene	ENV103	µg/L	<1	<1	<1	<1
Phenanthrene	ENV103	µg/L	<1	<1	<1	<1
Anthracene	ENV103	µg/L	<1	<1	<1	<1
Fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Pyrene	ENV103	µg/L	<1	<1	<1	<1
Benz(a)anthracene	ENV103	µg/L	<1	<1	<1	<1
Chrysene	ENV103	µg/L	<1	<1	<1	<1
Benzo(b)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(k)fluoranthene	ENV103	µg/L	<1	<1	<1	<1
Benzo(a)pyrene	ENV103	µg/L	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene	ENV103	µg/L	<1	<1	<1	<1
Dibenz(a,h)anthracene	ENV103	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	ENV103	µg/L	<1	<1	<1	<1
Surrogate Nitrobenzene-d5	ENV103	%	107.0	86.0	100.0	97.0
Surrogate 2-fluorobiphenyl	ENV103	%	122.0	125.0	123.0	125.0
Surrogate Phenanthrene-d10	ENV103	%	125.0	121.0	119.0	119.0
Surrogate 4-terphenyl-d14	ENV103	%	129.0	113.0	128.0	120.0
Aluminium Total	EFF261	mg/L	0.13	0.06	0.02	0.03
Aluminium Dissolved	EFF261	mg/L	0.002	0.003	0.003	0.002
Arsenic Total	EFF261	mg/L	0.001	0.001	0.001	0.001
Arsenic Dissolved	EFF261	mg/L	0.001	0.001	0.001	0.001
Cadmium Total	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium Total	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Chromium Dissolved	EFF261	mg/L	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt Dissolved	EFF261	mg/L	0.0002	0.0002	<0.0001	<0.0001
Cobalt Total	EFF261	mg/L	0.0003	0.0002	<0.0001	<0.0001
Copper Total	EFF261	mg/L	0.005	0.002	0.001	0.001

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-9 Site 7 Passage 9:30	248739-10 Site 8 Passage 10:00	248739-11 Site 9 Moreton Bay 11:00	248739-12 Site 10 Moreton Bay 11:30
Copper Dissolved	EFF261	mg/L	0.002	0.002	0.0003	0.0006
Iron Total	EFF261	mg/L	0.18	0.08	0.03	0.03
Iron Dissolved	EFF261	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Mercury Total	EFF261	ug/L	<0.1	<0.1	<0.1	<0.1
Mercury Dissolved	EFF261	ug/L	<0.1	<0.1	<0.1	<0.1
Manganese Dissolved	EFF261	mg/L	0.01	0.008	0.004	0.004
Manganese Total	EFF261	mg/L	0.02	0.01	0.006	0.007
Nickel Total	EFF261	mg/L	0.001	0.0005	<0.0004	<0.0004
Nickel Dissolved	EFF261	mg/L	0.0007	0.0005	<0.0004	<0.0004
Lead Total	EFF261	mg/L	0.0001	<0.0001	<0.0001	<0.0001
Lead Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Selenium Dissolved	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Selenium Total	EFF261	mg/L	<0.001	<0.001	<0.001	<0.001
Zinc Total	EFF261	mg/L	0.01	0.005	0.004	0.005
Zinc Dissolved	EFF261	mg/L	0.02	0.006	0.004	0.005

Sample Description Time Sampled Test	Code	Unit	248739-13 Site 11 Brisbane R 1230	248739-14 Site 12A Passage 1350	248739-15 Site 12B Passage 1350
Total Phosphorus	EFF029.1	mg/L	0.11	0.08	0.10
Ammonia-Nitrogen	EFF044	mg/L	<0.002	<0.002	<0.002
Nitrate-Nitrogen	EFF004.1	mg/L	0.015	0.004	0.009
Nitrite-Nitrogen	EFF005.1	mg/L	<0.002	<0.002	<0.002
Total Nitrogen	EFF029.1	mg/L	0.06	0.06	0.08
Solids (Suspended)	EFF009	mg/L	8	6	24
Tributyltin	EFF235	ng/L	<2.00	<2.00	<2.00
Aldrin	CR003.4	ug/L	<0.1	<0.1	<0.1
Dieldrin	CR003.4	ug/L	<0.1	<0.1	<0.1
a-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1
b-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1
d-BHC	CR003.4	ug/L	<0.1	<0.1	<0.1
Lindane (gamma-BHC)	CR003.4	ug/L	<0.1	<0.1	<0.1
DDD p,p	CR003.4	ug/L	<0.1	<0.1	<0.1
DDE p,p	CR003.4	ug/L	<0.1	<0.1	<0.1
DDT p,p	CR003.4	ug/L	<0.1	<0.1	<0.1
Dicofol	CR003.4	ug/L	<0.1	<0.1	<0.1
Endosulfan-alpha	CR003.4	ug/L	<0.1	<0.1	<0.1
Endosulfan-beta	CR003.4	ug/L	<0.1	<0.1	<0.1
Endosulfan-sulphate	CR003.4	ug/L	<0.1	<0.1	<0.1
Endrin	CR003.4	ug/L	<0.1	<0.1	<0.1
HCB	CR003.4	ug/L	<0.1	<0.1	<0.1
Heptachlor	CR003.4	ug/L	<0.1	<0.1	<0.1

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CERTIFICATE NO.: 248739

Sample Description Time Sampled Test	Code	Unit	248739-13 Site 11 Brisbane R 1230	248739-14 Site 12A Passage 1350	248739-15 Site 12B Passage 1350
Heptachlor epoxide	CR003.4	ug/L	<0.1	<0.1	<0.1
Benzene	ENV105	µg/L	<1	<1	<1
Ethylbenzene	ENV105	µg/L	<1	<1	<1
Toluene	ENV105	µg/L	<1	<1	<1
ortho-Xylenes	ENV105	µg/L	<2	<2	<2
meta- & para-Xylenes	ENV105	µg/L	<2	<2	<2
Surrogate 1,2-dichlorobenzene-d4	ENV105	%	105.0	113.0	92.0
Surrogate Chlorobenzene-d5	ENV105	%	93.0	108.0	87.0
Surrogate Fluorobenzene	ENV105	%	100.0	110.0	82.0
Naphthalene	ENV103	µg/L	<1	<1	<1
Acenaphthylene	ENV103	µg/L	<1	<1	<1
Acenaphthene	ENV103	µg/L	<1	<1	<1
Fluorene	ENV103	µg/L	<1	<1	<1
Phenanthrene	ENV103	µg/L	<1	<1	<1
Anthracene	ENV103	µg/L	<1	<1	<1
Fluoranthene	ENV103	µg/L	<1	<1	<1
Pyrene	ENV103	µg/L	<1	<1	<1
Benz(a)anthracene	ENV103	µg/L	<1	<1	<1
Chrysene	ENV103	µg/L	<1	<1	<1
Benzo(b)fluoranthene	ENV103	µg/L	<1	<1	<1
Benzo(k)fluoranthene	ENV103	µg/L	<1	<1	<1
Benzo(a)pyrene	ENV103	µg/L	<1	<1	<1
Indeno(1,2,3-cd)pyrene	ENV103	µg/L	<1	<1	<1
Dibenz(a,h)anthracene	ENV103	µg/L	<1	<1	<1
Benzo(g,h,i)perylene	ENV103	µg/L	<1	<1	<1
Surrogate Nitrobenzene-d5	ENV103	%	76.0	74.0	72.0
Surrogate 2-fluorobiphenyl	ENV103	%	111.0	109.0	105.0
Surrogate Phenanthrene-d10	ENV103	%	105.0	103.0	99.0
Surrogate 4-terphenyl-d14	ENV103	%	128.0	127.0	122.0
Aluminium Total	EFF261	mg/L	0.10	0.22	0.52
Aluminium Dissolved	EFF261	mg/L	0.002	0.003	0.003
Arsenic Total	EFF261	mg/L	0.001	0.001	0.001
Arsenic Dissolved	EFF261	mg/L	0.001	0.001	0.001
Cadmium Total	EFF261	mg/L	<0.0001	<0.0001	<0.0001
Cadmium Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001
Chromium Total	EFF261	mg/L	<0.0003	<0.0003	0.0006
Chromium Dissolved	EFF261	mg/L	<0.0003	<0.0003	<0.0003
Cobalt Dissolved	EFF261	mg/L	0.0002	0.0002	0.0003
Cobalt Total	EFF261	mg/L	0.0003	0.0004	0.0007
Copper Total	EFF261	mg/L	0.001	0.002	0.002

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Sample Description Time Sampled Test	Code	Unit	248739-13 Site 11 Brisbane R 1230	248739-14 Site 12A Passage 1350	248739-15 Site 12B Passage 1350
Copper Dissolved	EFF261	mg/L	0.0008	0.0007	0.001
Iron Total	EFF261	mg/L	0.13	0.31	0.81
Iron Dissolved	EFF261	mg/L	<0.0005	<0.0005	<0.0005
Mercury Total	EFF261	ug/L	<0.1	<0.1	<0.1
Mercury Dissolved	EFF261	ug/L	<0.1	<0.1	<0.1
Manganese Dissolved	EFF261	mg/L	0.01	0.02	0.03
Manganese Total	EFF261	mg/L	0.02	0.03	0.06
Nickel Total	EFF261	mg/L	0.0005	0.0008	0.001
Nickel Dissolved	EFF261	mg/L	<0.0004	<0.0004	<0.0004
Lead Total	EFF261	mg/L	0.0001	0.0002	0.0005
Lead Dissolved	EFF261	mg/L	<0.0001	<0.0001	<0.0001
Selenium Dissolved	EFF261	mg/L	<0.001	<0.001	<0.001
Selenium Total	EFF261	mg/L	<0.001	<0.001	<0.001
Zinc Total	EFF261	mg/L	0.003	0.005	0.005
Zinc Dissolved	EFF261	mg/L	0.005	0.005	0.006

DEFINITIONS: < = Less than, > = Greater than, - = Not Tested, DWB = Dry Weight Basis.
* This test is not covered by the scope of our NATA accreditation.
# The result is derived from calculation.

Please note: Tributyltin testing performed by an external subcontracted NATA certified Laboratory.
Accreditation No: 198 Report No: RN0987057

Please note: Metal testing performed by an external subcontracted NATA certified Laboratory.
Accreditation No: 11085 Report No: 13/09028
Results were reported on an "as received" basis unless otherwise indicated.
Sampling was carried out by the customer and results reported pertain only to the samples submitted, responsibility for representative sampling rests with the customer.

Betty Bi, Analyst

Jason Roumimper, Chemist

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Appendix C Laboratory Results Data – Re-analysis of Copper

CERTIFICATE NO.: 248739-A
ISSUE DATE: 22/11/13

REVISION NO.: 00
This certificate supersedes any previous revisions

CLIENT DETAILS: Markus Billerbeck
BMT WBM Pty Ltd
Level 8
200 Creek Street
Brisbane QLD 4000

CLIENT REF:
DATE RECEIVED: 13/11/2013
TEST DATE: Sample tested between date received and reported.

CONDITIONS OF SAMPLE: Receipt Temperature: Chilled (0 ~ 5 °C)
Storage Temperature: Refrigerated

RESULTS OF ANALYSIS:

Sample Description / Test	Method Code	Unit	248739-A-2 Site 2A Brisbane R 1500hr	248739-A-3 Site 2B Brisbane R 1500hr	248739-A-6 Site 4 Brisbane R 11:45
Copper (Dissolved)	EWM01	mg/L	0.0011	0.0011	0.0009
Copper (Total)	EWM02	mg/L	0.0012	0.0011	0.0011

Sample Description / Test	Method Code	Unit	248739-A-8 Site 6 Moreton Bay 10:30	248739-A-9 Site 7 Passage 9:30	248739-A-10 Site 8 Passage 10:00
Copper (Dissolved)	EWM01	mg/L	0.0006	0.0018	0.0021
Copper (Total)	EWM02	mg/L	0.0011	0.0041	0.0024

Sample Description / Test	Method Code	Unit	248739-A-14 Site 12A Passage 1350	248739-A-15 Site 12B Passage 1350
Copper (Dissolved)	EWM01	mg/L	0.0011	0.0010
Copper (Total)	EWM02	mg/L	0.0015	0.0022

DEFINITIONS: < = Less than, > = Greater than, - = Not Tested, DWB = Dry Weight Basis.
* This test is not covered by the scope of our NATA accreditation.
# = The result is derived from calculation.

Results were reported on an "as received" basis unless otherwise indicated.
Sampling was carried out by the customer and results reported pertain only to the samples submitted, responsibility for representative sampling rests with the customer.

Mandy Wang, Chemist

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Appendix D Laboratory Quality Control Data

Data Quality Report

Analyte	Method Code	Analysis Date	Units	LOR	Blank	Original Result	Duplicate Result	% RPD	Quality Control Sample (%)	Spike (%)
Aluminium	EFF261	4.9.13	mg/L	0.001	<0.001	0.002	0.002	0	104	103
Arsenic	EFF261	4.9.13	mg/L	0.0001	<0.0001	0.0014	0.0013	7.4	103	118
Cadmium	EFF261	4.9.13	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0	104	93
Chromium	EFF261	4.9.13	mg/L	0.0003	<0.0003	<0.0003	<0.0003	0	108	109
Cobalt	EFF261	4.9.13	mg/L	0.0001	<0.0001	0.0002	0.0002	0	109	109
Copper	EFF261	4.9.13	mg/L	0.001	<0.001	0.002	0.002	0	95	109
Iron	EFF261	4.9.13	mg/L	0.0005	<0.0005	<0.0005	<0.0005	0	104	102
Mercury	EFF261	4.9.13	ug/L	0.1	<0.1	<0.1	<0.1	0	92	94
Manganese	EFF261	4.9.13	mg/L	0.001	<0.001	0.009	0.008	11.8	107	102
Nickel	EFF261	4.9.13	mg/L	0.0001	<0.0001	0.0006	0.0005	18.2	101	108
Lead	EFF261	4.9.13	mg/L	0.0001	<0.0001	<0.0001	<0.0001	0	108	97
Selenium	EFF261	4.9.13	mg/L	0.001	<0.001	<0.001	<0.001	0	97	115
Zinc	EFF261	4.9.13	mg/L	0.001	<0.001	0.006	0.006	0	106	105
Total P	EFF029.1	21.8.13	mg/L	0.01	<0.01	0.10	0.11	9.5	98	87
Ammonia	EFF044	21.8.13	mg/L	0.002	<0.002	<0.002	<0.002	0	96	95
Nitrate	EFF004.1	21.8.13	mg/L	0.002	<0.002	0.036	0.034	8.6	94	94
Nitrite	EFF005.1	21.8.13	mg/L	0.002	<0.002	<0.002	<0.002	0	98	91

Laboratory Quality Control Data

Analyte	Method Code	Analysis Date	Units	LOR	Blank	Original Result	Duplicate Result	% RPD	Quality Control Sample (%)	Spike (%)
Total Nitrogen	EFF029.1	21.8.13	mg/L	0.05	<0.05	0.14	0.13	7.4	96	89
Suspended Solids	EFF009	22.8.13	mg/L	2	<1	18	16	11.7	104	92
Tributyl Tin	EFF235	29.8.13	ng/L	1	<1	<2	<2	0		74
OC Pesticides	CR003.4	23.8.13	ug/L	0.1	<0.1	<0.1	<0.1	0	92	93
PAH's	ENV103	23.8.13	ug/L	1	<1	<0.1	<0.1	0	96	94
Benzene	ENV105	23.8.13	ug/L	1	<1	<0.1	<0.1	0	92	97
Tolune	ENV105	23.8.13	ug/L	1	<1	<0.1	<0.1	0	94	95
Ethyl Benzene	ENV105	23.8.13	ug/L	1	<1	<0.1	<0.1	0	92	92
Xylenes	ENV105	23.8.13	ug/L	2	<1	<0.1	<0.1	0	94	91

Laboratory Duplicate
The laboratory duplicate is a split of a sample randomly picked from the sample batch and analysed under the same conditions as the parent sample. The acceptance criteria for laboratory duplicates are dependent on the level of the results in comparison with the limits of reporting, and typically increases as the result nears the limit of reporting. Analysis of duplicates provides a measure of precision and is reported as %RPD. Acceptance criteria are: Result <5 times LOR: No limit. Result 20 time LOR:0-50% acceptable. Results <20% LOR:0-20% acceptable

Blank
The blank is typically ultra pure water and is free of any of the analytes of interest. Any detected components are derived from treatment chemicals or analytical equipment. Blanks are processed in the same manner as samples. Blanks provide an indication of potential contamination from the analytical process.

Laboratory Control Sample (LCS)
Either a Certified Reference Material (CRM) or a blank sample spiked with known concentrations of the analytes of interest. Provides a measure of accuracy.

Matrix Spike
A Sample is Spiked with a known Concentration of the analytes of interest and provides a measure of matrix affects on recoveries % spike recovery is reported. Acceptance Criteria are for LCS and spikes: 70-130% for inorganics. 60-140% for organics.

Surrogate Spike
Are used for organic analytes. Surrogates are known additions to samples, blanks, duplicates, controls and spikes. Surrogates mimic the compounds of interest and are not normally expected to be present in a sample. Surrogates provide a measure of extraction efficiency and therefore % recovery.

Duplicates
Duplicates and matrix spikes may not always be available for the smaller batches as these are tested in batches of 20 samples. Acceptance criteria can vary with each analyte.

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