PORT OF BRISBANE PTY LTD

WATER QUALITY MONITORING PROGRAM

ANNUAL REVIEW

March 2011

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Executive Summary

In late 2009, Port of Brisbane (PBPL) commenced development of a pilot receiving water quality monitoring program (WQMP) to complement its existing environmental monitoring program. The objective of the program was to enhance PBPL's understanding of the quality (and variation in quality) of the receiving waters surrounding the Port. Its aim was to build upon existing broad-scale monitoring programs by providing improved spatial coverage, sampling frequency and the range of water quality analytes for the receiving waters adjacent to the Port. The results would provide a benchmark against which impacts of planned development activities at the Port could be measured; while also characterising the background water quality, and its variability, adjacent to the Port. ALS was invited to undertake the monthly sampling for the pilot receiving WQMP over a 12 month period in 2010.

A total of eight sampling locations were selected within the Brisbane River and Moreton Bay, adjacent to PBPL facilities for sampling on a monthly basis. A further two sampling sites were selected adjacent to Mud Island to be sampled on a quarterly basis. On each occasion, sampling was undertaken on an outgoing tide, commencing at high tide, and timed around the full moon period each month where the larger tides facilitate access to the shallow sites.

During each monthly event, vertical profiles were recorded for all *in-situ* water quality measured at each site using handheld water quality monitoring instruments, including water temperature, Electrical Conductivity, pH, Dissolved Oxygen, and turbidity. Grab water samples were also collected at half the depth of the water column, for analysis of a range of laboratory analysed parameters including Total Suspended Solids, hardness, anions (Ca and Mg), Chlorophyll a, nitrogen and phosphorus components, and a range of total and dissolved metals levels. On a quarterly basis, additional analytes were tested for including Tributyltin, Total Petroleum Hydrocarbons and Polynuclear Aromatic Hydrocarbons.

The data was assessed against relevant water quality guidelines. In addition, basic statistics (e.g. means, medians, and ranges) were generated for each analyte, and Non-metric Multi-Dimensional Scaling (NMDS) Ordinations and Analysis of Variance (ANOVA) were run to determine similarities/differences between site data.

The ambient conditions over the 12 month period indicated rainfall was variable over the program, with two high rainfall events occurring within days, or on the day of, the sampling program. Sites 3 and 4 were consistently recorded as the deepest sites (15-18m), whilst Site 7 was recorded as the shallowest (2 - 3.3m).

Vertical profiling results indicated no stratification of the water column at all sites over all events, with the exception of December within the Brisbane River (Sites 1 and 2). This single occurrence would be related to the large freshwater volume releases from Wivenhoe Dam and high rainfall recorded during this time period. In addition, a general trend emerged across all events for Sites 1, 2, and 7 with the turbidity data consistently higher at these sites compared to the other sites. Sites 1 and 2 are the most upstream sites along the Brisbane River, and Site 7 is the shallowest site at high tide and located within the boat passage which channels some flow out of the Brisbane River between Sites 1 and 2 on an outgoing tide. Thus, Sites 1 and 2 results would be heavily influenced by inputs from the Brisbane river catchment and stormwater runoff, while results for Site 7 would be heavily influenced by wind-wave and boat wave re-suspension of sediment.

Suspended solids peaked during the March sampling event and were well above the QWQG levels at all sites at this time. Interestingly, the March peak TSS levels correspond with relatively low turbidity levels, so are perhaps related to phytoplankton blooms rather than suspended sediments. However, Chlorophyll-a data show that chlorophyll levels in March

were also relatively low, so if phytoplankton blooms were responsible, this would most likely have related to non-chlorophyte taxa.

Sites 1, 2 and 7 recorded elevated Total Suspended Solids (TSS) levels on several occasions so turbidity at these sites is likely to have influenced the TSS results. On the other hand, the high turbidity recorded at Site 7 in October (24.1NTU) was not reflected in the TSS results for the same period. The rainfall events in February and December also appeared to have little influence on the TSS results for the program. TSS exceedances in August also corresponded to low turbidity. Therefore, there is no direct relationship between turbidity and TSS, and the mechanisms for driving high TSS and turbidity require further investigation.

Sites 1, 2 and 7 recorded consistently higher and more variable Total Nitrogen and Total Phosphorus results than remaining sites, with Site 7 also recording the highest mean Oxidised Nitrogen result, which would be assumed to relate to inputs from the Brisbane River and stormwater outlet from the Port of Brisbane.

A total of seven of the metals measured for this program had established guidelines, of which Total Copper (four results) and Total Lead (all February results) recorded measurements in exceedance of the guidelines. Investigation into the dissolved concentrations of these metals found one dissolved Copper and most February results for dissolved Lead exceeded guideline levels.

Elevated Tributyltin levels were recorded on one occasion only (in April at Site 5), whilst TPH and PAH levels were all below the limits of reporting across all sampling events at all sites.

Site comparisons, based upon the complete data set, found mixed results over the monitoring program, with no obvious grouping of individual sites based upon the combined water quality data set. There were, however, apparent groupings of sites based upon the sampling event (month). These ordinations suggest that, based upon the complete dataset, most sites would be similarly influenced by seasonal/natural changes. Data from sites of close proximity (i.e. 1 vs 2, 3 vs 4, 5 vs 6, 7 vs 8) were also assessed against each other and there were no significant differences within each group.

A summary of recommendations arising from this pilot program include:

- Consider inclusion of algal assessment into the monitoring program.
- Consider inclusion of event-based sampling into monitoring program.
- Determine the location of Site 8 in relation to the 'high ecological value' zone in Waterloo Bay.
- Reduce the number of analytes tested, and reduce metals testing to Total Metals form only (with data review to determine requirement for further dissolved metals analysis).
- Apply ultra-trace analytical techniques to Copper, Lead and Zinc metals only to ensure results meet ANZECC (2000) Guidelines. Remaining metals can be assessed using standard analytical techniques.
- Retain nutrient ultra-trace analysis for future programs.
- Remove Mud Island sites from the program as they did not add value to the objectives of the program.
- Reduce the number of site locations from 8 to 4 to reduce costs.
- Continue program for a further 4 years minimum to provide a strong baseline dataset for future comparisons (i.e. for DA assessments etc).

- Strongly consider carrying out sampling over the next few months to assess the impacts of the January 2011 flood on water quality in the study area.

Overall, the pilot program highlighted minimal issues in relation to metal concentrations, and the presence of TPH and PAH compounds within the waters surrounding the Port of Brisbane in 2010. However, a general trend did emerge across most events at Sites 1, 2, and 7, with turbidity and nutrient concentrations consistently higher at these sites compared to other sites further out in the bay. This program has provided a useful background dataset to provide a benchmark against which impacts of planned development activities in the Port can be measured, although, the recent major flooding event of January 2011 may have created a shift in water quality which currently has not been accounted for. A continuation of the water quality monitoring program is strongly recommended to determine any long term changes to the waters surrounding the Port after this major natural disaster event.

1 Introduction

1.1 Background

The Port of Brisbane Pty Ltd (PBPL) has an extensive environmental monitoring program that aims to provide a detailed understanding of the Port of Brisbane's surrounding environment, its natural variability, and the interactions between port-related activities and this environment. This environmental monitoring program is a critical element of the PBPL's ISO14001 accredited, Environmental Management System.

In late 2009, PBPL commenced development of a pilot receiving water quality monitoring program to complement its existing environmental monitoring program. The objective of the program was to enhance PBPL's understanding of the quality (and variation in quality) of the receiving waters surrounding the Port. The proposed receiving water monitoring program would build upon existing broad-scale monitoring programs (e.g. Ecosystem Health Monitoring Program, refer to section 2.1 for further details) by providing improved spatial coverage, sampling frequency and the range of water quality analytes for the receiving waters adjacent to the Port of Brisbane. The results would provide a benchmark against which impacts of planned development activities at the Port could be measured; while also characterising the background water quality, and its variability, adjacent to the Port.

Data collected could also be used to better inform negotiations with the Department of Environment and Resource Management's (DERM) in relation to licensing conditions for receiving water quality within the Port.

PBPL developed a draft pilot receiving water monitoring program that contained a preliminary list of analytes of interest and prospective sampling sites. The list of analytes chosen were based on a combination of value for money, data utility maximisation and logistic considerations, as well as PBPL's understanding of the likely nature of potential impacts associated with future development programs. Proposed sampling site locations were chosen based on particular areas of interest (e.g. adjacent to future development areas, adjacent to the existing spoil ground near Mud Island, adjacent to an existing major stormwater outlet etc.), as well as the desire to build on the information collected at existing monitoring sites and maximise spatial representativeness in terms of the monitoring being carried out.

PBPL commissioned ALS Water Sciences Group to provide an independent scientific assessment of the draft receiving water monitoring program with a view to developing the receiving water monitoring program to an implementation stage. As a result of that process, some additional analytes were added to the program and sampling and analysis methods were clarified (e.g. frequency of data collection for certain analytes, and limit of reporting (LOR) to be used for various analytes). ALS was then invited to undertake the monthly sampling for the pilot PBPL receiving water monitoring program over a 12 month period in 2010.

This report details the results of the 12 month pilot monitoring program.

1.2 Scope of Work

ALS was commissioned by PBPL to undertake the pilot water quality monitoring program (WQMP), with PBPL providing field and operational assistance. The requirements of the program included:

- The program was to be conducted over a period of twelve months, with a scheduled commencement of January 28th 2010. Continuation of the program was contingent on the results of the first 12 months of monitoring and at PBPL's discretion.
- Monthly water samples were to be collected from selected locations within the Brisbane River and Moreton Bay, including additional analytes on a quarterly basis.
- The samples were to be analysed using a combination of field meters and laboratory analysis for a broad suite of analytes.
- Maintaining a database of results, with monthly results emailed to PBPL.
- The results were to be collated and interpreted, with a summary report prepared after the first six months of sampling and a final report after twelve months.

This document is the final report for the 12 month pilot monitoring program.

2 Sampling Sites

A total of eight sampling locations were selected within the Brisbane River and Moreton Bay, adjacent to PBPL facilities for sampling on a monthly basis. A further two sampling sites were selected adjacent to Mud Island to be sampled on a quarterly basis. The criteria used for site selection are presented in Table 2-1, and the location of each site is presented in Figure 2-1. Sites were located during each monthly sampling event using a GPS unit.

Table 2-1: Site location information for Water Quality Monitoring Program, 2010.

Site	Basis For Sampling at Location	Other Information
1	Adjacent to Port West – major future development area, which will include significant stormwater drain outlets. Future wharf development area on Pinkenba side of the river. Spatial distribution of sites around Port. Annual river sediment sampling sites in close proximity.	Site located in approximately middle of navigation channel.
2	Spatial distribution of sites around Port representing southern end of Fisherman Island. Located adjacent to general purpose berth, which has Environmental Relevant Activity 50 water quality monitoring requirements. Ecosystem Health Monitoring Program (EHMP) Site 700 in this area (replication opportunity). Annual river sediment sampling sites in close proximity.	Site located to correspond with location of EHMP Site 700.
3	Spatial distribution of sites around Port representing mid Fisherman Island. Area of wharf development 11/12. Amity current and future capital dredging. Annual river sediment sampling sites in close proximity.	Site located in approximately middle of navigation channel.
4	Spatial distribution of sites around Port representing downstream Fisherman Island. Adjacent to ongoing reclamation site and future development. Annual river sediment sampling sites in close proximity. Proximity to rock wall ecology sampling site 1	Site located in approximately middle of navigation channel.
5	Spatial distribution of sites around Port. Adjacent to probable future drain outlet. Adjacent to ongoing reclamation site and future development. Proximity to rock wall ecology sampling site 3. Proximity to worm digger sediment study sites. Boundary of Marine Park.	Site located at corner of Port Land (NE corner of Lot 93 on SP 143710)
6	Spatial distribution of sites around Port. Adjacent to probable future drain outlet. Adjacent to ongoing reclamation site and future development. Proximity to rock wall ecology sampling site 5. Proximity to worm digger sediment study sites. Approx 500m from wall similar to Site 5. General vicinity of seagrass watch and mangrove watch sites.	Site located adjacent to Stepout approx 500m from the wall.
7	Spatial distribution of sites around Port. Adjacent to Lucinda drain outlet.	Site located in approximately middle of navigation channel.
8	Spatial distribution of sites around Port. Proximity to worm digger sediment study sites. EHMP Site 409 in this area (replication opportunity).	Site located to correspond with location of EHMP Site 409.
9	Within Mud Island Spoil Disposal Area.	Site located to correspond with Mud Island SAP Site 6
10	Within Mud Island Spoil Disposal Area.	Site located to correspond with Mud Island SAP Site 3

LEGEND

EHMP WATER QUALITY SAMPLING SITES

PBC WATER QUALITY SAMPLING SITES

SITE	EASTING	NORTHING
1	514333.8	6967598.3
2	515105.2	6970388.9
3	517628.6	6974265.7
4	518335.3	6975398.4
5	519992.5	6974455.6
6	519365.7	6972629.0
7	517631.8	6969329.6
8	518754.7	6968230.2
9	522872.0	6974873.0
10	522028.0	6976971.0
409	518754.7	6968230.1
516	519689.0	6976531.0
700	515105.3	6970388.9
701	512839.1	6966425.6
906	515934.4	6974449.3

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PREPARED by K TUCKER

Date 28/01/2010

PORT OF BRISBANE

WATER QUALITY MONITORING SITES

JANUARY 2010

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PLAN NUMBER 123054

2.1 Ecosystem Health Monitoring Program

The Ecosystem Health Monitoring Program (EHMP) is one of the most comprehensive marine, estuarine and freshwater monitoring programs in Australia. It delivers a regional assessment of the ambient ecosystem health for each of South East Queensland's 19 major catchments, 18 river estuaries, and Moreton Bay. The ecosystem health of Moreton Bay is assessed using traditional water quality parameters measured every month. However, given its primary objective is to focus on comparing ecological condition between local council areas and collectively looking at the implications of point and non-point pollution sources on the health of Moreton Bay, the design of the EHMP monitoring program does not fully address the data requirements for PBPL's planning needs.

The WQMP monitoring Sites 2 and 8 correspond with EHMP Sites 700 and 409, respectively (see Figure 2-1). In addition, several other EHMP sites are in close proximity to the WQMP sites, including:

- Site 516 which is located in relatively close proximity to Mud Island
- Site 701 located in the Brisbane River near the mouth of Aquarium Passage
- Site 906 on the northern side of the Brisbane River off Juno Point.

3 Methodology

3.1 Field sampling

Sampling was carried out on a monthly basis and on each occasion was undertaken on an outgoing tide, commencing at high tide. Sampling was conducted around the full moon period each month where the larger tides facilitate access to the shallow sites. The sampling schedule and task across the 12 months is presented in Table 3-1.

Table 3-1: Sampling schedule

Full Moon	Sampling Date	High Tide	Sites	Task/Activity
Saturday 30th January	Friday 29th January	8:51am	10 Sites	Vertical Profiling Quarterly Sample Collection
Sunday 28th February	Monday 1st March	10:00am	8 Sites	Vertical Profiling Monthly Sample Collection
Tuesday 30th March	Tuesday 30th March	9:30am	8 Sites	Vertical Profiling Monthly Sample Collection
Wednesday 28th April	Thursday 29th April	9:45am	8 Sites (2 sites cancelled)*	Vertical Profiling Quarterly Sample Collection
Friday 28th May	Friday 28th May	9:26am	8 Sites	Vertical Profiling Monthly Sample Collection
Saturday 26th June	Friday 25th June	8:27am	8 Sites	Vertical Profiling Monthly Sample Collection
Monday 26th July	Monday 26th July	9:35am	10 Sites	Vertical Profiling Quarterly Sample Collection
Wednesday 25th August	Wednesday 25th August	9:45am	8 Sites	Vertical Profiling Monthly Sample Collection
Thursday 23rd September	Thursday 23rd September	9:19am	8 Sites	Vertical Profiling Monthly Sample Collection
Saturday 23rd October	Friday 22nd October	8:53am	10 Sites	Vertical Profiling Quarterly Sample Collection
Monday 22nd November	Monday 22nd November	9:45am	8 Sites	Vertical Profiling cancelled (poor weather conditions)* Monthly Sample Collection
Tuesday 21st December	Tuesday 21st December	9:29am	8 Sites	Vertical Profiling Monthly Sample Collection

*Notes: * refer to Section 3.4.1 for further details.*

PBPL provided a suitable vessel, an appropriately qualified skipper, and an environmental officer to assist with the collection of the water samples. *In-situ* water quality was measured at each site using handheld water quality monitoring instruments (Figure 3-1). Water temperature (ºC), Electrical Conductivity (EC - mS/cm), pH and Dissolved Oxygen (DO - mg/L and % saturation) were measured using a YSI 600QS multi-parameter probe

attached to a YSI 650MDS display. Turbidity was also measured using a TPS WP-88 Turbidity sensor (Figure 3-1). *In-situ* water quality was profiled at each site to gain an understanding of the vertical variation within the water column. Both instruments were calibrated in the laboratory to industry standards prior to deployment each month.

Figure 3-1: Staff preparing for vertical profile assessment.

A grab water sample was collected from each site using a Wildco © Niskin depth water sampler, at half the depth of the water column, with each sample bottle systematically filled from the tap (Figure 3-2). Dissolved metal samples were field filtered using individual sterile syringes and 50 micron disposable filters. Sample bottles were clearly labelled with site code, sampler, date and time of sampling.

Figure 3-2: Niskin water sampler used for water sample collection.

Samples were stored in eskies with ice as soon as collected; and at completion of sampling, were hand delivered same day to the ALS NATA accredited laboratory in Stafford.

3.2 Laboratory analysis

The key analytes that PBPL suggested in the sampling suite are presented in Table 3-2 and Table 3-3. Limits of reporting (LOR) are presented in these tables as initially nominated by ALS as being achievable, and the associated guideline levels.

Table 3-2: Laboratory analysed parameters for sampling on a monthly basis as part of the WQMP.

Parameter	Units	LOR	Guideline level*
TSS	mg/L	1	15 mg/L
Total Hardness	mg/L	1	*Not defined*
Dissolved Calcium	mg/L	1	*Not defined*
Dissolved Magnesium	mg/L	1	*Not defined*
Chlorophyll a	mg/m^3 (µg/L)	1	<1.6 µg/L
Ultra Trace Nutrients			
Ammonia as N	mg/L	0.005	<0.005 mg/L
Nitrate and Nitrite as N	mg/L	0.002	<0.002 mg/L
Total Nitrogen	mg/L	0.01	<0.200 mg/L
Total Phosphorus	mg/L	0.005	<0.03 mg/L
Metals (Total and Dissolved)			
Aluminium	mg/L	0.5	*Not defined*
Arsenic	mg/L	0.001	*Not defined*
Cadmium	mg/L	0.0001	<0.0055 mg/L
Chromium	mg/L	0.001	<0.0274 mg/L
Copper	mg/L	0.001	0.0013 mg/L
Iron	mg/L	0.5	*Not defined*
Nickel	mg/L	0.001	0.070 mg/L
Lead	mg/L	0.001	<0.0044 mg/L
Mercury	mg/L	0.0001	<0.0004 mg/L
Manganese	mg/L	0.01	*Not defined*
Zinc	mg/L	0.005	0.015 mg/L
Selenium	mg/L	0.1	*Not defined*

Notes: ** - Refer to section 3.3 for further details on guideline levels*

Laboratory analysis included appropriate QA/QC protocols to ensure a high level of quality control and confidence in the results. Where possible, the LOR's were selected to ensure results could be compared against relevant guidelines. However, due to matrix interference issues associated with seawater samples, the LOR's put forward by ALS for this study could not be achieved using the nominated analytical methods. This issue is further discussed in section 3.4.2.

Table 3-3: Additional laboratory analysed parameters for sampling on quarterly basis as part of the WQMP.

Parameter	Units	LOR	Guideline level*
Tributyltin (TBT)	ngSn/L	2	6 ngSn/L
Tripropyltin	%	5	*Not defined*
Polynuclear Aromatic Hydrocarbons (PAH)			
Naphthalene	µg/L	1	<70 µg/L
Acenaphthylene	µg/L	1	*Not defined*
Acenaphthene	µg/L	1	*Not defined*
Fluorene	µg/L	1	*Not defined*
Phenanthrene	µg/L	1	*Not defined*
Anthracene	µg/L	1	*Not defined*
Fluoranthene	µg/L	1	*Not defined*
Pyrene	µg/L	1	*Not defined*
Benz(a)anthracene	µg/L	1	*Not defined*
Chrysene	µg/L	1	*Not defined*
Benzo(b)fluoranthene	µg/L	1	*Not defined*
Benzo(k)fluoranthene	µg/L	1	*Not defined*
Benzo(a)pyrene	µg/L	0.5	*Not defined*
Indeno(1.2.3.cd)pyrene	µg/L	1	*Not defined*
Dibenz(a.h)anthracene	µg/L	1	*Not defined*
Benzo(g.h.i)perylene	µg/L	1	*Not defined*
PAH surrogates			
2-Fluorobiphenyl	%	1	*Not defined*
Anthracene-d10	%	1	*Not defined*
4-Terphenyl-d14	%	1	*Not defined*
Phenolic Compound Surrogates			
Phenol-d6	%	1	*Not defined*
2-Chlorophenol-D4	%	1	*Not defined*
2.4.6-Tribromophenol	%	1	*Not defined*
Total Petroleum Hydrocarbons			
C6 - C9 Fraction	µg/L	20	<10 mg/L
C10 - C14 Fraction	µg/L	50	<10 mg/L
C15 - C28 Fraction	µg/L	100	<10 mg/L
C29 - C36 Fraction	µg/L	50	<10 mg/L
TPH(V) / BTEX surrogates			
1.2-Dichloroethane-D4	%	2	*Not defined*
Toluene-D8	%	2	*Not defined*
4-Bromofluorobenzene	%	2	*Not defined*

Notes: ** - Refer to section 3.3 for further details on guideline levels*

3.3 Data analysis

3.3.1 Comparison with guidelines

The data was assessed against relevant water quality guidelines, including:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality for south-east Australian marine waters (ANZECC and ARMCANZ, 2000),
- Queensland Water Quality Guidelines (QWQG) for south east QLD region - enclosed coastal water type, and sub-region - western bays (DERM, 2009), and
- PBPL ERA 50 licence conditions.

The relevant 'slightly to moderately disturbed ecosystem' guidelines related to the parameters under investigation are presented in Table 3-4.

Table 3-4: Relevant 'slightly to moderately disturbed ecosystem' Guidelines for WQMP, 2010.

Parameter	Guidelines	
pH	8.1 - 8.4 mg/L	20th and 80th percentile value, QLD Water Quality Guidelines for Western Bays
Turbidity	1 - 6 NTU	20th and 80th percentile value, QLD Water Quality Guidelines for Western Bays
DO	95 - 105%	20th and 80th percentile value, QLD Water Quality Guidelines for Western Bays
TSS	<15 mg/L	QLD Water Quality Guidelines for south-east QLD region - enclosed coastal
Total N	<200 µg/L	80th percentile value, QLD Water Quality Guidelines for Western Bays
NOx	<2 µg/L	80th percentile value, QLD Water Quality Guidelines for Western Bays
Ammonia	<5 µg/L	80th percentile value, QLD Water Quality Guidelines for Western Bays
Total P	<30 µg/L	80th percentile value, QLD Water Quality Guidelines for Western Bays
Chlorophyll a	<1.6 µg/L	80th percentile value, QLD Water Quality Guidelines for Western Bays
Cadmium	<5.5 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Chromium (Cr III)*	<27.4 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Copper	<1.3 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Nickel	<70µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Lead	<4.4 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Mercury	<0.4µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Zinc	<15 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
TPH (C6-C36)	<10 mg/L	ERA 50 licensing conditions
Napthalene	<70 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters
Tributyltin	<0.006 µg/L	ANZECC (2000) 95% protection level for slightly disturbed marine waters

Notes

1. ** - Chromium levels were not speciated into Cr III and VI in water samples for this program, therefore selection of Cr III guideline is an indication only.*

The choice of guideline levels for use in this study was based on the nature of the receiving waters. ANZECC (2000) define slightly to moderately disturbed ecosystems as "ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity". Guideline levels associated with 95% ecosystem protection for the ANZECC (2000) guidelines were used for this study based on the fact that the receiving waters would be considered slightly to moderately disturbed marine waters.

The QWQG's definition of aquatic ecosystem condition is based upon the ANZECC (2000) framework; therefore, using the slightly to moderately disturbed definition, the QWQG's suggest "the test site median be compared against the 80th percentile value" within the relevant guideline tables (DERM, 2009).

In addition, it was inferred in the six monthly data review (ALS, 2010) that Site 8 may be within the zone of 'high ecological value' as outlined in the Environmental Protection (Water) Policy (EPP) 2009 South-east Queensland Map Series (Plan WQ1441) (2010). Whilst this question had not been confirmed during the time of writing this report, this site also corresponds with EHMP site 409, therefore, it may be implied this site be considered as having high ecological value and, hence, be assessed at the higher level of protection in terms of related guideline levels.

For high ecological value ecosystems, ANZECC (2000) guidelines state there should be *no change* to the existing condition, hence the 99% level of protection is recommended for such ecosystems. In addition, the QWQG's suggest assessing compliance against 20th, 50th and 80th percentiles of each parameter. In order to do this it is necessary to first establish the true distribution of values of all relevant indicators for the test sites. The QWQG approach is to assess compliance against 20th, 50th and 80th percentiles based upon at least 24 test values (DERM, 2009). Unfortunately, the results to date total only 12 test values. This methodology should be applied if/once:

1. Site 8 is confirmed to be within the 'high ecological value' zone of Waterloo Bay, and
2. The program is extended a further 12 months to collect an additional 12 test value results for this site.

3.3.2 Site comparisons

Basic statistics (e.g. means, medians, and ranges) were generated for each analyte in order to investigate the spatial and temporal variation of data at each site over the monitoring period.

In addition, to aid in the assessment of a future monitoring program design, sites were assessed against each other to determine similarities/differences, by:

- individual site data comparisons, and
- groupings of two sites within a similar area, and comparing data within groups, and
- groupings of two sites within a similar area, and comparing data between groups.

A Non-metric Multi-Dimensional Scaling (NMDS) Ordination was first used to compare site data. Ordination provides a representation of the relative similarity of entities (i.e. site samples) based on their attributes (i.e. water quality data) within a reduced dimensional space. The more similar sites are to each other, the closer they are located in the ordination space. This procedure is useful to display the samples interrelationships on a continuous scale. A NMDS ordination was performed on the similarity matrix for all pairs of samples based on the Euclidean similarity coefficient, after the data had been normalised. The number of axes used in the ordination is based on resultant stress levels. The stress level is a measure of the distortion produced by compressing multi-dimensional data into a reduced set of dimensions and would increase as the number of axes (i.e. dimensions) is reduced. The dataset was manipulated slightly for this test as the last three months of analytical results were set with a lower LOR therefore artificially isolating these three months of data from the remaining set. The final three sets of data were reassessed based upon the original LOR's and reanalysed by NMDS. This assessment was performed in the software package Primer Version 6.

Site and data group comparisons were then assessed using Analysis of Variance (ANOVA). ANOVA is a parametric statistical method which tests for differences in a single response variable (e.g. suspended solids) between different levels of one or more categorical variables or factors (e.g. Site). However, ANOVA techniques carry assumptions about the data that are being analysed, including assumptions of normality and homogeneity (Zar, 1999). As most laboratory results recorded analyte concentrations below the limit of reporting, standard ANOVA assessment was not possible as this method cannot accommodate unbalanced replication between groups. Therefore, nonparametric Kruskal-Wallis tests were substituted, as nonparametric techniques do not require the aforementioned assumptions to be met. These tests were performed in the statistical software package Statistica Version 6.

For all statistical tests, significance was calculated based on a 5% significance level (95% confidence level). Significance of Kruskal-Wallis tests were assessed from p-values. Based on a 5% significance level, quoted p values were classed as significant if they were less than 0.05 ($p<0.05$).

3.4 Program issues

3.4.1 Field component

A few minor field sampling issues occurred over the 12 months of monitoring, including:

- The DO sensor on the YSI 600QS was generating spurious results measurements during the February sampling event, although the instrument calibrated correctly in the laboratory prior to the event. The electrolyte used when completing the routine maintenance of the instrument was found to be faulty. Hence, no DO measurements are available for the February sampling event.
- The quarterly program in April was reduced to 8 sites due to the time limited availability of the vessel and skipper. Sites 9 and 10 were not sampled during this event.
- The weather conditions were very poor during the November event, preventing the ability to collect vertical profile measurements safely. Water samples only were collected.
- High flow releases from Wivenhoe Dam in conjunction with an outgoing tide during the December program resulted in high speed drift of the vessel at Sites 1 and 2 and hence *in-situ* profile measurements which were not directly vertical through the water column along the Brisbane River. Indicative *in-situ* water quality results were recorded only.

3.4.2 Laboratory component

Several issues were raised over the 12 month monitoring program regarding the laboratory analysed results, including:

- There were some discrepancies between the Total and Dissolved (filtered) results for some analytes, with some dissolved levels recorded higher than the total. The accepted criteria between the two results as stated in the ALS Quality Work Instruction QWI-EN/38 "Quality Control Specifications" under Section 5.3.2 is "*that for low level results (the higher of the duplicate results is less than 10 times LOR): No duplicate RPD reject criteria applicable*".

  After this issue was raised with the laboratory and as part of the quality assurance, notes were made on the laboratory chain of analysis results when this occurred to

ensure the results had been re-checked for systematic errors and the results met quality control specifications.

- Questions were raised regarding the cadmium results for the May sampling round due to the more precise LOR and lack of detectable results for total metals, and that all results exceeded the ANZECC and ARMCANZ (2000) guidelines at the 95% level of protection. Whilst the feedback from the ALS Laboratory Manager was encouraging with no issues with the instruments raw data, no transcript errors, and no cadmium detected in the method blank samples, his preference would have been to re-run the samples for cadmium as these results did appear to be an anomaly. As this anomaly was not discovered until after holding times were exceeded, these samples could not be re-analysed therefore it is recommended that the cadmium results for May be removed from the dataset.
- Due to matrix interference issues associated with seawater samples, the LORs put forward by ALS for this study could not be achieved using the nominated analytical methods. This issue should have been foreseen as potentially arising by laboratory staff when the initial quote for services was provided, but unfortunately was not. ALS accepted the responsibility of this error and, by way of compensation, organised to analyse samples collected from September onwards using the ultra-trace (higher resolution) method at no extra cost to PBPL.
- There had been some differences in the LOR's used during the laboratory analysis each month for some metals analyses and the ultra-trace Total Nitrogen analysis. In addition, the LOR's for Lead were not low enough to measure levels within the ANZECC and ARMCANZ (2000) guidelines. Lead was included in the ultra-trace method of analysis from September onwards (as per discussions above). These differences have been identified as occurring due to sample receipt staff allocating different codes to the analytical suite. Whilst differences in LORs between sampling events were such that they did not have an impact on our ability to meaningfully compare the data obtained within the guideline values, it is important to provide consistency in detection limits.

4 Weather conditions

A total of 1511mm of rain was recorded at Port of Brisbane by PBPL between 1st January and 31st December, 2010. The monthly rainfall results (Table 4-1) indicated the highest rainfall was recorded in December over the 12 months, whilst June and July recorded the lowest rainfall.

Table 4-1: Monthly rainfall (mm) recorded at Port of Brisbane, 2010.

Month	Total Rainfall (mm)
January	63.4
February	110.2
March	208.4
April	65.2
May	50.6
June	14.6
July	33.6
August	91.8
September	63.4
October	307.4
November	80.6
December	421.8

Source: PBPL

Weekly rainfall data across the 12 months of monitoring is presented in Figure 4-1, and highlights two main high intensity rainfall events of over 150mm within a week, at the end of February and mid October.

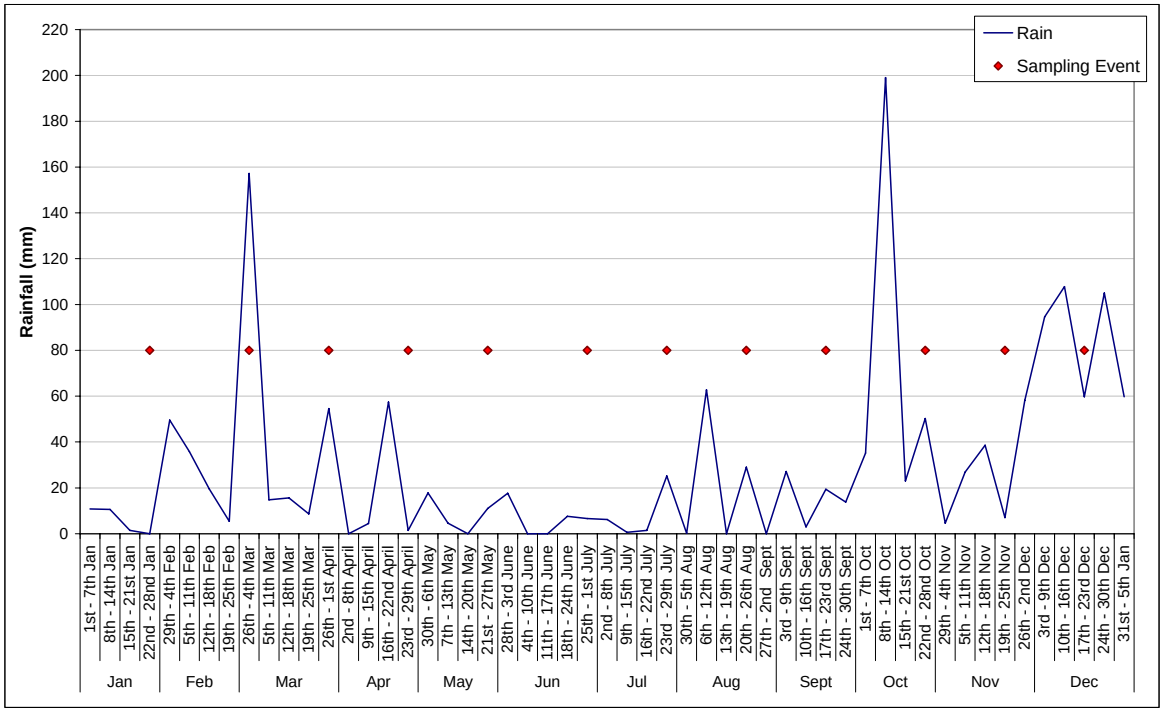

Figure 4-1: Weekly rainfall data recorded by PBPL between 1st January 2010 and 5th January 2011. Sampling events are indicated in red.

The high monthly total of rainfall recorded for December is indicated in Figure 4-1 as a series of storm events of greater than 60mm per week.

The amount of recorded rainfall within the week prior to sampling, and also on the day of sampling, is presented in Table 4-2. The February sampling event was found to record 103.4mm between the 22nd February and 1st March, with 62mm falling on the day of sampling. The other major rainfall event was recorded during the week prior to the December sampling program, with 99.4mm recorded the week of the 14th to 20th December.

Table 4-2: Rainfall (mm) recorded one week prior to sampling, and on day of sampling.

Month	Week	Rainfall	Sampling day	Rainfall
Jan	22nd - 28th Jan	0	29th January	5.8
Feb	22nd - 28th Feb	41.4	1st March	62.0
Mar	23rd - 29th Mar	24.8	30th March	10.6
April	22nd - 28th Apr	2.6	29th April	0
May	21st - 27th May	11.0	28th May	2.0
June	18th - 24th June	7.6	25th June	0
July	19th - 25th July	5.2	26th July	0.8
August	18th - 24th Aug	29.0	25th August	0
Sept	16th - 22nd Sept	19.4	23rd September	0
October	15th - 21st Oct	23.0	22nd October	0
November	15th - 21st Nov	43.4	22nd November	0.6
December	14th - 20th Dec	99.4	21st December	0

Further investigation into the high rainfall event which occurred the week of the February sampling event (conducted on the 1st March) found that of the 62mm recorded on the day of sampling, 30mm was recorded prior to beginning sampling at 9.30am. A total of 16.4mm fell in the space of 30 minutes between 7-7.30am (Figure 4-2).

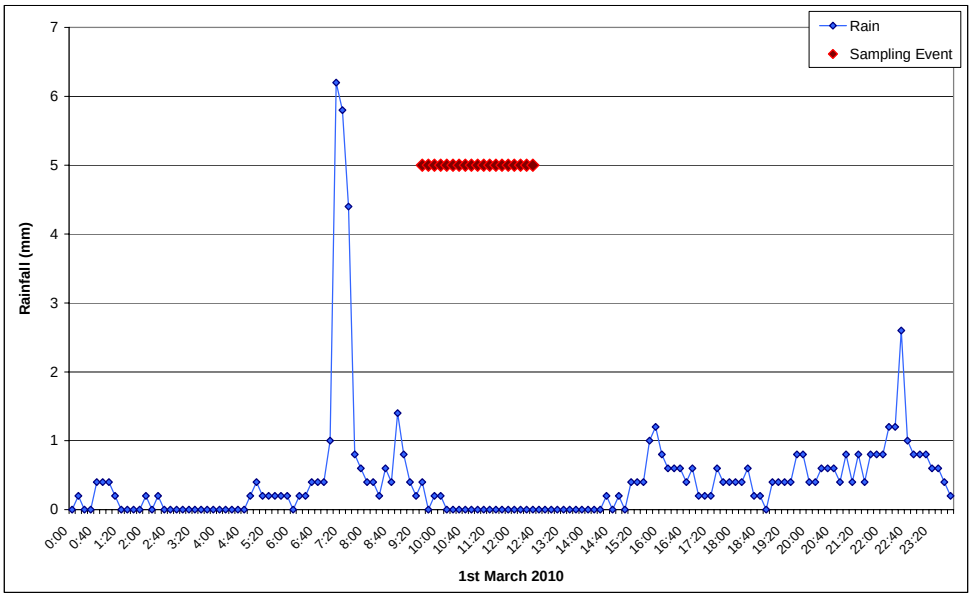

Figure 4-2: Rainfall (mm) recorded by PBPL every 10 minutes on 1st March 2010.

The week prior to the December sampling program, rainfall was recorded at 99.4mm between 14th and 20th December. The data recorded in 10 minute increments over 7 days is presented in Figure 4-3. A total of 5 rainfall events were recorded over the 7 days, of which 3 events did not last longer than 1hr. The other two rainfall events were recorded on 16th December of which 33mm was recorded over 12hrs, and 19th December of which 42mm was recorded over 13hrs.

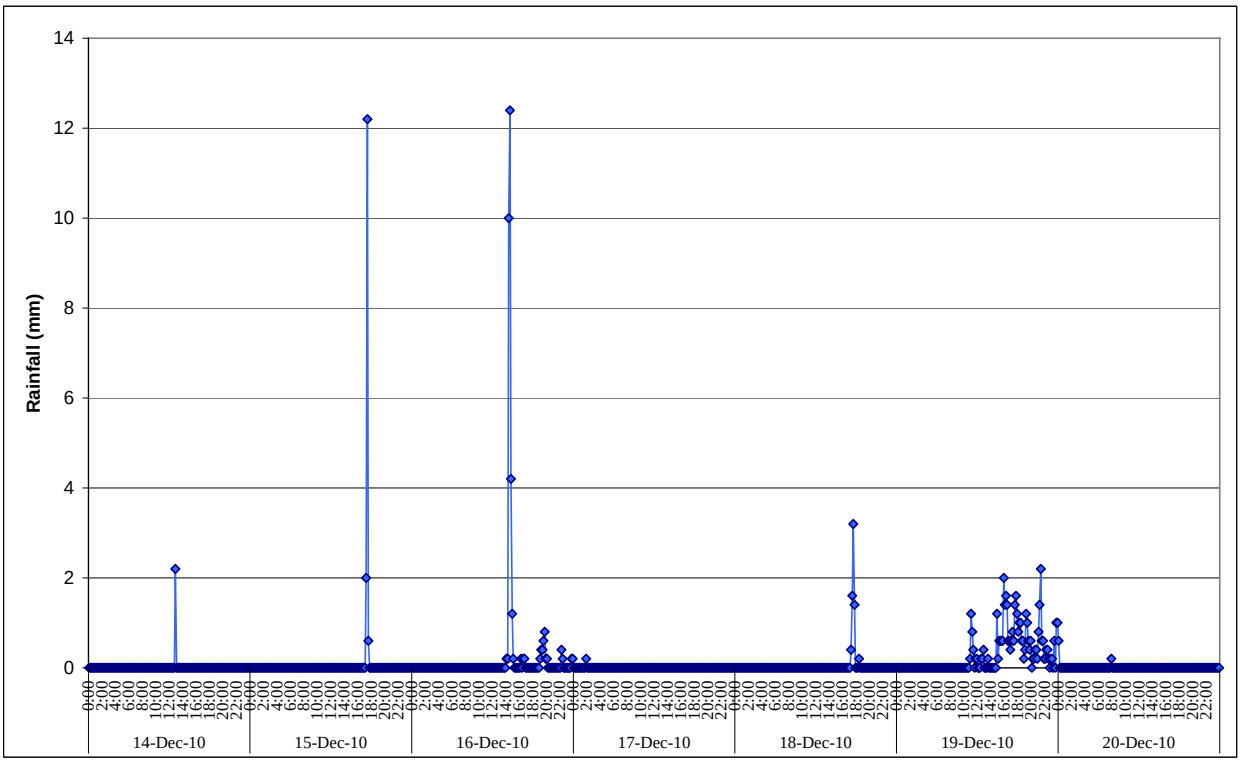

Figure 4-3: Rainfall data recorded by PBPL every 10 minutes between 14th and 20th December, 2010

This rainfall data was recorded at the Port of Brisbane and does not take into account rainfall in the upper catchments which would provide inflows to the Brisbane River and Moreton Bay. Nonetheless, the high volume of rainfall during some weeks in 2010 is likely to have influenced water quality results during some sampling events.

5 Summary of Results

5.1 Site depth information

The water depth at each site was recorded during each monthly sampling event, and is presented in Table 5-1. Sites 3 and 4 were recorded as the deepest sites (15-18m), whilst Site 7 was recorded as the shallowest (2 - 3.3m).

Table 5-1: Water depth (m) measurements at each site measured by the PBPL fishfinder sensor.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	10	11.3	11	10.6	11.2	7	10.8	11.4	12	11	10.6	10
2	5	5.1	5.4	6	4.9	5	5.5	7.7	7	7.2	7.4	8
3	15	16.8	16.8	15.1	16	16.6	15.5	17.2	16	15.6	16.1	15
4	15.7	16.6	16.4	15.5	16.6	16.6	15.8	18	16	16.1	16.7	15
5	6.5	6.9	6.5	6	5.8	5.5	6.4	6.4	7	6.5	7.1	8
6	3	3.2	2.5	4.1	2.3	2.4	2.5	2.4	3.5	2.6	3.4	3.5
7	2.2	2.7	2.4	2.4	2.1	2	2.1	2.2	3	2.4	3.3	2
8	3.8	4.3	3.9	2.5	3.4	3.5	3.1	3.1	3.7	4.1	3.9	4
9	11	--	--	N/S	--	--	10.6	--	--	10.6	--	--
10	9	--	--	N/S	--	--	9.3	--	--	9.4	--	--

Notes

1. *-- indicates these sites were not part of the monthly monitoring program*
2. *N/S indicates site was not sampled due to boat/skipper time constraints.*

5.2 Vertical profile data

Statistical summaries of vertical profile data for each site are presented in Appendix A.

There was no suggestion of stratification at any of the sites monitored, as indicated by the minimal variation in maximum and minimum results, with the exception of the December event. High volumes of freshwater were released from Wivenhoe Dam through the Brisbane River during this period, coupled with frequent high rainfall events and the outgoing tide at the time of sampling, resulted in a halocline effect along the mouth of the River. The layering of freshwater over seawater was evident when recording the vertical profiles for the event at Site 1 and Site 2 (Figure 5-1). Site 7 also recorded low EC concentrations, although this site is relatively shallow, located in close proximity to the Brisbane River, and also a major stormwater outlet for the Port of Brisbane.

Mid-column results were assessed against relevant water quality parameters and are presented in Figure 5-2, Figure 5-3, and Figure 5-4.

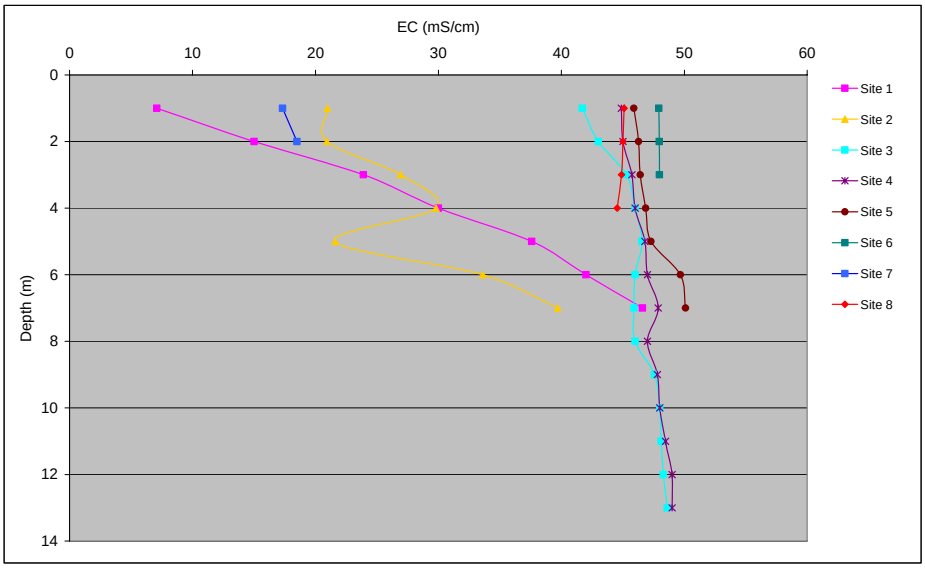

Figure 5-1: Vertical profile results for Electrical Conductivity (mS/cm) at all sites monitored during the December 2010 monthly sampling event.

5.2.1 pH

Figure 5-2 shows that pH was consistently between 8.0 - 8.3 across all sites and mostly within the 80th and 20th percentile value for the Queensland Water Quality Guidelines for Western Bays (DERM, 2009), with the exception of the July and December events. Results recorded during the July event were marginally above the 80th percentile guideline, while most results for December were below the 20th percentile guideline. The lowest results were recorded at Sites 1, 2 and 7 during the December event, which would have been influenced by the high freshwater flows from the Brisbane River and high rainfall events during the month.

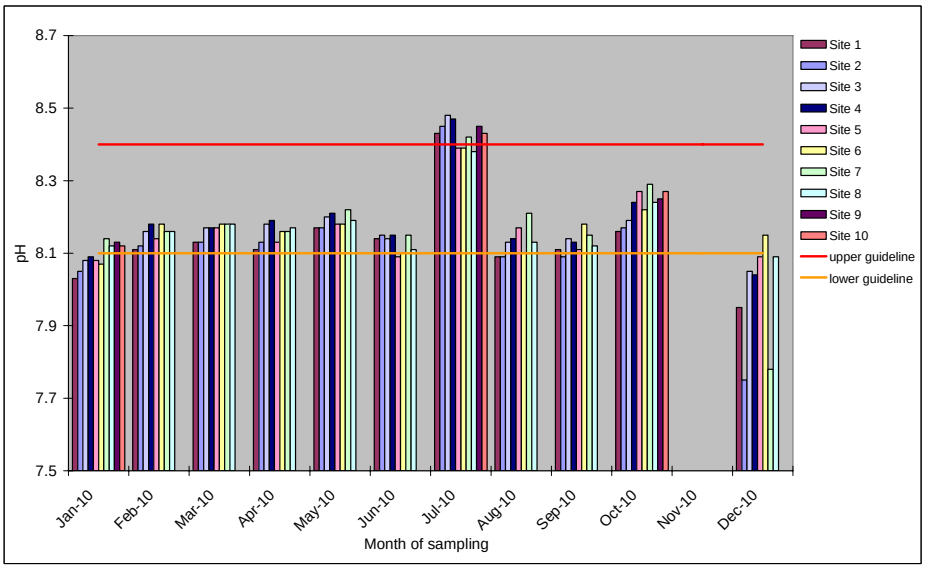

Figure 5-2: *In-situ* measurements of pH recorded mid-column at each site during the monthly WQMP, January to December 2010. Red and orange lines indicate 80th and 20th percentile guidelines for the QWQG.

5.2.2 Dissolved oxygen

Dissolved oxygen results were variable across sites within any given sampling occasion, with examples of super-saturation (greater than upper guideline) observed at some sites (Figure 5-3). Site 5 recorded super-saturation levels on five occasions, Site 6 on 3 occasions and Sites 1 and 2 during the June event only. Dissolved oxygen is influenced by salinity, temperature, biological activity and rate of transfer from the atmosphere (ANZECC, 2000), and is a highly variable parameter which changes over a daily period. As dissolved oxygen data represents the status at a single point in time and sampling was carried out across a range of times of day among the various sites on each occasion, results for dissolved oxygen presented in this study should be taken as being indicative only of water quality condition.

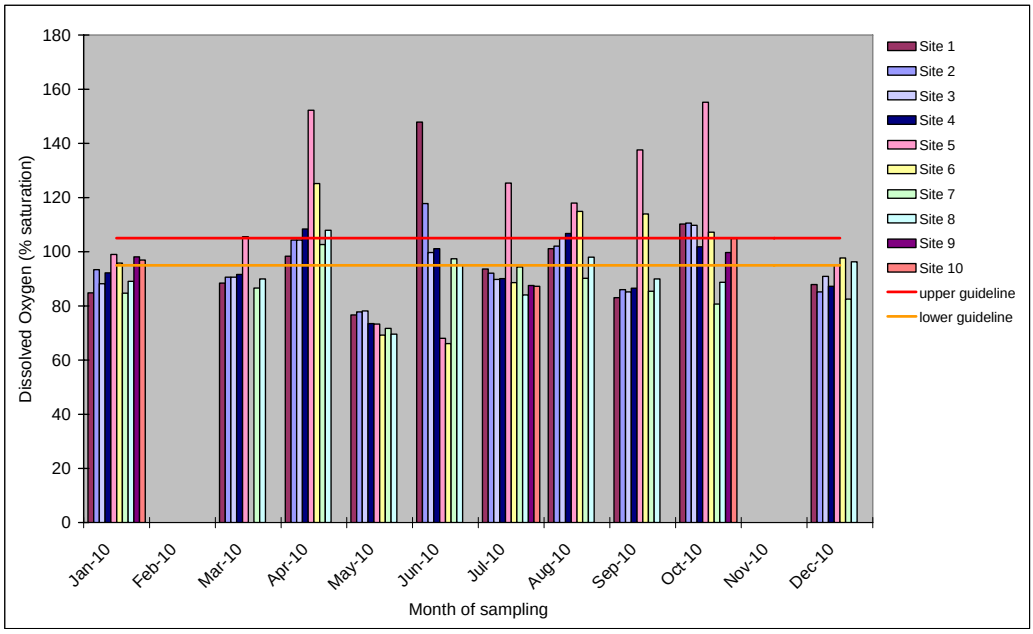

Figure 5-3: ***In-situ*** **measurements of dissolved oxygen (% saturation) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red and orange lines indicate 80th and 20th percentile guidelines for the QWQG.**

5.2.3 Turbidity

A general trend emerged across all events for Sites 1, 2, and 7, with turbidity being consistently higher at these sites compared to the other sites (Figure 5-4). Sites 1 and 2 are the most upstream sites along the Brisbane River, and Site 7 is the shallowest site at high tide and located within the boat passage which channels flow out of the Brisbane River from between Sites 1 and 2. Exceedances of the QWQG for turbidity occurred mainly at Sites 1, 2 and 7, though turbidity at some other sites was above guideline levels in January, March and December. July and August were the only months where no exceedances of guideline levels for turbidity were recorded. This period corresponds with a period of relatively low rainfall.

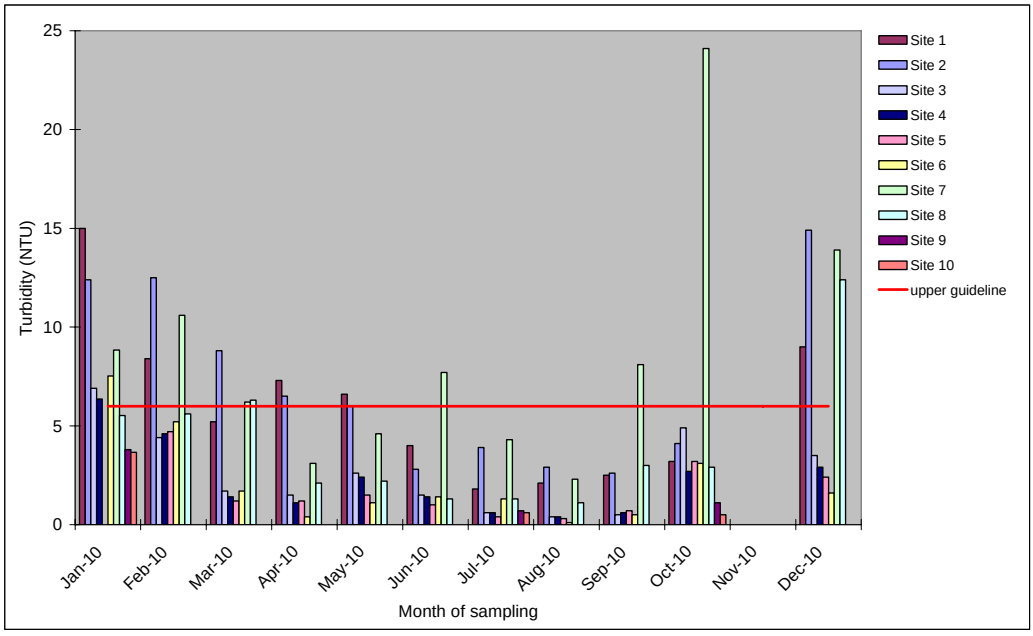

Figure 5-4: ***In-situ*** **measurements of turbidity (NTU) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile guideline for the QWQG.**

5.3 Laboratory analysed data

5.3.1 Monthly Program

The statistical summary data for each analyte and site is presented in Appendix B.

5.3.1.1 Suspended solids

Suspended solids peaked during the March sampling event and were well above the QWQG (DERM, 2009) levels at all sites at this time (Figure 5-5). Interestingly, the March peak TSS levels corresponded with relatively low turbidity levels (Figure 5-5), so are perhaps related to phytoplankton blooms rather than suspended sediments. However, Chlorophyll-a data show that chlorophyll levels in March were also relatively low (Figure 5-6), so if phytoplankton blooms were responsible, this would most likely have related to non-chlorophyte taxa.

Sites 1, 2 and 7, which tended to be more turbid than other sites (Figure 5-4), recorded elevated TSS levels on several occasions so turbidity at these sites is likely to have influenced the TSS results shown here. On the other hand, the high turbidity recorded at Site 7 in October (24.1NTU) was not reflected in the TSS results for the same period. The rainfall events in February and December also appeared to have little influence on the TSS results for the program. TSS exceedances in August also corresponded to low turbidity. Therefore, there is no direct relationship between turbidity and TSS and the mechanisms for driving high TSS and turbidity require further investigation.

5.3.1.2 Chlorophyll a

Chlorophyll a levels varied inconsistently between sites and sampling occasions (Figure 5-6). The results were all above the QWQG (2009) recommended maximum levels at all sites in January, October and November, and at most sites in February. As would be expected, given the phytoplankton production is determined partly by temperature, Chlorophyll a levels were lower over the cooler months from July to September.

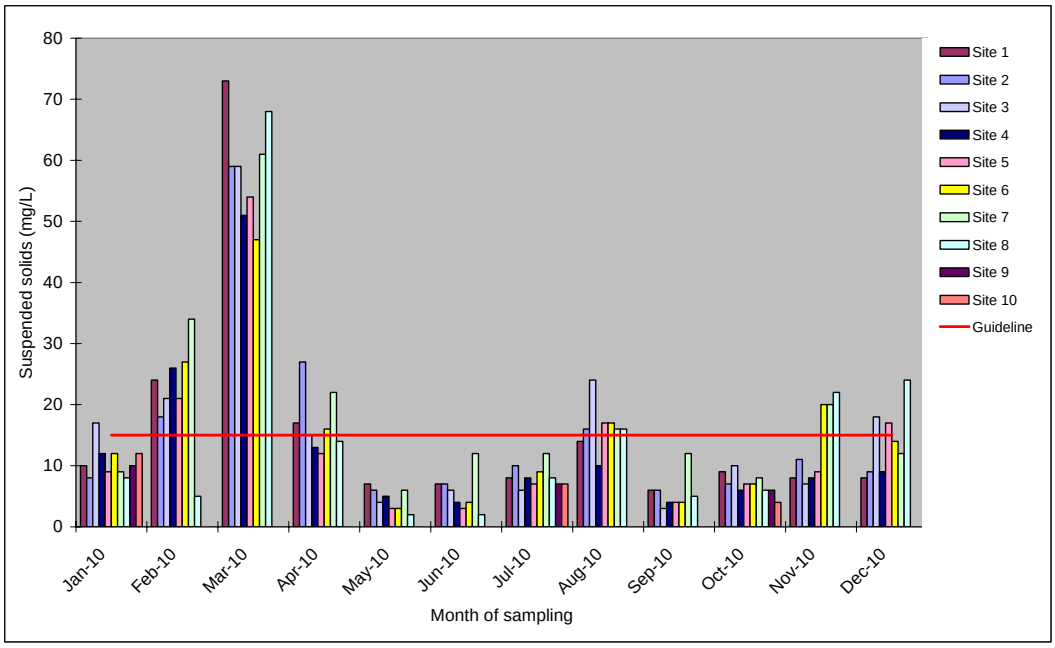

Figure 5-5: **Suspended solids (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile for the QWQG.**

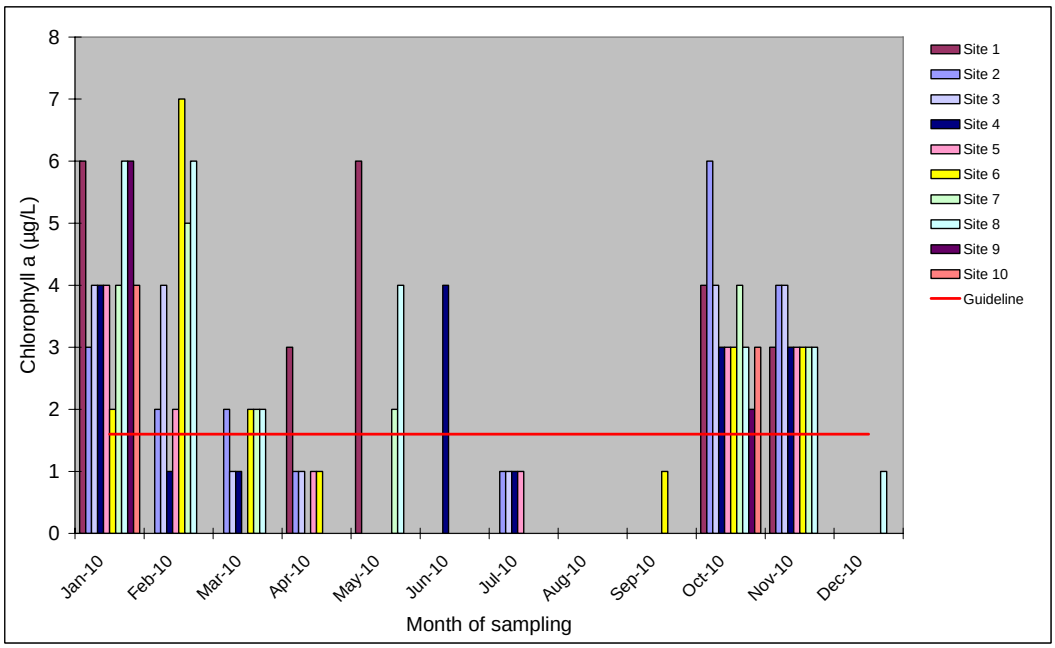

Figure 5-6: **Chlorophyll a (µg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile for the QWQG.**

5.3.1.3 Nutrients

Total Phosphorus (TP) (Figure 5-7) and Total Nitrogen (TN) (Figure 5-8) concentrations were consistently higher at Sites 1 and 2 in comparison to other sites. TP levels at the same two sites exceeded recommended guideline levels in 9 out of the 12 months, while TN levels exceeded guideline levels in 4 out of the 12 events. Extremely high TN and TP levels were recorded at Sites 1 and 2 during the December sampling event. These results show that TN and TP were consistently higher within the Brisbane River than those sites in Moreton Bay around the Port of Brisbane.

Oxidised Nitrogen results (NOx) were routinely above the 80th percentile recommended guidelines set by the QWQG for western bays. The highest NOx level (0.396mg/L) was recorded in May at Site 7 (Figure 5-9). NOx levels were also relatively high at Site 6 in March.

Most ammonia results were below the LOR and were therefore not included as part of the graphed data presented in this report. However, those that were recorded were above the recommended QWQG values for western bays are presented in Figure 5-10. In November, 7 out of 8 sites recorded elevated Ammonia levels, while in May, 50% of sites monitored had elevated ammonia levels. The highest ammonia concentrations were recorded from Sites 1, 2 and 7 in December.

The high concentration of nutrients recorded in December are probably the result of the large volume freshwater releases from Wivenhoe Dam and high rainfall events influencing elevated nutrient stormwater inflows to the Brisbane River.

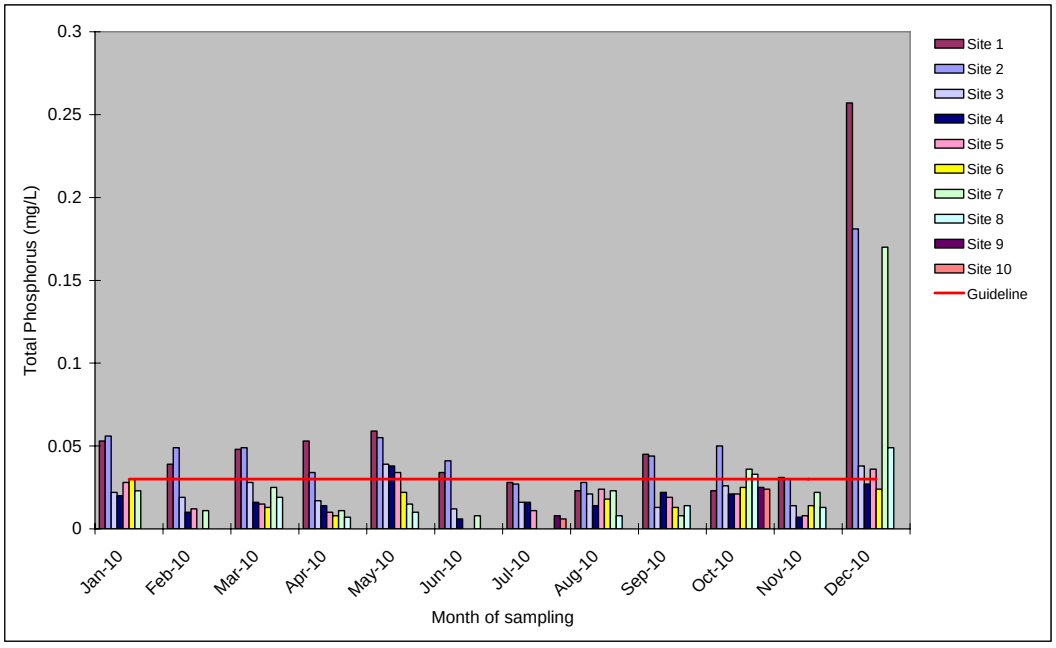

Figure 5-7: Total Phosphorus (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile for the QWQG.

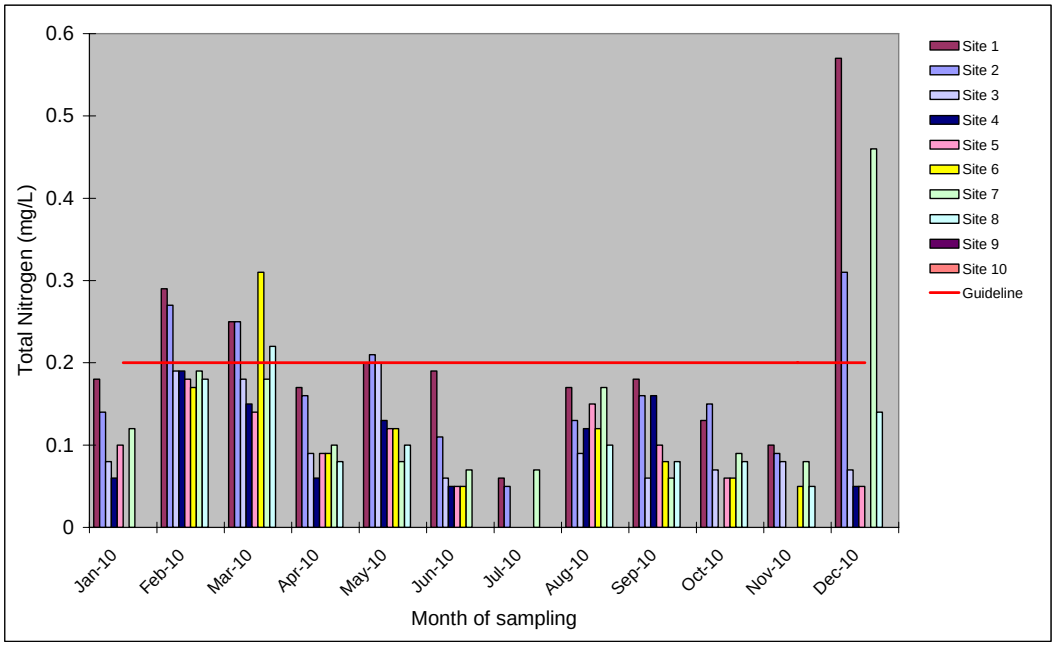

Figure 5-8: **Total Nitrogen (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile for the QWQG.**

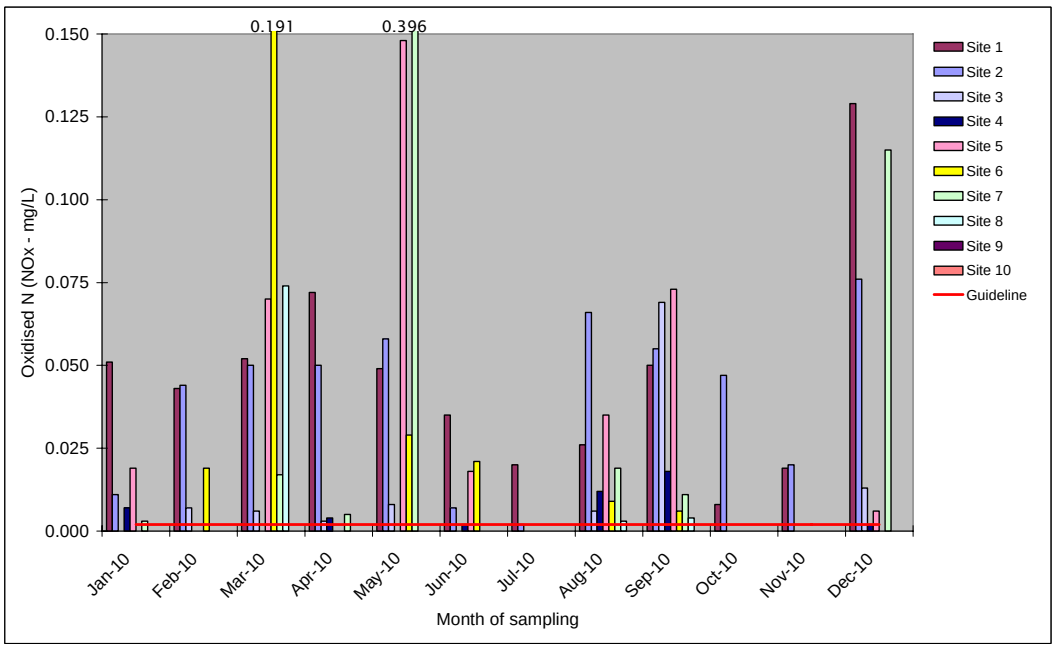

Figure 5-9: **Oxidised Nitrogen (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 80th percentile for the QWQG.**

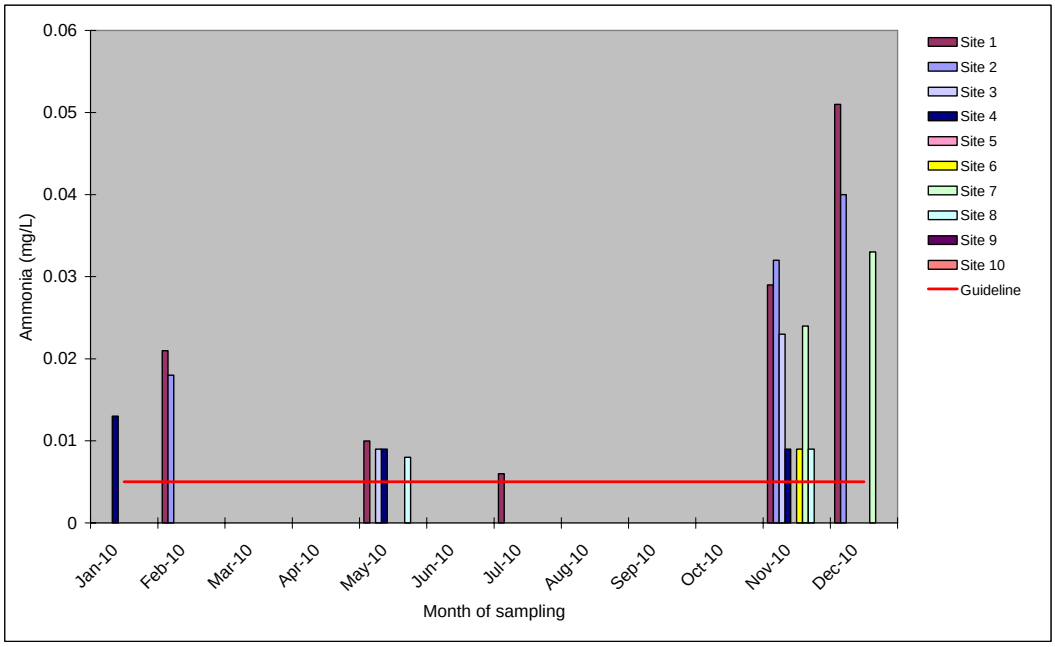

Figure 5-10: Ammonia (mg/L) recorded mid-column at each site during the monthly WQMP, January to June 2010. Red line indicates 80th percentile for the QWQG.

5.3.1.4 Metal levels

A total of seven of the metals measured for this program had established guidelines, and a summary of the results obtained for these metals is given below:

- Total Cadmium - all results were less than LOR/less than guideline.
- Total Chromium - all results well below guideline.
- Total Copper - 4 results above guideline, most results less than LOR (Figure 5-11).
- Total Lead - all results in February at all sites were above the guideline, other results below guideline or LOR (Figure 5-12).
- Total Nickel - all results less than guideline and/or LOR.
- Total Zinc - results detected at greater than the limit of reporting, were all below guideline (December),
- Total Mercury - no results recorded above the LOR/guideline.

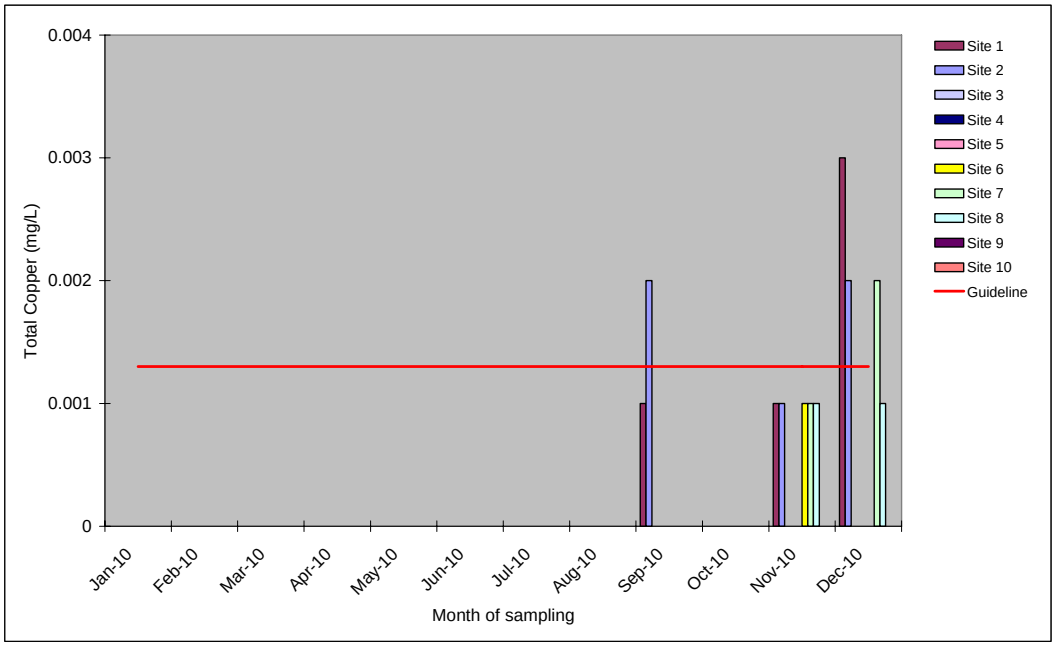

Figure 5-11: Total Copper (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 95% level of protection for the ANZECC guideline.

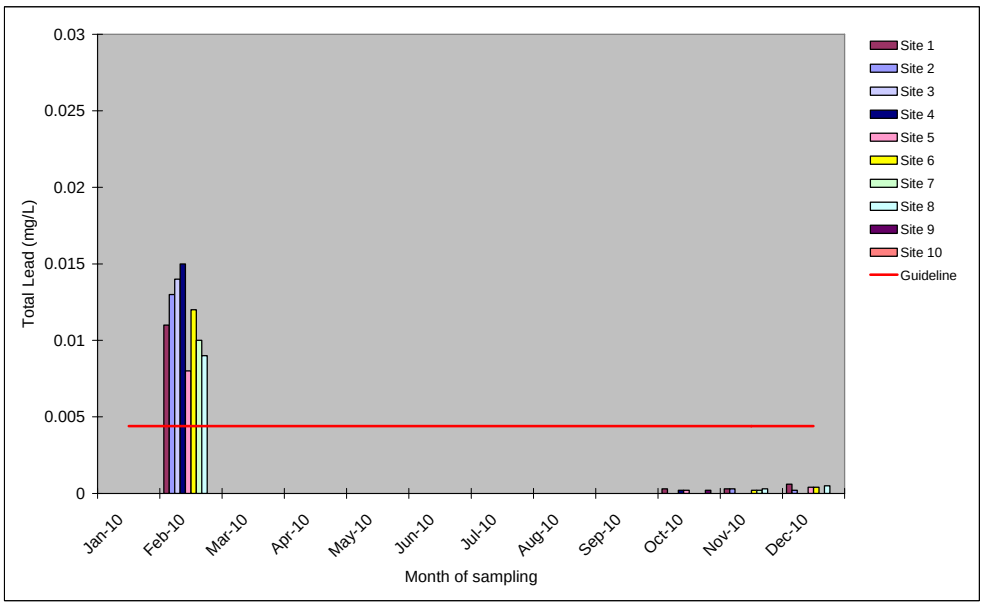

Figure 5-12: Total Lead (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 95% level of protection for the ANZECC guideline.

Where the total metals levels were above guidelines, further investigation was warranted based on dissolved metals results as this form is more bioavailable to aquatic fauna. Results for relevant dissolved metals analysis are summarised below:

- Copper - one result from Site 1 in December remained above the guideline (Figure 5-13).
- Lead - most dissolved lead results were also above the guidelines in February (Figure 5-14).

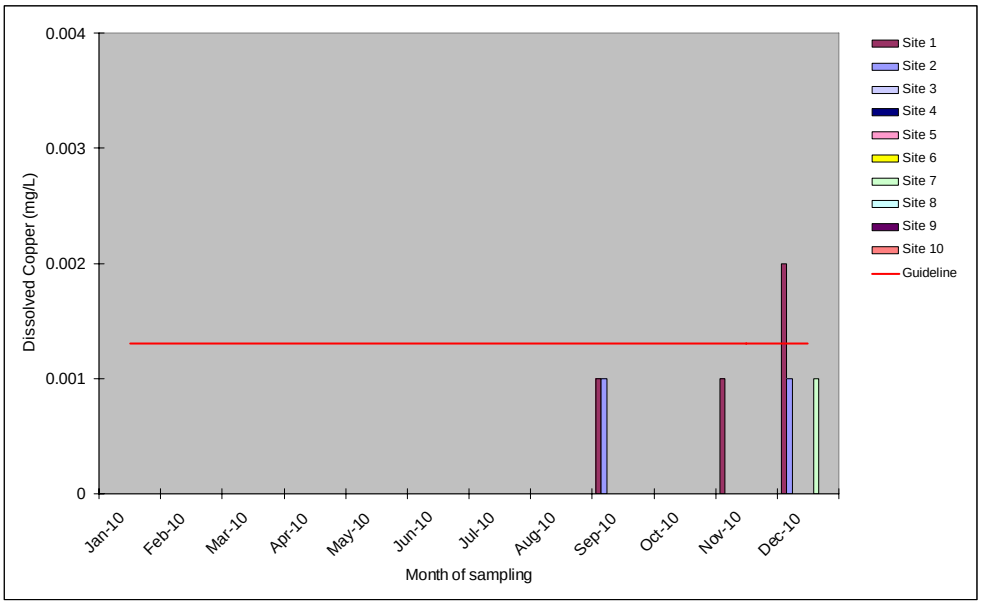

Figure 5-13: Dissolved Copper (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 95% level of protection for the ANZECC guideline.

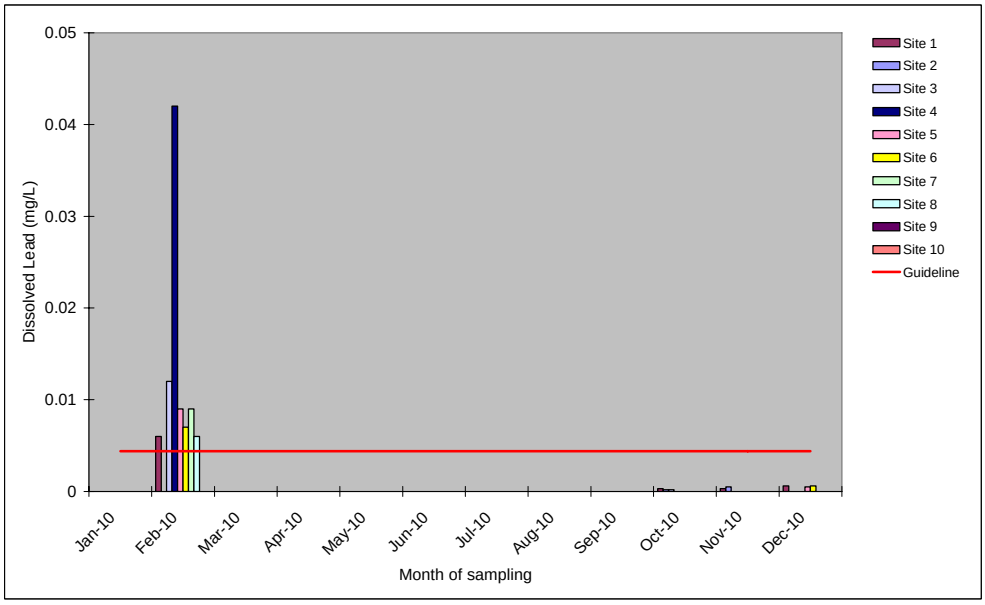

Figure 5-14: Dissolved Lead (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010. Red line indicates 95% level of protection for the ANZECC guideline.

A summary of the remaining Total Metal results where there is no guideline assigned is as follows:

- Total Aluminium - was recorded at various concentrations throughout the program, with 9 results recorded greater than 0.5mg/L (Figure 5-15). The highest result was measured at 0.92mg/L at Site 1 in April. No consistently high results were recorded at any one site. The October to December period was the only period where total aluminium levels above LOR were detected at most of the sites monitored.
- Total Manganese - was detected at all sites above 0.01mg/L concentration on at least two occasions over the monitoring program (Figure 5-16).
- Total Arsenic - all results were recorded below the initial LOR of 0.05mg/L. Trace levels were detected when the LOR was reduced for the final three months; however, these levels were less than 0.002mg/L.
- Total Selenium - was not detected in any samples above the LOR over the monitoring period.
- Total Iron - results were variable over the program, with generally higher results recorded from all sites in January (Figure 5-17).

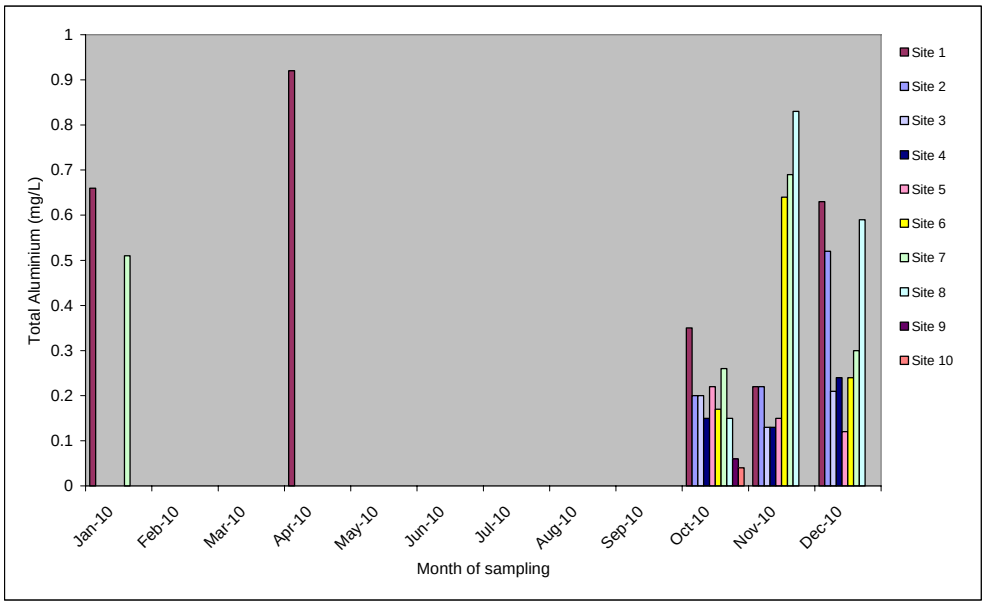

Figure 5-15: Total Aluminium (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010.

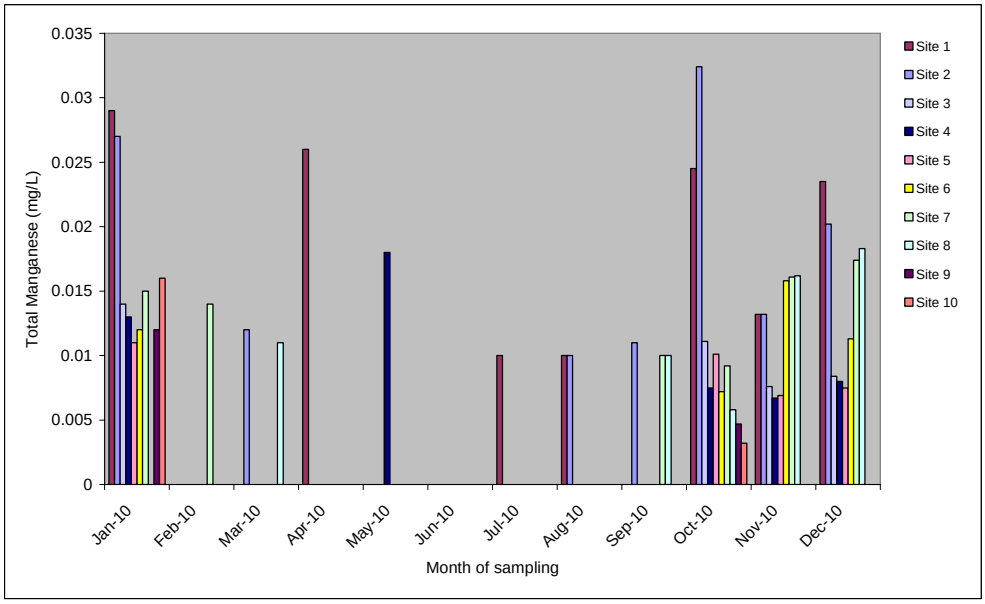

Figure 5-16: Total Manganese (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010.

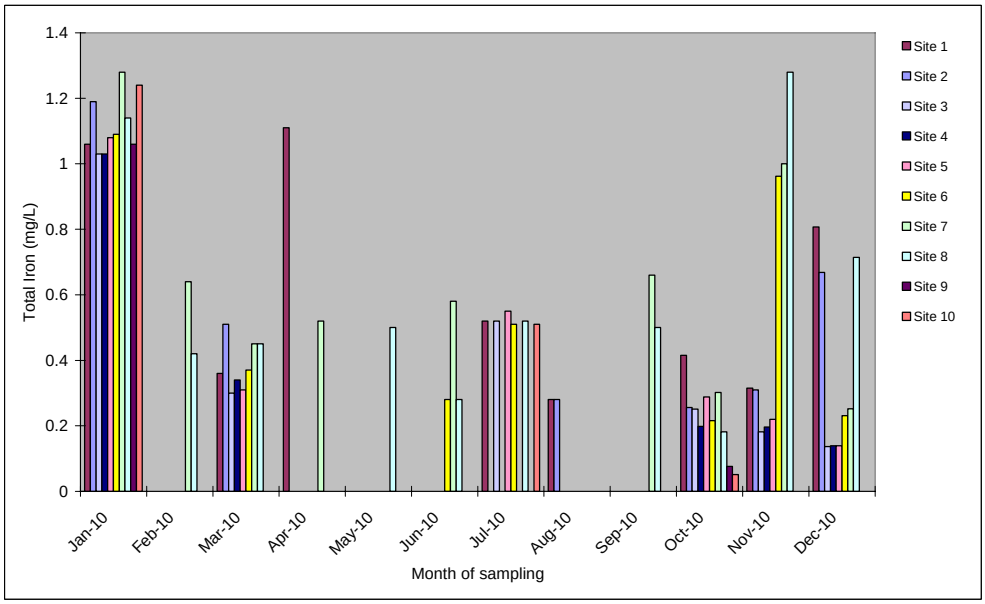

Figure 5-17: Total Iron (mg/L) recorded mid-column at each site during the monthly WQMP, January to December 2010.

5.3.2 Quarterly program

The three parameters where guideline trigger levels apply include:

- TPH (C6-C36) - <10µg/L,
- Napthalene - <70µg/L, and
- Tributyltin - <0.006µg/L.

The detection limits for TPH were not low enough to meet the guidelines (20-100 µg/L); however, all results were recorded below the LOR's suggesting concentrations of TPH, if present, would be in the lower range across all quarterly monitoring programs.

Napthalene was not detected in the water column at concentrations above the LOR of 1µg/L across all sites during all sampling events.

Tributyltin was only recorded above the guideline on one occasion at one site (Site 5) during the April sampling event. Apart from this all remaining results were below the LOR. The result from Site 5 was questioned immediately after receipt of the results in April, and the laboratory quality checks indicated that there were no QA issues associated with this result.

5.4 Site comparisons

The complete dataset for Sites 1 to 8 were assessed and compared using an NMDS ordination based upon site as a factor (Figure 5-18), and month as a factor (Figure 5-19). All sites recorded mixed results over the monitoring program, with no obvious consistent grouping of individual sites based upon the water quality data recorded. Although Sites 1 and 2 were outliers on two occasions (September and December), Site 7 on one occasion (December) and Site 4 on one occasion (February). There were, however, apparent groupings of sites based upon the sampling event (month), although not all months. These ordinations imply that, based upon the complete dataset, most sites would be similarly influenced by seasonal/natural changes.

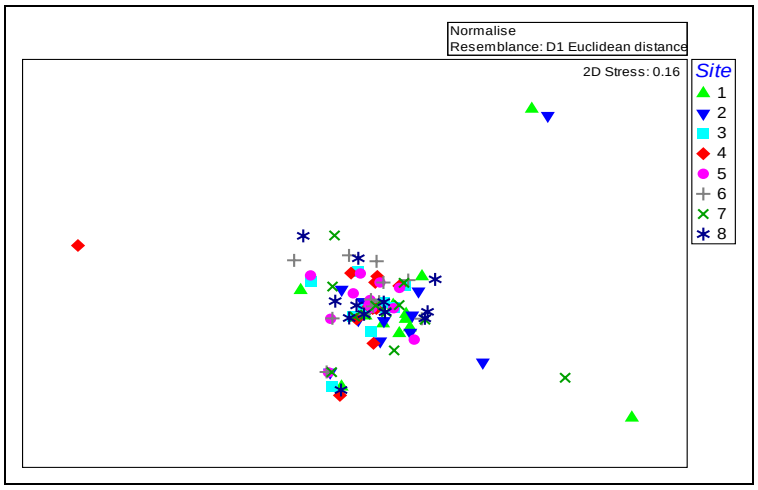

Figure 5-18: NMDS of laboratory analysed monthly water quality data between January and December 2010, with site as the factor.

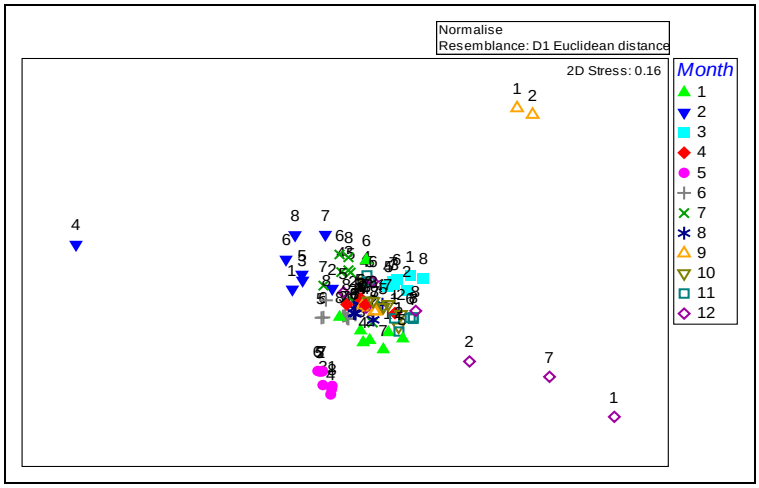

Figure 5-19: NMDS of laboratory analysed monthly water quality data between January and December 2010, with month of sampling as the factor.

Kruskal-Wallis tests between sites based upon individual parameters highlighted significant differences between sites in relation to NOx, TN and TP results recorded across the monitoring program. Box and Whisker plots are presented for these three parameters in Figure 5-20.

Sites 1, 2 and 7 consistently recorded higher and more variable Total Nitrogen and Total Phosphorus results than remaining sites. Site 7 also recorded the highest mean Oxidised Nitrogen result, which would be assumed to relate to inputs from the Brisbane River and stormwater outlet from the Port of Brisbane.

Sites of close proximity (i.e. 1 vs 2, 3 vs 4, 5 vs 6, 7 vs 8) were also assessed against each other and there were no significant differences within each group[1].

An assessment of grouped site comparisons (i.e. Group 1 = Site 1 and 2; Group 2 = Site 3 and 4; Group 3 = Site 5 and 6; Group 4 = Site 7 and 8) revealed significant differences between site groups based on Total Aluminium, Total Manganese and Total Nickel concentrations and the same nutrients highlighted in the individual site assessment (NOx, TN and TP). Box and Whisker plots for each parameter are presented in Figure 5-21.

Three of the six significant parameters were highest among Group 1 sites (Sites 1 and 2) in comparison to the other groups, while Group 4 sites (Sites 7 and 8) recorded the highest mean concentrations for the remaining three parameters. Group 2 (Sites 3 and 4) located in the mouth of the Brisbane River and in the shipping channel, and Group 3 (Sites 5 and 6) located around the north eastern point of the Port of Brisbane and into Moreton Bay, appear to have limited variability in terms of the concentrations of these parameters.

[1] Those parameters that recorded results above the LOR.

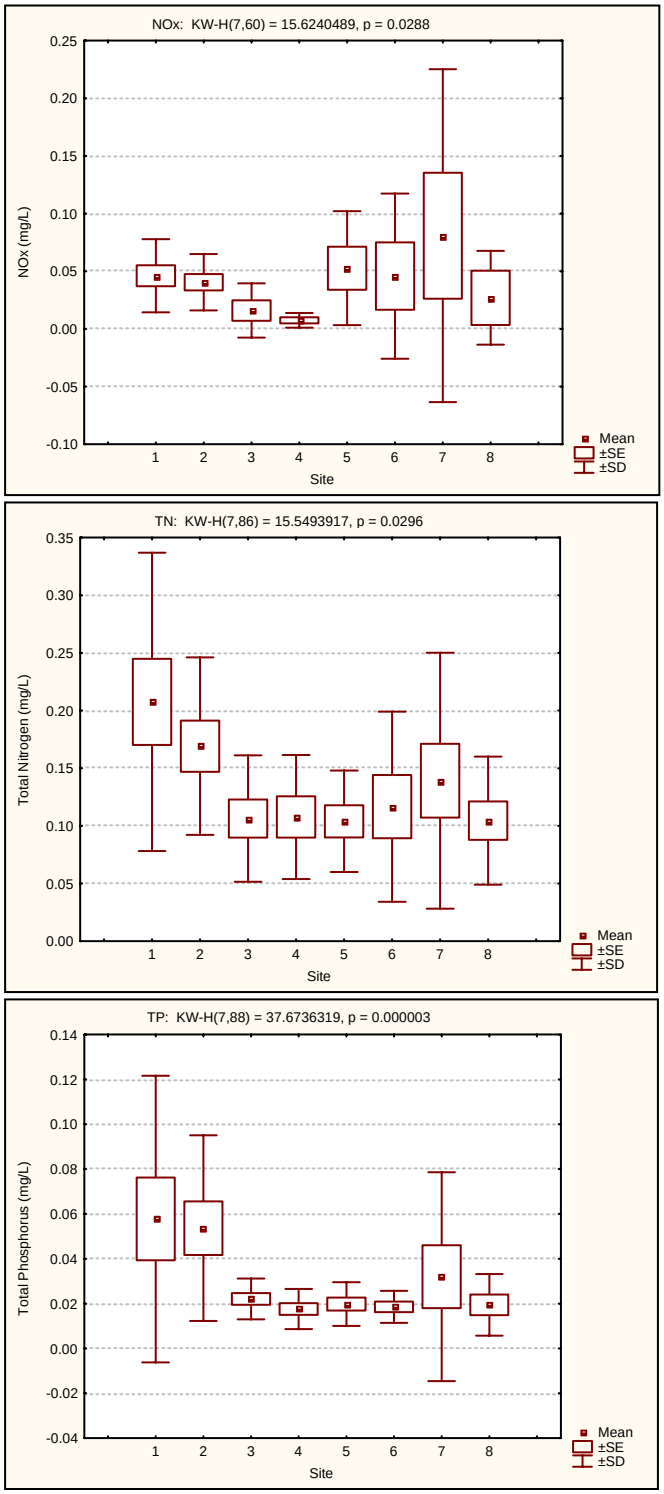

Figure 5-20: Box and Whisker plots for Oxidised Nitrogen (NOx), Total Nitrogen (TN), and Total Phosphorus (TP) results measured at each site on a monthly basis between January and December, 2010.

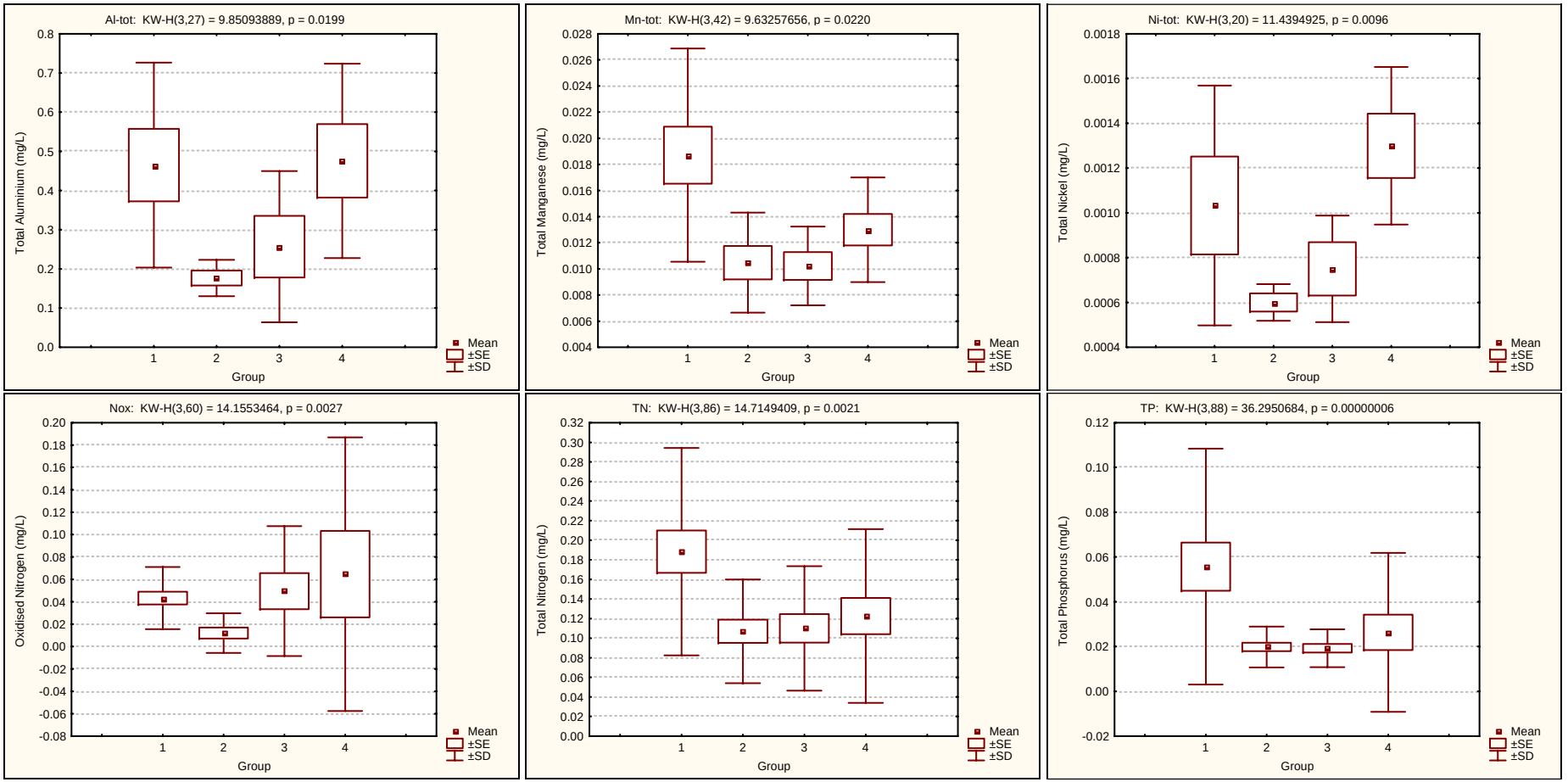

Figure 5-21: Box and Whisker plots for monthly water quality parameters with significant differences between groups, January and December, 2010. Group 1 = Sites 1 and 2, Group 2 = Sites 3 and 4, Group 3 = Sites 5 and 6, and Group 4 = Sites 7 and 8.

6 Conclusions

In January 2010, PBPL commenced a receiving water quality pilot monitoring program to complement its existing environmental monitoring program. The objective of the program was to enhance PBPL's understanding of the quality (and variation in quality) of the receiving waters surrounding the Port by providing improved spatial coverage, sampling frequency and the range of water quality analytes. The results were to be used to provide a benchmark against which impacts of planned development activities in the Port can be measured; while also characterising the background water quality, and its variability, adjacent to the Port.

Data was also collected with the aim to better inform the Department of Environment and Resource Management's (DERM) licensing conditions for receiving water quality within the Port.

A summary of the results of the 12 month monitoring program are as follows:

- Weather conditions were variable over the program, with two high rainfall events occurring within days, or on the day of, the sampling program.
- Vertical profiling results indicated no stratification of the water column at all sites over all events, with the exception of December. The December event measured a freshwater top layer over the dense seawater layer at sites within the Brisbane River (Sites 1 and 2). This occurrence would be related to the large volume releases from Wivenhoe Dam and high rainfall recorded during this time period.
- A general trend emerged across all events for Sites 1, 2, and 7 with the turbidity data consistently higher at these sites compared to the other sites. Sites 1 and 2 are the most upstream sites along the Brisbane River, and Site 7 is the shallowest site at high tide and located within the boat passage which channels some flow out of the Brisbane River between Sites 1 and 2 on an outgoing tide. Thus, Sites 1 and 2 results would be heavily influenced by inputs from the Brisbane river catchment and stormwater runoff, while results for Site 7 would be heavily influenced by wind-wave and boat wave re-suspension of sediment.
- Suspended solids peaked during the March sampling event and were well above the QWQG levels at all sites at this time. Interestingly, the March peak TSS levels correspond with relatively low turbidity levels, so are perhaps related to phytoplankton blooms rather than suspended sediments. However, Chlorophyll-a data show that chlorophyll levels in March were also relatively low, so if phytoplankton blooms were responsible, this would most likely have related to non-chlorophyte taxa.
- Sites 1, 2 and 7, which tended to be more turbid than other sites, recorded elevated TSS levels on several occasions so turbidity at these sites is likely to have influenced the TSS results shown here. On the other hand, the high turbidity recorded at Site 7 in October (24.1NTU) was not reflected in the TSS results for the same period. The rainfall events in February and December also appeared to have little influence on the TSS results for the program. TSS exceedances in August also corresponded to low turbidity. Therefore, there is no direct relationship between turbidity and TSS and the mechanisms for driving high TSS and turbidity require further investigation.
- A total of seven of the metals measured for this program had established guidelines, of which Total Copper (four results) and Total Lead (all February results) recorded measurements in exceedance of the guidelines. Investigation into the dissolved concentrations of these metals found one dissolved Copper and most February results for dissolved Lead exceeded guideline levels.
- Elevated Tributyltin levels were recorded on one occasion only, in April at Site 5.
- TPH and PAH levels were all below the LOR across all sampling events at all sites.

- Site 8 was assessed against 'high ecological value' guidelines under the assumption the site was located within the high ecological value marine waters of Waterloo Bay. Most results were recorded around the 20th percentile value or 99% level of protection guidelines.
- Limitations exist for the assessment of metals levels against guideline levels based on 99% level ecosystem protection as numerous results were below the LORs applied for this study and the majority of those LORs were above the guidelines for this level of ecosystem protection. Should Site 8 be determined to be located within the boundaries of the 'high ecological value' zone in Waterloo Bay, and this site remained in the future program scope, a review of the testing methods and LOR's would be required to ensure appropriate detection limits were applied.
- Site comparisons, based upon the complete data set, found mixed results over the monitoring program, with no obvious grouping of individual sites based upon the combined water quality data set. There were, however, apparent groupings of sites based upon the sampling event (month). These ordinations suggest that, based upon the complete dataset, most sites would be similarly influenced by seasonal/natural changes.
- Sites 1, 2 and 7 recorded consistently higher and more variable Total Nitrogen and Total Phosphorus results than remaining sites, with Site 7 also recording the highest mean Oxidised Nitrogen result, which would be assumed to relate to inputs from the Brisbane River and stormwater outlet from the Port of Brisbane.
- Sites of close proximity (i.e. 1 vs 2, 3 vs 4, 5 vs 6, 7 vs 8) were also assessed against each other and there were no significant differences within each group,
- An assessment of grouped site comparisons resulted in a number of significant differences, including Total Aluminium, Total Manganese and Total Nickel, and the nutrients highlighted in the individual site assessment (NOx, TN and TP).

Overall, the pilot program highlighted minimal issues in relation to metal concentrations, and the presence of TPH and PAH compounds within the waters surrounding the Port of Brisbane in 2010. However, a general trend did emerge across most events at Sites 1, 2, and 7, with turbidity and nutrient concentrations consistently higher at these sites compared to other sites further out in the bay.

This program has provided a useful background dataset to provide a benchmark against which impacts of planned development activities in the Port can be measured, although, the recent major flooding event of January 2011 may have created a shift in water quality which currently has not been accounted for. A continuation of the water quality monitoring program is strongly recommended to determine any long term changes to the waters surrounding the Port after this major natural disaster event.

7 Recommendations

The aim of the pilot WQMP is to provide baseline water quality data for the receiving waters surrounding the Ports operations. Typical water quality issues when considering the value of aquatic ecosystems, and their associated common pollutants and stressors, are presented in Table 7-1.

Table 7-1: Water quality issues that commonly affect the aquatic ecosystem environmental value of water and their associated pollutants and stressors (from DEWHA, 2002).

Environmental value	Common water quality issues	Common pollutants and stressors
Aquatic Ecosystems	Death/stress of aquatic organisms	Low dissolved oxygen, toxicity (algal blooms or chemical contamination), habitat modification, or altered habitat condition (sediment, algal blooms), acidic waters, heavy metals.
	Loss of seagrasses	Nutrients and turbidity
	Smothering of benthic fauna	Suspended sediments
	Loss of spawning trigger for fish	Altered temperatures
	Loss of aquatic plants	Acidic waters

All of these potential pollutants are included as part of the pilot WQMP, with the exception of algal identification and enumeration. The inclusion of algal identification and enumeration as part of an ongoing WQMP would provide some insight as to whether or not the higher suspended solids (TSS) levels observed in this study are attributable to non-chlorophyte algal taxa, or to some other factor. If high TSS levels are associated with non-chlorophyte algal taxa, this would shed light on the ecosystem response to nutrients delivered to the system through diffuse runoff upstream of the port. Such information may be useful for predicting potential impacts as part of future port expansions.

- **Consider inclusion of algal assessment into the monitoring program.**

Currently, the pilot WQMP involves sampling on a monthly basis. While this provides characterisation of the within-year variability in water quality, it does not necessarily take into full account the temporal variability associated with catchment runoff during storm events. The characterisation of the effects of stormwater runoff on the quality of receiving waters around the Port is required to assess the assimilation capacity of the study area, as any impacts of port expansion development would be additive to those associated with runoff from urban stormwater, agricultural land and other land uses in the catchment upstream. If event-based monitoring has not already been considered and disregarded by PBPL, it is recommended that event-based sampling be considered as an option to complement the existing WQMP.

- **Consider inclusion of event-based sampling into monitoring program.**

All sites monitored as part of the pilot WQMP are located within the Bramble Bay and Waterloo Bay (part) water areas as outlined in the Environmental Protection (Water) Policy (EPP) 2009. However, based on a qualitative assessment of the map shown in the EPP 2009 South-east Queensland Map Series (Plan WQ1441) (2010), some sites (possibly Site 7 and 8) may be within the zone of 'high ecological value' within the Bramble Bay and Waterloo Bay. Site 8 was assessed against the higher ecological value guidelines in this report which provide guidelines to which there should be '*no change*' in the ecological condition in this zone. Although most results were within the guidelines, there is potential for this site to be naturally impacted by not only the influence of Brisbane River flow through the boat passage, but also from the stormwater run off from the Port of Brisbane.

It is recommended that the location of monitoring sites be plotted on a map overlain with the DERM environmental value boundary dataset.

- **If this site is to remain in the program, determine the location of Site 8 in relation to the 'high ecological value' zone in Waterloo Bay.**

ALS is aware that the pilot WQMP builds on existing monitoring carried out by PBPL, Healthy Waterways and other organisations; hence, there is pressure to reduce/remove redundant programs. This program is directly relevant to the Port of Brisbane as a baseline program designed to provide pre-development water quality data of surrounding waterways to allow for impact assessments/monitoring programs to occur during and post-development should the development be deemed an environmentally relevant activity (ERA) with the potential to impact surrounding waterways. To date the results have shown a high level of nutrient input is transported from the Brisbane River to Moreton Bay. If cost is the main decision factor in relation to the continuation of the program, there are three options available to reduce the overall expenses whilst still providing a worthy outcome:

1. Review and reduce the number of analytes required,
2. Assess cost effectiveness of ultra-trace analysis on some metals, and
3. Consider reducing number of site locations.

The current suite of analytes was selected in the initial design as they were considered directly related to the activities surrounding the Port (refer Table 3-2 and Table 3-3). There are, however, several analytes which do not have corresponding guideline levels, including Total Hardness (and associated anions), five of the 12 metals, and most of the Polynuclear Aromatic Hydrocarbons (PAH) parameters, Removal of these analytes from the program would result in substantial cost savings. In addition, the metals analyses currently includes an assessment of total and dissolved forms of which the ANZECC (2000) guidelines framework suggests first reviewing the total metal content and if levels exceed the guideline, then continue with further investigations to determine the bioavailable or dissolved content of the toxicant. It may be best to continue monitoring based on total metals analyses until the metals that routinely exceed guideline levels becomes known. Subsequent to that, the program could include analysis of dissolved concentrations of those particular metals, thus reducing the need to carry out dissolved metals testing for all metals across all sampling periods.

- **Reduce the number of analytes tested, and reduce metals testing to Total Metals form only (with data review to determine requirement for further dissolved metals analysis)**

It was evident from the results presented in the first eight months of data that the chosen analytical methods were not capable of achieving the originally nominated LOR's due to seawater matrix interference issues. This resulted in instances where the LOR achieved for Lead, Copper and Zinc were above the guideline level for this metal. Obviously if this were to continue, it would make it difficult to make a scientifically robust assessment of trends with regard to these parameters. It is possible to achieve lower LOR's for metals using ultra-trace methods (which did occur for the latter four months of monitoring), but this analysis is more expensive compared to standard methods. The most cost effective approach would be to undertake ultra-trace analysis on the three selected metals only beyond the 2010 program given that the same issue does not apply to other parameters based on the use of the current standard analytical techniques. In addition, the current program design included ultra-trace analysis of nutrients which were required to meet the QWQG's for Ammonia and Oxidised Nitrogen, although standard methods would meet the guideline for Total Nitrogen and Total Phosphorus. Consequently, by grouping the nutrient analysis into an ultra-trace suite, it is more cost-effective than itemising the nutrient components into separate methods.

- **Apply ultra-trace analytical techniques to Copper, Lead and Zinc metals only to ensure results meet ANZECC (2000) Guidelines. Remaining metals can be assessed using standard analytical techniques.**
- **Retain nutrient ultra-trace analysis for future programs.**

Mud Island sites (Sites 7 and 8) were only assessed on three occasions and there was minimal variation in results for these sites with no concentrations of analytes recorded above the guideline limits.

- **Remove Mud Island sites from the program as they did not add value to the objectives of the program.**

The site comparisons assessment resulted in little differences between site data over the monitoring program. Sites within close proximity (i.e. 1 vs 2, 3 vs 4, 5 vs 6, 7 vs 8) were also assessed against each other and there were no significant differences within each group, therefore leading to a between group assessment. The group assessment found several differences in water quality across the monitoring program suggesting the general location of these groups are suitable to provide an overall assessment of water quality surrounding the port.

- **Reduce the number of site locations from 8 to 4 to reduce costs.**

Ecosystems need to be protected against not only long term chronic effects caused by low levels of pollutants but also against acute effects caused by exposure to short pulses of high levels of pollutants (DERM, 2009). From an environmental management perspective, it is important that compliance issues relating to all these different scenarios are addressed. It is also important that compliance is placed in a context of natural variability that occurs in the environment. Therefore, it is normally suggested that baseline monitoring be carried out over several years to assess the extent of both seasonal and inter-annual variation and to provide a strong basis for future comparisons (DEWHA, 2002). DERM (2009) also states that parameters such as nutrients and suspended solids may not immediately influence biota but have a more long term impact (i.e. seagrass communities, coral reefs), therefore monitoring over a long term period is essential.

In addition, this program was undertaken during a major La Nina event. Thus results may or may not reflect general ambient conditions. In some ways, fewer exceedances might be expected for turbidity, nutrients and metals during normal years or El Nino years than observed in this study, but the extent to which this is the case cannot be predicted based on the 2010 results. Further to this, a major flood event occurred in January 2011. This event resulted in a plethora of (and probably unprecedented amounts of) pollutants entering the system through agricultural runoff, storm water runoff and the unplanned release of untreated sewage as result of wastewater treatment plant failure. This event has been deemed so significant by DERM that substantial monitoring effort in Moreton Bay is now underway to assess the impacts associated with this. The current monitoring program was not extended to cover the effects of the flood event and, in any case, boat navigation in January was too hazardous for sampling to take place in the weeks shortly after that event occurred. Given that such a substantial disturbance event has occurred, the results presented in this study are unlikely to be indicative of ongoing conditions in the study area, with potential marked changes to the system and an acute shift in water quality. It is therefore highly recommended that this monitoring program be extended at least for several months (or several sampling rounds spread over the next year) to capture the impacts of the January 2011 flood event on water quality conditions in the study area.

- **Continue program for a further 4 years minimum to provide a strong baseline dataset for future comparisons (i.e. for DA assessments etc).**
- **Strongly consider carrying out sampling over the next few months to assess the impacts of the January 2011 flood on water quality in the study area.**

8 References

ANZECC and ARMCANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality, Volume 1. National Water Quality Management Strategy: No. 4.

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Appendix A - Vertical profile summary statistics

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
1	pH	Max	8.03	8.13	8.13	8.11	8.17	8.14	8.49	8.11	8.13	8.20	0	8.01	
1	pH	Min	8.02	8.11	8.12	8.10	8.16	8.14	8.38	8.06	8.11	8.14	0	7.34	
1	pH	Range	0.01	0.02	0.01	0.01	0.01	0.00	0.11	0.05	0.02	0.06	0	0.67	0.09
1	EC	Max	55.24	52.30	51.05	51.29	50.58	52.67	54.46	52.67	52.73	46.24	0	46.60	
1	EC	Min	54.84	51.04	50.77	50.75	50.30	52.39	53.57	52.46	52.37	35.24	0	7.09	
1	EC	Range	0.40	1.26	0.28	0.54	0.28	0.28	0.89	0.21	0.36	11.00	0	39.51	5.00
1	Salinity	Max	36.50	34.39	33.49	33.73	33.23	34.76	35.97	34.59	34.71	29.94	0	30.35	
1	Salinity	Min	36.44	34.33	33.28	33.70	33.22	34.57	35.32	34.42	34.46	22.24	0	3.83	
1	Salinity	Range	0.06	0.06	0.21	0.03	0.01	0.19	0.65	0.17	0.25	7.70	0	26.52	3.26
1	DO (%sat.)	Max	86.60	*	88.70	99.60	77.80	151.90	95.10	101.90	83.80	110.20	0	92.50	
1	DO (%sat.)	Min	84.70	*	86.60	97.00	75.00	146.60	91.60	99.10	80.90	103.30	0	83.30	
1	DO (%sat.)	Range	1.90	*	2.10	2.60	2.80	5.30	3.50	2.80	2.90	6.90	0	9.20	4.00
1	Turbidity	Max	15.00	11.80	9.10	10.60	9.80	4.30	2.60	2.90	8.00	6.60	0	47.00	
1	Turbidity	Min	15.00	8.30	4.80	4.30	5.20	3.10	1.80	2.00	2.10	2.90	0	5.80	
1	Turbidity	Range	0.00	3.50	4.30	6.30	4.60	1.20	0.80	0.90	5.90	3.70	0	41.20	6.58
1	Water temp	Max	29.31	26.54	25.75	23.75	19.37	17.02	13.21	11.48	13.57	15.41	0	25.14	
1	Water temp	Min	29.10	26.31	25.67	23.22	19.30	16.88	12.94	11.41	13.20	14.42	0	24.60	
1	Water temp	Range	0.21	0.23	0.08	0.53	0.07	0.14	0.27	0.07	0.37	0.99	0	0.54	0.32
2	pH	Max	8.06	8.12	8.13	8.13	8.17	8.15	8.46	8.11	8.10	8.19	0	7.93	
2	pH	Min	8.05	8.11	8.12	8.13	8.17	8.15	8.39	8.09	8.08	8.15	0	7.75	
2	pH	Range	0.01	0.01	0.01	0.00	0.00	0.00	0.07	0.02	0.02	0.04	0	0.18	0.03
2	EC	Max	56	51.82	51.02	51.71	50.36	52.78	54.48	52.69	52.47	42.49	0	39.7	
2	EC	Min	54.75	51.72	50.41	51.69	50.34	52.59	54.45	52.42	52.39	39.76	0	20.93	
2	EC	Range	1.25	0.1	0.61	0.02	0.02	0.19	0.03	0.27	0.08	2.73	0	18.77	2.19
2	Salinity	Max	37.04	34.03	33.47	34.02	33.08	34.84	36	34.59	34.54	27.32	0	25.31	
2	Salinity	Min	36.12	33.97	33.03	34.02	33.06	34.7	35.98	34.38	34.47	25.4	0	12.49	
2	Salinity	Range	0.92	0.06	0.44	0	0.02	0.14	0.02	0.21	0.07	1.92	0	12.82	1.51
2	DO (%sat.)	Max	99.4	*	92	104.4	77.9	118.9	94.1	102.7	86.9	111.2	0	88.8	
2	DO (%sat.)	Min	89.6	*	90.2	103.7	77.6	114.2	86.2	101.9	84.5	105.9	0	79.9	
2	DO (%sat.)	Range	9.8	*	1.8	0.7	0.3	4.7	7.9	0.8	2.4	5.3	0	8.9	4.26

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
2	Turbidity	Max	12.4	13.4	11.3	7.3	6	3.1	4	3.3	3	6.1	0	21.2	
2	Turbidity	Min	12.4	9.6	5.2	5	5.3	2.8	3.4	2.9	2.2	2.4	0	10.3	
2	Turbidity	Range	0	3.8	6.1	2.3	0.7	0.3	0.6	0.4	0.8	3.7	0	10.9	2.69
2	Water temp	Max	29.52	26.45	25.62	23.47	19.44	16.94	13.26	11.39	13.61	15.23	0	25.59	
2	Water temp	Min	29.29	26.42	25.6	23.43	19.43	16.84	13.24	11.32	13.49	14.81	0	25.18	
2	Water temp	Range	0.23	0.03	0.02	0.04	0.01	0.1	0.02	0.07	0.12	0.42	0	0.41	0.13
3	pH	Max	8.08	8.17	8.18	8.18	8.21	8.14	8.5	8.14	8.16	8.22	0	8.07	
3	pH	Min	8.06	8.16	8.17	8.18	8.2	8.14	8.42	8.11	8.12	8.17	0	8.02	
3	pH	Range	0.02	0.01	0.01	0	0.01	0	0.08	0.03	0.04	0.05	0	0.05	0.03
3	EC	Max	57.43	54.06	53.39	53.03	51.59	53.93	55.36	53.91	53.69	49.96	0	48.62	
3	EC	Min	57.1	53.42	51.75	52.61	50.97	53.77	55.19	53.75	53.07	44.88	0	41.7	
3	EC	Range	0.33	0.64	1.64	0.42	0.62	0.16	0.17	0.16	0.62	5.08	0	6.92	1.52
3	Salinity	Max	38.16	35.69	35.26	35.01	33.9	35.7	36.63	35.47	35.69	32.67	0	31.72	
3	Salinity	Min	37.91	35.23	34.01	34.7	33.7	35.57	36.51	35.35	35.19	29.01	0	26.9	
3	Salinity	Range	0.25	0.46	1.25	0.31	0.2	0.13	0.12	0.12	0.5	3.66	0	4.82	1.07
3	DO (%sat.)	Max	89.5	*	92.8	105.6	78.2	101.4	90.7	105	87.2	113.4	0	90.9	
3	DO (%sat.)	Min	88	*	89.3	103.2	73.1	97.1	85.4	104	84	108.7	0	84.5	
3	DO (%sat.)	Range	1.5	*	3.5	2.4	5.1	4.3	5.3	1	3.2	4.7	0	6.4	3.74
3	Turbidity	Max	6.9	5.7	2.4	2.8	4.1	1.6	0.7	0.6	0.9	7.7	0	6.8	
3	Turbidity	Min	6.9	3.9	1.4	1.1	2.6	1.2	0.6	0.2	0.5	2.5	0	3.5	
3	Turbidity	Range	0	1.8	1	1.7	1.5	0.4	0.1	0.4	0.4	5.2	0	3.3	1.44
3	Water temp	Max	57.43	54.06	53.39	53.03	51.59	53.93	55.36	53.91	53.69	49.96	0	48.62	
3	Water temp	Min	57.1	53.42	51.75	52.61	50.97	53.77	55.19	53.75	53.07	44.88	0	41.7	
3	Water temp	Range	0.33	0.64	1.64	0.42	0.62	0.16	0.17	0.16	0.62	5.08	0	6.92	1.52
4	pH	Max	8.09	8.18	8.18	8.2	8.22	8.17	8.5	8.15	8.13	8.27	0	8.08	
4	pH	Min	8.08	8.16	8.17	8.18	8.21	8.14	8.44	8.14	8.11	8.22	0	8.04	
4	pH	Range	0.01	0.02	0.01	0.02	0.01	0.03	0.06	0.01	0.02	0.05	0	0.04	0.03
4	EC	Max	57.45	54.46	53.42	53.51	51.77	54.07	55.67	54.37	54.33	49.5	0	49.02	
4	EC	Min	57.42	53.59	52.91	52.52	51.56	53.86	55.31	53.91	53.83	46.15	0	44.88	
4	EC	Range	0.03	0.87	0.51	0.99	0.21	0.21	0.36	0.46	0.5	3.35	0	4.14	1.06

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
4	Salinity	Max	38.17	36	35.26	35.37	34.1	35.8	36.86	35.82	35.87	32.36	0	32.01	
4	Salinity	Min	38.15	35.36	34.86	34.64	33.96	35.65	36.66	35.48	35.54	29.98	0	29.01	
4	Salinity	Range	0.02	0.64	0.4	0.73	0.14	0.15	0.2	0.34	0.33	2.38	0	3	0.76
4	DO (%sat.)	Max	92.9	*	91.6	109.3	74.7	101.8	90.9	106.9	88.6	107.2	0	91.3	
4	DO (%sat.)	Min	89.6	*	90.1	102.8	71.8	94.8	87.7	105.7	86	92.3	0	80.4	
4	DO (%sat.)	Range	3.3	*	1.5	6.5	2.9	7	3.2	1.2	2.6	14.9	0	10.9	5.40
4	Turbidity	Max	6.36	6	1.9	2	3.3	1.5	0.6	0.8	0.7	3	0	3.6	
4	Turbidity	Min	6.36	3.2	1.4	0.8	2.4	1.1	0.5	0.2	0.5	2.3	0	1.9	
4	Turbidity	Range	0	2.8	0.5	1.2	0.9	0.4	0.1	0.6	0.2	0.7	0	1.7	0.83
4	Water temp	Max	29.13	26.46	25.54	23.41	19.37	16.87	13.02	11.42	13.24	14.41	0	25.36	
4	Water temp	Min	28.48	26.3	25.45	23.04	19.26	16.78	12.77	11.36	13.08	14.37	0	25.17	
4	Water temp	Range	0.65	0.16	0.09	0.37	0.11	0.09	0.25	0.06	0.16	0.04	0	0.19	0.20
5	pH	Max	8.08	8.14	8.18	8.14	8.18	8.09	8.41	8.18	8.12	8.27	0	8.09	
5	pH	Min	8.06	8.12	8.14	8.11	8.17	8.09	8.35	8.17	8.08	8.25	0	8.09	
5	pH	Range	0.02	0.02	0.04	0.03	0.01	0	0.06	0.01	0.04	0.02	0	0	0.02
5	EC	Max	57.36	54.46	53.37	53.67	51.8	54.35	56.05	53.76	54.28	49.43	0	50.1	
5	EC	Min	57.25	53.12	52.66	52.7	51.8	54.34	55.77	53.54	53.6	48.76	0	45.9	
5	EC	Range	0.11	1.34	0.71	0.97	0	0.01	0.28	0.22	0.68	0.67	0	4.2	0.84
5	Salinity	Max	38.1	36	35.22	35.49	34.18	36.01	37.16	35.37	35.85	32.33	0	32.86	
5	Salinity	Min	38.01	35.01	34.68	34.7	34.17	36	36.93	35.21	35.34	31.81	0	29.75	
5	Salinity	Range	0.09	0.99	0.54	0.79	0.01	0.01	0.23	0.16	0.51	0.52	0	3.11	0.63
5	DO (%sat.)	Max	99.4	*	108.7	164	74.9	68.3	125.4	121.9	147.1	155.2	0	95.4	
5	DO (%sat.)	Min	96.3	*	103.8	141.7	70.5	66.7	117.2	114.2	132.7	144.5	0	90.7	
5	DO (%sat.)	Range	3.1	*	4.9	22.3	4.4	1.6	8.2	7.7	14.4	10.7	0	4.7	8.20
5	Turbidity	Max	*	4.8	1.3	1.2	1.8	1	0.7	0.5	0.9	3.9	0	2.8	
5	Turbidity	Min	*	4.5	1	0.5	1.2	0.7	0.4	0.3	0.7	3	0	2.2	
5	Turbidity	Range	*	0.3	0.3	0.7	0.6	0.3	0.3	0.2	0.2	0.9	0	0.6	0.44
5	Water temp	Max	28.97	26.52	25.47	23.3	19.1	16.67	12.8	11.33	13.13	14.5	0	25.29	
5	Water temp	Min	28.82	26.14	25.44	22.9	19.08	16.64	12.7	11.24	13.03	14.3	0	25.13	
5	Water temp	Range	0.15	0.38	0.03	0.4	0.02	0.03	0.1	0.09	0.1	0.2	0	0.16	0.15

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
6	pH	Max	8.07	8.18	8.18	8.17	8.18	8.1	8.39	8.1	8.18	8.23	0	8.15	
6	pH	Min	8.05	8.17	8.18	8.16	8.18	8.1	8.38	8.1	8.17	8.22	0	8.15	
6	pH	Range	0.02	0.01	0	0.01	0	0	0.01	0	0.01	0.01	0	0	0.01
6	EC	Max	57.04	53.9	53.02	53.6	52.29	54.4	56.21	53.6	54.38	48.83	0	47.97	
6	EC	Min	57.02	53.72	52.98	53.49	52.28	54.38	56.2	53.57	54.13	48.76	0	47.93	
6	EC	Range	0.02	0.18	0.04	0.11	0.01	0.02	0.01	0.03	0.25	0.07	0	0.04	0.07
6	Salinity	Max	37.86	35.59	34.96	35.44	34.5	36.05	37.28	35.24	35.75	31.9	0	31.26	
6	Salinity	Min	37.85	35.45	34.92	35.36	34.49	36.04	37.28	35.22	35.74	31.84	0	31.23	
6	Salinity	Range	0.01	0.14	0.04	0.08	0.01	0.01	0	0.02	0.01	0.06	0	0.03	0.04
6	DO (%sat.)	Max	95.8	*	98.9	129	69.4	66.3	88.6	114.9	114.8	107.2	0	98.5	
6	DO (%sat.)	Min	95.6	*	98.8	124.2	69.2	66.1	85.5	114.9	113.8	99.6	0	95.8	
6	DO (%sat.)	Range	0.2	*	0.1	4.8	0.2	0.2	3.1	0	1	7.6	0	2.7	1.99
6	Turbidity	Max	7.52	7.7	1.7	1.2	1.4	1.4	1.9	0.2	0.7	3.1	0	2.3	
6	Turbidity	Min	7.52	4.4	1.1	0.4	1.1	1.4	1.3	0.1	0.5	2.9	0	1.6	
6	Turbidity	Range	0	3.3	0.6	0.8	0.3	0	0.6	0.1	0.2	0.2	0	0.7	0.62
6	Water temp	Max	28.71	26.23	25.43	23.03	18.75	17.17	13.2	11.17	13.28	14.76	0	24.96	
6	Water temp	Min	28.62	26.15	25.42	22.87	18.75	17.16	13.2	11.16	13.24	14.59	0	24.94	
6	Water temp	Range	0.09	0.08	0.01	0.16	0	0.01	0	0.01	0.04	0.17	0	0.02	0.05
7	pH	Max	8.14	8.17	8.19	8.16	8.22	8.15	8.42	8.21	8.15	8.32	0	7.8	
7	pH	Min	8.03	8.16	8.16	8.16	8.22	8.14	8.41	8.19	8.15	8.29	0	7.78	
7	pH	Range	0.11	0.01	0.03	0	0	0.01	0.01	0.02	0	0.03	0	0.02	0.02
7	EC	Max	57.91	52.88	52.79	53.68	52.55	54.34	56.27	53.4	54.29	44.05	0	18.5	
7	EC	Min	57.88	52.84	52.49	53.54	52.46	54.32	56.27	52.77	54.21	42.98	0	17.32	
7	EC	Range	0.03	0.04	0.3	0.14	0.09	0.02	0	0.63	0.08	1.07	0	1.18	0.33
7	Salinity	Max	38.54	34.82	34.8	35.5	34.69	36	37.34	35.11	35.84	28.53	0	11.09	
7	Salinity	Min	38.5	34.79	34.55	35.39	34.62	35.99	37.33	34.58	35.82	27.87	0	10.37	
7	Salinity	Range	0.04	0.03	0.25	0.11	0.07	0.01	0.01	0.53	0.02	0.66	0	0.72	0.22
7	DO (%sat.)	Max	84.7	*	86.7	102.7	71.7	97.4	94.5	90.2	85.4	89.1	0	83.3	
7	DO (%sat.)	Min	81	*	85.9	100.3	71.1	97.3	94.4	88.8	84.1	80.7	0	82.5	
7	DO (%sat.)	Range	3.7	*	0.8	2.4	0.6	0.1	0.1	1.4	1.3	8.4	0	0.8	1.96

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
7	Turbidity	Max	8.84	10.9	7.1	8.2	5.2	7.7	4.3	2.4	8.1	32.6	0	13.9	
7	Turbidity	Min	8.84	10.6	5.9	3.1	4.6	7.6	3.9	2.3	6.6	24.1	0	11.7	
7	Turbidity	Range	0	0.3	1.2	5.1	0.6	0.1	0.4	0.1	1.5	8.5	0	2.2	1.82
7	Water temp	Max	28.97	26.48	25.52	24.2	18.31	16.89	13.4	10.25	13	14.34	0	24.74	
7	Water temp	Min	27.61	26.42	25.13	22.84	18.31	16.89	13.4	10.18	12.78	14.27	0	24.5	
7	Water temp	Range	1.36	0.06	0.39	1.36	0	0	0	0.07	0.22	0.07	0	0.24	0.34
8	pH	Max	8.14	8.16	8.18	8.18	8.19	8.14	8.39	8.14	8.12	8.26	0	8.1	
8	pH	Min	8.12	8.16	8.17	8.17	8.19	8.11	8.36	8.1	8.12	8.23	0	8.08	
8	pH	Range	0.02	0	0.01	0.01	0	0.03	0.03	0.04	0	0.03	0	0.02	0.02
8	EC	Max	57.85	53.05	52.83	53.63	52.78	54.34	56.34	54.42	54.46	47.31	0	45.11	
8	EC	Min	57.82	52.77	52.51	53.6	52.74	54.33	56.32	54.4	54.45	45.42	0	44.55	
8	EC	Range	0.03	0.28	0.32	0.03	0.04	0.01	0.02	0.02	0.01	1.89	0	0.56	0.29
8	Salinity	Max	38.49	34.97	34.81	35.46	34.86	35.99	37.41	35.78	35.97	30.88	0	29.21	
8	Salinity	Min	38.43	34.75	34.57	35.43	34.83	35.98	37.35	35.76	35.96	29.34	0	28.86	
8	Salinity	Range	0.06	0.22	0.24	0.03	0.03	0.01	0.06	0.02	0.01	1.54	0	0.35	0.23
8	DO (%sat.)	Max	89.1	*	90.1	109.4	70.3	95.2	85.9	99.5	90	92.1	0	100.7	
8	DO (%sat.)	Min	86.2	*	89.5	107.9	69	94.6	82.1	97.8	90	79.9	0	94.5	
8	DO (%sat.)	Range	2.9	*	0.6	1.5	1.3	0.6	3.8	1.7	0	12.2	0	6.2	3.08
8	Turbidity	Max	5.52	7.2	6.3	2.1	2.2	1.3	1.4	1.2	3.4	3.1	0	12.7	
8	Turbidity	Min	5.52	5.3	4.4	1.6	2	0.9	1.3	1.1	2	2.9	0	10.6	
8	Turbidity	Range	0	1.9	1.9	0.5	0.2	0.4	0.1	0.1	1.4	0.2	0	2.1	0.80
8	Water temp	Max	29.16	26.35	25.55	22.93	18.24	16.35	13.2	10.22	13.01	14.57	0	23.42	
8	Water temp	Min	28.21	26.28	25.38	22.9	18.19	16.05	13.1	10.21	12.92	13.92	0	23.13	
8	Water temp	Range	0.95	0.07	0.17	0.03	0.05	0.3	0.1	0.01	0.09	0.65	0	0.29	0.25
9	pH	Max	8.13			n/c			8.48			8.26			
9	pH	Min	8.1			n/c			8.4			8.25			
9	pH	Range	0.03			n/c			0.08			0.01			0.04
9	EC	Max	57.69			n/c			55.92			50			
9	EC	Min	57.34			n/c			55.87			48.36			
9	EC	Range	0.35			n/c			0.05			1.64			0.68

Site	Parameter		Month												Avg. Range
			Jan-10 29/01/10	Feb-10 1/03/10	Mar-10 30/03/10	Apr-10 29/04/10	May-10 28/05/10	Jun-10 25/06/10	Jul-10 26/7/10	Aug-10 25/8/10	Sep-10 23/9/10	Oct-10 22/10/10	Nov-10 22/11/10	Dec-10 21/12/10	
9	Salinity	Max	38.36			n/c			37.04			32.76			
9	Salinity	Min	38.09			n/c			37.01			31.57			
9	Salinity	Range	0.27			n/c			0.03			1.19			0.50
9	DO (%sat.)	Max	98.1			n/c			88.1			100.3			
9	DO (%sat.)	Min	93.2			n/c			80.5			88.3			
9	DO (%sat.)	Range	4.9			n/c			7.6			12			8.17
9	Turbidity	Max	3.8			n/c			0.7			1.6			
9	Turbidity	Min	3.8			n/c			0.4			0.9			
9	Turbidity	Range	0			n/c			0.3			0.7			0.33
9	Water temp	Max	29.69			n/c			12.92			14.88			
9	Water temp	Min	28.47			n/c			12.82			14.21			
9	Water temp	Range	1.22			n/c			0.1			0.67			0.66
10	pH	Max	8.12			n/c			8.47			8.28			
10	pH	Min	8.11			n/c			8.39			8.27			
10	pH	Range	0.01			n/c			0.08			0.01			0.03
10	EC	Max	57.66			n/c			55.92			50.4			
10	EC	Min	57.41			n/c			55.86			48.62			
10	EC	Range	0.25			n/c			0.06			1.78			0.70
10	Salinity	Max	38.34			n/c			37.05			33.01			
10	Salinity	Min	38.18			n/c			37.02			31.73			
10	Salinity	Range	0.16			n/c			0.03			1.28			0.49
10	DO (%sat.)	Max	100.3			n/c			7.44			105.1			
10	DO (%sat.)	Min	94.7			n/c			7.01			99.1			
10	DO (%sat.)	Range	5.6			n/c			0.43			6			4.01
10	Turbidity	Max	3.66			n/c			0.8			0.8			
10	Turbidity	Min	3.66			n/c			0.4			0.3			
10	Turbidity	Range	0			n/c			0.4			0.5			0.30
10	Water temp	Max	29.43			n/c			13.14			14.63			
10	Water temp	Min	28.42			n/c			12.98			14.28			
10	Water temp	Range	1.01			n/c			0.16			0.35			0.51

Appendix B - Laboratory sample results summary statistics – monthly program

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 1		SS	mg/L	15	10	24	73	17	7	7	8	14	6	9	8	8	73	6	67
Site 1		Total Hardness	mg/L		6360	6310	5580	6440	6350	6350	7100	6330	5970	5250	5430	1610	7100	1610	5490
Site 1		Calcium	mg/L		411	402	370	422	419	411	429	409	416	345	357	113	429	113	316
Site 1		Magnesium	mg/L		1300	1290	1130	1310	1290	1290	1460	1290	1200	1060	1100	322	1460	322	1138
Site 1	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	0.69	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	0.03	0.69	<0.01	
Site 1	Dissolved	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0011	0.0017	0.002	0.0020	<0.050	
Site 1	Dissolved	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	0.019	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0194	<0.0002	
Site 1	Dissolved	Chromium	mg/L		0.010	<0.005	<0.005	<0.010	0.019	0.006	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.019	<0.0005	
Site 1	Dissolved	Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.001	<0.001	0.001	0.002	0.002	<0.001	
Site 1	Dissolved	Iron	mg/L		<0.50	0.48	<0.25	<0.50	0.53	<0.25	<0.50	<0.25	<0.50	<0.005	<0.005	0.078	0.53	<0.005	
Site 1	Dissolved	Lead	mg/L		<0.010	0.006	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	0.0003	0.0003	0.0006	0.006	<0.0002	
Site 1	Dissolved	Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	0.014	0.0035	0.0112	0.015	<0.010	
Site 1	Dissolved	Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 1	Dissolved	Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.0005	<0.0005	0.0015	0.0015	<0.0005	
Site 1	Dissolved	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 1	Dissolved	Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 1	Total	Aluminium	mg/L		0.660	<0.50	<0.50	0.920	<0.50	<0.50	<0.50	<0.50	<0.50	0.35	0.22	0.63	0.9200	<0.50	
Site 1	Total	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.001	0.0015	0.002	0.0020	<0.050	
Site 1	Total	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 1	Total	Chromium	mg/L	0.0274	<0.010	<0.005	0.006	<0.010	<0.010	<0.005	<0.010	0.007	<0.010	<0.0005	0.0006	0.001	0.0070	<0.0005	
Site 1	Total	Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.001	<0.001	0.001	0.003	0.0030	<0.001	
Site 1	Total	Iron	mg/L		1.060	<0.25	0.360	1.110	<0.50	<0.26	0.52	0.28	<0.50	0.415	0.315	0.807	1.1100	<0.50	
Site 1	Total	Lead	mg/L	0.0044	<0.010	0.011	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	0.0003	0.0003	0.0006	0.0110	<0.0002	
Site 1	Total	Manganese	mg/L		0.029	<0.010	<0.010	0.026	<0.010	<0.010	0.01	0.01	<0.010	0.0245	0.0132	0.0235	0.0290	<0.010	
Site 1	Total	Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 1	Total	Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0007	0.0008	0.0021	0.0021	<0.050	
Site 1	Total	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 1	Total	Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	0.007	0.0070	<0.005	
Site 1		Chl a	mg/m³	1.6	6	<1	<1	3	6	<1	<1	<1	<1	4	3	<1	6.0000	<1	
Site 1		Ammonia	mg/L	0.005	<0.005	0.021	<0.005	<0.005	0.010	<0.025	0.006	<0.005	<0.005	<0.005	0.029	0.051	0.0510	<0.005	
Site 1		Nitrite +	mg/L	0.19	0.051	0.043	0.052	0.072	0.049	0.035	0.02	0.026	0.05	0.008	0.019	0.129	0.129	0.008	0.121

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
		Nitrate as N																	
Site 1		TN	mg/L	0.2	0.18	0.29	0.25	0.17	0.20	0.19	0.06	0.17	0.18	0.13	0.1	0.57	0.57	0.06	0.51
Site 1		TP	mg/L	0.03	0.053	0.039	0.048	0.053	0.059	0.034	0.028	0.023	0.045	0.023	0.031	0.257	0.257	0.023	0.234
Site 2		SS	mg/L	15	8	18	59	27	6	7	10	16	6	7	11	9	59	6	53
Site 2		Total Hardness	mg/L		6160	6490	5670	6300	6420	6380	7300	6440	5970	4790	5590	3960	7300	3960	3340
Site 2		Calcium	mg/L		401	414	374	414	425	413	419	420	426	314	369	260	426	260	166
Site 2		Magnesium	mg/L		1250	1320	1150	1280	1300	1300	1520	1310	1190	974	1130	804	1520	804	716
Site 2	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	0.75	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.75	<0.01	
Site 2	Dissolved	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0008	0.0016	0.001	0.0016	<0.05	
Site 2	Dissolved	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	0.0186	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0186	<0.0002	
Site 2	Dissolved	Chromium	mg/L		0.010	<0.005	<0.005	<0.010	0.020	0.006	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.02	<0.0005	
Site 2	Dissolved	Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.001	<0.001	<0.001	0.001	0.001	<0.001	
Site 2	Dissolved	Iron	mg/L		0.840	<0.25	<0.25	<0.50	0.780	0.250	<0.50	0.27	<0.50	<0.005	<0.005	0.017	0.8400	<0.005	
Site 2	Dissolved	Lead	mg/L		<0.010	<0.005	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	0.0002	0.0005	<0.0002	0.0005	<0.0002	
Site 2	Dissolved	Manganese	mg/L		0.013	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	0.0251	0.0035	0.0105	0.0251	<0.010	
Site 2	Dissolved	Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 2	Dissolved	Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0006	<0.0005	0.0008	0.0008	<0.0005	
Site 2	Dissolved	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 2	Dissolved	Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 2	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.2	0.22	0.52	0.52	<0.50	
Site 2	Total	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0009	0.0016	0.0011	0.0016	<0.050	
Site 2	Total	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 2	Total	Chromium	mg/L	0.0274	<0.010	<0.005	0.007	<0.010	<0.010	<0.005	<0.010	0.007	<0.010	<0.0005	<0.0005	0.0006	0.0070	<0.0005	
Site 2	Total	Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.002	<0.001	0.001	0.002	0.0020	<0.001	
Site 2	Total	Iron	mg/L		1.190	<0.25	0.510	<0.50	<0.50	<0.26	<0.50	0.28	<0.50	0.256	0.310	0.668	1.1900	<0.50	
Site 2	Total	Lead	mg/L	0.0044	<0.010	0.013	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	0.0003	0.0002	0.0130	<0.0002	
Site 2	Total	Manganese	mg/L		0.027	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	0.01	0.011	0.0324	0.0132	0.0202	0.0324	<0.01	
Site 2	Total	Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 2	Total	Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0007	0.0010	0.0009	0.0010	<0.050	
Site 2	Total	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 2	Total	Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 2		Chl a	mg/m³	1.6	3	2	2	1	<1	<1	1	<1	<1	6	4	<1	6	<1	
Site 2		Ammonia	mg/L	0.005	<0.005	0.018	<0.005	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	0.032	0.04	0.04	<0.005	
Site 2		Nitrite + Nitrate as N	mg/L	0.19	0.011	0.044	0.050	0.050	0.058	0.007	0.002	0.066	0.055	0.047	0.02	0.076	0.076	0.002	0.074
Site 2		TN	mg/L	0.2	0.140	0.270	0.250	0.160	0.210	0.110	0.05	0.13	0.16	0.15	0.09	0.31	0.31	0.05	0.26
Site 2		TP	mg/L	0.03	0.056	0.049	0.049	0.034	0.055	0.041	0.027	0.028	0.044	0.05	0.03	0.181	0.181	0.027	0.154
Site 3		SS	mg/L	15	17	21	59	15	4	6	6	24	3	10	7	18	59	3	56
Site 3		Total Hardness	mg/L		6690	6690	6070	6400	6550	6510	7600	6410	6130	5680	5850	5880	7600	5680	1920
Site 3		Calcium	mg/L		433	426	393	418	432	421	453	415	434	376	384	385	453	376	77
Site 3		Magnesium	mg/L		1360	1370	1240	1300	1330	1320	1570	1300	1220	1150	1190	1200	1570	1150	420
Site 3	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	0.780	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.78	<0.01	
Site 3		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0012	0.0018	0.0015	0.0018	<0.050	
Site 3		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	0.019	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.019	<0.0002	
Site 3		Chromium	mg/L		0.013	<0.005	<0.005	<0.010	0.022	0.006	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.022	<0.0005	
Site 3		Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 3		Iron	mg/L		0.79	0.58	<0.25	<0.50	0.73	0.40	<0.50	0.3	<0.50	<0.005	<0.005	<0.005	0.790	<0.005	
Site 3		Lead	mg/L		<0.010	0.012	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	0.0002	<0.0002	<0.0002	0.012	<0.0002	
Site 3		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	0.004	0.0017	0.0026	0.015	0.0017	
Site 3		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 3		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.0005	<0.0005	<0.0005			
Site 3		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 3		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 3	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.2	0.13	0.21	0.21	<0.50	
Site 3		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0016	0.0018	0.002	0.002	<0.050	
Site 3		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 3		Chromium	mg/L	0.0274	0.010	<0.005	0.006	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	0.0005	<0.0005	<0.0005	0.01	<0.0005	
Site 3		Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 3		Iron	mg/L		1.030	<0.25	0.300	<0.50	<0.50	<0.26	0.52	<0.26	<0.50	0.251	0.182	0.137	1.030	<0.50	
Site 3		Lead	mg/L	0.0044	<0.010	0.014	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	0.014	<0.0002	
Site 3		Manganese	mg/L		0.014	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0111	0.0076	0.0084	0.014	<0.010	
Site 3		Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 3		Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0006**	**0.0006**	<0.0005	0.001	<0.0005	
Site 3		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 3		Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 3		Chl a	mg/m³	1.6	**4**	**4**	**1**	**1**	<1	<1	**1**	<1	<1	**4**	**4**	<1	4	<1	
Site 3		Ammonia	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.025	<0.005	<0.005	<0.005	<0.005	**0.023**	<0.005	0.023	<0.005	
Site 3		Nitrite + Nitrate as N	mg/L	0.19	<0.002	**0.007**	**0.006**	**0.003**	**0.008**	<0.002	<0.002	**0.006**	**0.069**	<0.002	<0.002	**0.013**	0.069	0.003	0.066
Site 3		TN	mg/L	0.2	**0.08**	**0.19**	**0.18**	**0.09**	**0.20**	**0.06**	<0.05	**0.09**	**0.06**	**0.07**	**0.08**	**0.07**	0.20	0.060	0.140
Site 3		TP	mg/L	0.03	**0.022**	**0.019**	**0.028**	**0.017**	**0.039**	**0.012**	**0.016**	**0.021**	**0.013**	**0.026**	**0.014**	**0.038**	0.039	0.012	0.027
Site 4		SS	mg/L	15	**12**	**26**	**51**	**13**	**5**	**4**	**8**	**10**	**4**	**6**	**8**	**9**	51	4	47
Site 4		Total Hardness	mg/L		**6920**	**6810**	**6020**	**6360**	**6590**	**6600**	**7670**	**6540**	**6000**	**5800**	**6000**	**5900**	7670	5800	1870
Site 4		Calcium	mg/L		**451**	**432**	**396**	**414**	**435**	**427**	**462**	**423**	**428**	**383**	**395**	**382**	462	382	80
Site 4		Magnesium	mg/L		**1410**	**1390**	**1220**	**1290**	**1340**	**1340**	**1580**	**1330**	**1200**	**1180**	**1220**	**1200**	1580	1180	400
Site 4	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	**0.700**	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.700	<0.01	
Site 4		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0016**	**0.0019**	**0.0013**	0.0019	<0.050	
Site 4		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	**0.019**	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0192	<0.0002	
Site 4		Chromium	mg/L		**0.013**	<0.005	<0.005	<0.010	**0.021**	**0.006**	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.021	<0.0005	
Site 4		Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 4		Iron	mg/L		**0.930**	**0.680**	<0.25	<0.50	**0.790**	**0.400**	<0.50	<0.25	<0.50	<0.005	<0.005	<0.005	0.930	<0.005	
Site 4		Lead	mg/L		<0.010	**0.042**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	0.042	<0.0002	
Site 4		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	**0.015**	<0.010	<0.010	<0.010	<0.010	**0.0026**	**0.0018**	**0.0024**	0.015	<0.010	
Site 4		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 4		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0019**	<0.0005	<0.0005	0.0019	<0.0005	
Site 4		Selenium	mg/L		<0.10	**0.100**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002	0.100	<0.002	
Site 4		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 4	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.15**	**0.13**	**0.24**	0.240	<0.50	
Site 4		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0013**	**0.0015**	**0.0014**	0.0015	<0.050	
Site 4		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 4		Chromium	mg/L	0.0274	**0.011**	<0.005	**0.007**	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.011	<0.0005	
Site 4		Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 4		Iron	mg/L		**1.030**	<0.25	**0.340**	<0.50	<0.50	<0.26	<0.50	<0.26	<0.50	**0.198**	**0.196**	**0.139**	1.030	<0.50	

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 4		Lead	mg/L	0.0044	<0.010	**0.015**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	**0.0002**	<0.0002	<0.0002	0.015	<0.0002	
Site 4		Manganese	mg/L		**0.013**	<0.010	<0.010	<0.010	**0.018**	<0.010	<0.010	<0.010	<0.010	**0.0075**	**0.0067**	**0.008**	0.018	<0.010	
Site 4		Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 4		Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0005**	**0.0007**	<0.0005	0.0007	<0.0005	
Site 4		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 4		Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	**0.005**	0.0050	<0.005	
Site 4		Chl a	mg/m³	1.6	**4**	**1**	**1**	<1	<1	**4**	**1**	<1	<1	**3**	**3**	<1	4.0000	<1	
Site 4		Ammonia	mg/L	0.005	**0.013**	<0.005	<0.005	<0.005	**0.009**	<0.025	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.005	0.0130	<0.005	
Site 4		Nitrite + Nitrate as N	mg/L	0.19	**0.007**	<0.002	<0.002	**0.004**	<0.002	**0.002**	<0.002	**0.012**	**0.018**	<0.002	<0.002	**0.002**	0.0180	<0.002	
Site 4		TN	mg/L	0.2	**0.060**	**0.190**	**0.150**	**0.060**	**0.130**	**0.050**	<0.05	**0.12**	**0.16**	<0.05	<0.05	**0.05**	0.1900	<0.05	
Site 4		TP	mg/L	0.03	**0.020**	**0.010**	**0.016**	**0.014**	**0.038**	**0.006**	**0.016**	**0.014**	**0.022**	**0.021**	**0.007**	**0.027**	0.038	0.006	0.0320
Site 5		SS	mg/L	15	**9**	**21**	**54**	**12**	**3**	**3**	**7**	**17**	**4**	**7**	**9**	**17**	54	3	51
Site 5		Total Hardness	mg/L		**4840**	**6690**	**6170**	**6400**	**6540**	**6650**	**7420**	**6570**	**6050**	**5710**	**5980**	**6080**	7420	4840	2580
Site 5		Calcium	mg/L		**319**	**430**	**413**	**421**	**431**	**430**	**460**	**427**	**433**	**378**	**393**	**395**	460	319	141
Site 5		Magnesium	mg/L		**983**	**1360**	**1250**	**1300**	**1330**	**1360**	**1520**	**1340**	**1210**	**1160**	**1210**	**1240**	1520	983	537
Site 5	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	**0.780**	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.780	<0.01	
Site 5		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0015**	**0.0013**	**0.0016**	0.0016	<0.050	
Site 5		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	**0.019**	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0186	<0.0002	
Site 5		Chromium	mg/L		**0.011**	<0.005	<0.005	<0.010	**0.022**	**0.006**	<0.010	<0.005	<0.010	<0.0005	<0.0005	<0.0005	0.0220	<0.0005	
Site 5		Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 5		Iron	mg/L		**1.050**	**0.710**	<0.25	<0.50	**0.830**	**0.440**	<0.50	<0.25	<0.50	<0.005	<0.005	<0.005	1.0500	<0.005	
Site 5		Lead	mg/L		<0.010	**0.009**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	**0.0005**	0.0090	0.0005	
Site 5		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	**0.015**	<0.010	<0.010	<0.010	<0.010	**0.0037**	**0.0017**	**0.0026**	0.0150	0.0026	
Site 5		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 5		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0014**	<0.0005	<0.0005	0.0014	<0.0005	
Site 5		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 5		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	**0.006**	0.0060	<0.005	
Site 5	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.22**	**0.15**	**0.12**	0.2200	<0.50	
Site 5		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0016**	**0.0014**	**0.0019**	0.0019	<0.050	
Site 5		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 5		Chromium	mg/L	0.0274	0.011	<0.005	0.006	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	<0.0005	<0.0005	0.0009	0.0110	<0.0005	
Site 5		Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 5		Iron	mg/L		1.080	<0.25	0.310	<0.50	<0.50	<0.26	0.55	<0.26	<0.50	0.288	0.22	0.139	1.080	<0.50	
Site 5		Lead	mg/L	0.0044	<0.010	0.008	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	0.0002	<0.0002	0.0004	0.008	<0.0002	
Site 5		Manganese	mg/L		0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0101	0.0069	0.0075	0.011	<0.010	
Site 5		Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 5		Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0006	0.0007	0.0006	0.0007	<0.050	
Site 5		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 5		Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	0.007	0.007	<0.005	
Site 5		Chl a	mg/m³	1.6	4	2	<1	1	<1	<1	1	<1	<1	3	3	<1	4	<1	
Site 5		Ammoni	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.000	<0.005	
Site 5		Nitrite + Nitrate as N	mg/L	0.19	0.019	<0.002	0.070	<0.002	0.148	0.018	<0.002	0.035	0.073	<0.002	<0.002	0.006	0.148	<0.002	
Site 5		TN	mg/L	0.2	0.100	0.180	0.140	0.090	0.120	0.050	<0.05	0.15	0.1	0.06	<0.05	0.05	0.180	<0.05	
Site 5		TP	mg/L	0.03	0.028	0.012	0.015	0.010	0.034	<0.005	0.011	0.024	0.019	0.021	0.008	0.036	0.036	<0.005	
Site 6		SS	mg/L	15	12	27	47	16	3	4	9	17	4	7	20	14	47	3	44
Site 6		Total Hardness	mg/L		6760	6740	6230	6380	6620	6650	7150	6550	6120	5750	6090	5910	7150	5750	1400
Site 6		Calcium	mg/L		435	428	401	420	436	430	447	428	437	380	404	385	447	380	67
Site 6		Magnesium	mg/L		1380	1380	1270	1290	1340	1360	1470	1330	1220	1170	1230	1200	1470	1170	300
Site 6	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	0.760	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.760	<0.01	
Site 6		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0014	0.0018	0.0016	0.0018	<0.050	
Site 6		Cadmium	mg/L	0.0055	<0.0050	<0.0005	0.001	<0.0050	0.019	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0187	<0.0002	
Site 6		Chromium	mg/L		0.012	<0.005	<0.005	<0.010	0.022	0.006	<0.010	0.005	<0.010	<0.0005	<0.0005	<0.0005	0.022	<0.0005	
Site 6		Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	<0.001			
Site 6		Iron	mg/L		1.130	0.650	<0.25	<0.50	0.860	0.380	<0.50	<0.25	<0.50	<0.005	<0.005	<0.005	1.130	<0.005	
Site 6		Lead	mg/L		<0.010	0.007	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	0.0006	0.007	<0.0002	
Site 6		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	0.0026	0.0014	0.0032	0.0160	<0.010	
Site 6		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 6		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0011	<0.0005	0.0005	0.0011	<0.050	
Site 6		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 6		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 6	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.17**	**0.64**	**0.24**	0.640	<0.50	
Site 6		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0017**	**0.0018**	**0.002**	0.002	<0.05	
Site 6		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 6		Chromium	mg/L	0.0274	**0.012**	<0.005	**0.007**	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	<0.0005	**0.0013**	<0.0005	0.012	<0.0005	
Site 6		Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	**0.001**	<0.001	0.001	<0.001	
Site 6		Iron	mg/L		**1.090**	<0.25	**0.370**	<0.50	<0.50	**0.280**	**0.51**	<0.26	<0.50	**0.216**	**0.962**	**0.231**	1.090	<0.25	
Site 6		Lead	mg/L	0.0044	<0.010	**0.012**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	**0.0002**	**0.0004**	0.012	<0.0002	
Site 6		Manganese	mg/L		**0.012**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	**0.0072**	**0.0158**	**0.0113**	0.0158	<0.010	
Site 6		Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 6		Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.0005	**0.0011**	<0.0005	0.0011	<0.0005	
Site 6		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 6		Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 6		Chl a	mg/m³	1.6	**2**	**7**	**2**	**1**	<1	<1	<1	<1	**1**	**3**	**3**	<1	7	<1	
Site 6		Ammonia	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.005	0.009	<0.005	
Site 6		Nitrite + Nitrate as N	mg/L	0.19	<0.002	**0.019**	**0.191**	<0.002	**0.029**	**0.021**	<0.002	**0.009**	**0.006**	<0.002	<0.002	<0.002	0.191	<0.002	
Site 6		TN	mg/L	0.2	<0.05	**0.17**	**0.31**	**0.09**	**0.12**	**0.05**	<0.05	**0.12**	**0.08**	**0.06**	**0.05**	<0.05	0.31	<0.05	
Site 6		TP	mg/L	0.03	**0.030**	<0.005	**0.013**	**0.008**	**0.022**	<0.005	<0.005	**0.018**	**0.013**	**0.025**	**0.014**	**0.024**	0.030	<0.005	
Site 7		SS	mg/L	15	**9**	**34**	**61**	**22**	**6**	**12**	**12**	**16**	**12**	**8**	**20**	**12**	61	6	55
Site 7		Total Hardness	mg/L		**6770**	**6600**	**6190**	**6540**	**6540**	**6670**	**7510**	**6440**	**6020**	**5090**	**5890**	**2460**	7510	2460	5050
Site 7		Calcium	mg/L		**437**	**418**	**399**	**428**	**430**	**430**	**459**	**420**	**430**	**334**	**388**	**166**	459	166	293
Site 7		Magnesium	mg/L		**1380**	**1350**	**1260**	**1330**	**1330**	**1360**	**1540**	**1310**	**1200**	**1030**	**1200**	**497**	1540	497	1043
Site 7	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	**0.790**	<0.50	<0.50	<0.50	<0.50	<0.01	**0.02**	<0.01	0.790	<0.01	
Site 7		Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0011**	**0.0018**	**0.0007**	0.0018	<0.050	
Site 7		Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	**0.019**	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.019	<0.0002	
Site 7		Chromium	mg/L		**0.013**	<0.005	<0.005	<0.010	**0.023**	**0.010**	<0.010	**0.005**	<0.010	<0.0005	<0.0005	<0.0005	0.023	<0.0005	
Site 7		Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	**0.001**	0.001	<0.001	
Site 7		Iron	mg/L		**1.140**	**0.730**	<0.25	<0.50	**0.870**	**0.430**	<0.50	<0.25	<0.50	<0.005	**0.019**	**0.034**	1.14	<0.005	
Site 7		Lead	mg/L		<0.010	**0.009**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	0.009	<0.0002	
Site 7		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	**0.017**	<0.010	<0.010	<0.010	<0.010	**0.0048**	**0.0027**	**0.0139**	0.017	<0.010	
Site 7		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 7		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0009**	<0.0005	**0.0009**	0.0009	<0.0005	
Site 7		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 7		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	**<0.005**	<0.005	**0.006**	0.006	<0.005	
Site 7	Total	Aluminium	mg/L		**0.510**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.26**	**0.69**	**0.3**	0.690	<0.50	
Site 7	Total	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.001**	**0.0016**	**0.0013**	0.0016	<0.05	
Site 7	Total	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 7	Total	Chromium	mg/L	0.0274	**0.011**	**0.005**	**0.007**	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	<0.0005	**0.0012**	<0.0005	0.011	<0.0005	
Site 7	Total	Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	**0.001**	**0.002**	0.002	<0.001	
Site 7	Total	Iron	mg/L		**1.280**	**0.640**	**0.450**	**0.520**	<0.50	**0.580**	<0.50	<0.26	**0.66**	**0.302**	**1**	**0.252**	1.280	<0.26	
Site 7	Total	Lead	mg/L	0.0044	<0.010	**0.010**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	**0.000**	<0.0002	0.010	<0.0002	
Site 7	Total	Manganese	mg/L		**0.015**	**0.014**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	**0.01**	**0.0092**	**0.0161**	**0.0174**	0.0174	<0.01	
Site 7	Total	Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 7	Total	Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0019**	**0.0013**	**0.001**	0.0019	<0.050	
Site 7	Total	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 7	Total	Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	**0.006**	0.006	<0.005	
Site 7		Chl a	mg/m³	1.6	**4**	**5**	**2**	<1	**2**	<1	<1	<1	<1	**4**	**3**	<1	5	<1	
Site 7		Ammonia	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	**0.024**	**0.033**	0.033	<0.005	
Site 7		Nitrite + Nitrate as N	mg/L	0.19	**0.003**	<0.002	**0.017**	**0.005**	**0.396**	<0.002	<0.002	**0.019**	**0.011**	<0.002	<0.002	**0.115**	0.396	<0.002	
Site 7		TN	mg/L	0.2	**0.12**	**0.19**	**0.18**	**0.10**	**0.08**	**0.07**	**0.07**	**0.17**	**0.06**	**0.09**	**0.08**	**0.46**	0.460	0.06	0.40
Site 7		TP	mg/L	0.03	**0.023**	**0.011**	**0.025**	**0.011**	**0.015**	**0.008**	<0.005	**0.023**	**0.008**	**0.036**	**0.022**	**0.17**	0.170	<0.005	
Site 8		SS	mg/L	15	**8**	**5**	**68**	**14**	**2**	**2**	**8**	**16**	**5**	**6**	**22**	**24**	68	2	66
Site 8		Total Hardness	mg/L		**6810**	**6570**	**6060**	**6680**	**6610**	**6640**	**6580**	**6530**	**6140**	**5400**	**5910**	**5260**	6810	5260	1550
Site 8		Calcium	mg/L		**442**	**417**	**387**	**437**	**432**	**430**	**435**	**425**	**436**	**353**	**389**	**343**	442	343	99
Site 8		Magnesium	mg/L		**1380**	**1340**	**1240**	**1360**	**1340**	**1350**	**1330**	**1330**	**1230**	**1100**	**1200**	**1070**	1380	1070	310
Site 8	Dissolved	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	**0.800**	<0.50	<0.50	<0.50	<0.50	<0.01	<0.01	<0.01	0.8000	<0.01	
Site 8	Dissolved	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0015**	**0.002**	**0.0012**	0.0020	<0.050	
Site 8	Dissolved	Cadmium	mg/L	0.0055	<0.0050	<0.0005	**0.001**	<0.0050	**0.020**	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002	0.0195	<0.0002	
Site 8	Dissolved	Chromium	mg/L		**0.013**	<0.005	<0.005	<0.010	**0.023**	<0.005	<0.010	**0.006**	<0.010	<0.0005	<0.0005	<0.0005	0.0230	<0.0005	
Site 8	Dissolved	Copper	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	<0.001	**<0.001**	0.0000	<0.001	
Site 8	Dissolved	Iron	mg/L		**1.310**	**0.720**	<0.25	**0.530**	**0.880**	**0.340**	<0.50	<0.25	<0.50	<0.005	**0.005**	<0.005	1.3100	<0.005	

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 8		Lead	mg/L		<0.010	**0.006**	<0.005	<0.010	<0.010	<0.005	<0.010	<0.005	<0.0002	<0.0002	<0.0002	<0.0002	0.0060	<0.0002	
Site 8		Manganese	mg/L		<0.010	<0.010	<0.010	<0.010	**0.017**	<0.010	<0.010	<0.010	<0.010	**0.0029**	**0.0017**	**0.0032**	0.0170	<0.010	
Site 8		Mercury	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
Site 8		Nickel	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0006**	<0.0005	**0.0006**	0.0006	<0.0005	
Site 8		Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002			
Site 8		Zinc	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	<0.005			
Site 8	Total	Aluminium	mg/L		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.15**	**0.83**	**0.59**	0.8300	<0.50	
Site 8	Total	Arsenic	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0009**	**0.0014**	**0.0018**	0.0018	<0.05	
Site 8	Total	Cadmium	mg/L	0.0055	<0.0050	<0.0005	<0.0005	<0.0050	<0.0050	<0.0005	<0.0050	<0.0005	<0.0050	<0.0002	<0.0002	<0.0002			
Site 8	Total	Chromium	mg/L	0.0274	**0.012**	**0.006**	**0.008**	<0.010	<0.010	<0.005	<0.010	<0.005	<0.010	<0.0005	**0.0014**	**0.0006**	0.012	<0.0005	
Site 8	Total	Copper	mg/L	0.0013	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.001	<0.001	**0.001**	**0.001**	0.001	<0.001	
Site 8	Total	Iron	mg/L		**1.140**	**0.420**	**0.450**	<0.50	**0.500**	**0.280**	**0.52**	<0.26	**0.5**	**0.182**	**1.28**	**0.714**	1.280	<0.26	
Site 8	Total	Lead	mg/L	0.0044	<0.010	**0.009**	<0.005	<0.010	<0.010	<0.005	**<0.010**	<0.005	<0.0002	<0.0002	**0.0003**	**0.0005**	0.009	<0.0002	
Site 8	Total	Manganese	mg/L		<0.010	<0.010	**0.011**	<0.010	<0.010	<0.010	<0.010	<0.010	**0.01**	**0.0058**	**0.0162**	**0.0183**	0.0183	<0.010	
Site 8	Total	Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	**<0.0001**	0.0000	<0.0001	
Site 8	Total	Nickel	mg/L	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	**0.0013**	**0.0014**	**0.0009**	0.0014	<0.050	
Site 8	Total	Selenium	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.002	<0.002	<0.002	0.0000	<0.002	
Site 8	Total	Zinc	mg/L	0.015	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.005	<0.005	<0.005	**0.005**	0.0050	<0.005	
Site 8		Chl a	mg/m³	1.6	**6**	**6**	**2**	<1	**4**	<1	<1	<1	<1	**3**	**3**	**1**	6	<1	
Site 8		Ammonia	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	**0.008**	<0.025	<0.005	<0.005	<0.005	<0.005	**0.009**	<0.005	0.009	<0.005	
Site 8		Nitrite + Nitrate as N	mg/L	0.19	<0.002	<0.002	**0.074**	<0.002	<0.002	<0.002	<0.002	**0.003**	**0.004**	<0.002	<0.002	<0.002	0.074	<0.002	
Site 8		TN	mg/L	0.2	**0.090**	**0.180**	**0.220**	**0.080**	**0.100**	**0.03**	<0.05	**0.1**	**0.08**	**0.08**	**0.05**	**0.14**	0.220	<0.05	
Site 8		TP	mg/L	0.03	**0.022**	<0.005	**0.019**	**0.007**	**0.010**	<0.005	<0.005	**0.008**	**0.014**	**0.033**	**0.013**	**0.049**	0.049	<0.005	
Site 9		SS	mg/L	15	**10**						**7**			**6**			10	6	4
Site 9		Total Hardness	mg/L		**6620**						**6780**			**5830**			6780	5830	950
Site 9		Calcium	mg/L		**428**						**463**			**384**			463	384	79
Site 9		Magnesium	mg/L		**1350**						**1370**			**1180**			1370	1180	190
Site 9	Dissolved	Aluminium	mg/L		<0.50						<0.50			<0.01					
Site 9	Dissolved	Arsenic	mg/L		<0.050						<0.050			**0.0013**			0.0013	<0.050	
Site 9	Dissolved	Cadmium	mg/L	0.0055	<0.0050						<0.0050			<0.0002					

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 9		Chromium	mg/L		**0.014**						<0.010			<0.0005			0.0140	<0.0005	
Site 9		Copper	mg/L		<0.050						<0.050			<0.001					
Site 9		Iron	mg/L		**1.420**						<0.50			<0.005			1.4200	<0.005	
Site 9		Lead	mg/L		<0.010						<0.010			<0.0002					
Site 9		Manganese	mg/L		<0.010						<0.010			**0.002**			0.0020	<0.010	
Site 9		Mercury	mg/L		<0.0001						<0.0001			<0.0001					
Site 9		Nickel	mg/L		<0.050						<0.050			<0.0005					
Site 9		Selenium	mg/L		<0.10						<0.10			<0.002					
Site 9		Zinc	mg/L		<0.050						<0.050			<0.005					
Site 9	Total	Aluminium	mg/L		<0.50						<0.50			**0.06**			0.0600	<0.50	
Site 9		Arsenic	mg/L		<0.050						<0.050			**0.0015**			0.0015	<0.050	
Site 9		Cadmium	mg/L	0.0055	<0.0050						<0.0050			<0.0002					
Site 9		Chromium	mg/L	0.0274	**0.011**						<0.010			<0.0005			0.0110	<0.0005	
Site 9		Copper	mg/L	0.0013	<0.050						<0.050			<0.001					
Site 9		Iron	mg/L		**1.060**						<0.50			**0.076**			1.0600	<0.50	
Site 9		Lead	mg/L	0.0044	<0.010						<0.010			**0.0002**			0.0002	<0.010	
Site 9		Manganese	mg/L		**0.012**						<0.010			**0.0047**			0.0120	<0.010	
Site 9		Mercury	mg/L	0.0001	<0.0001						<0.0001			<0.0001					
Site 9		Nickel	mg/L	0.07	<0.050						<0.050			**0.0011**			0.0011	<0.050	
Site 9		Selenium	mg/L		<0.10						<0.10			<0.002					
Site 9		Zinc	mg/L	0.015	<0.050						<0.050			<0.005					
Site 9		Chl a	mg/m³	1.6	**6**						<1			**2**			6	<1	
Site 9		Ammonia	mg/L	0.005	<0.005						<0.005			<0.005					
Site 9		Nitrite + Nitrate as N	mg/L	0.19	<0.002						<0.002			<0.002					
Site 9		TN	mg/L	0.2	**0.160**						<0.05			<0.05			0.1600	<0.05	
Site 9		TP	mg/L	0.03	**0.021**						**0.008**			**0.025**			0.025	0.008	0.017
Site 10		SS	mg/L	15	**12**						**7**			**4**			12	4	8
Site 10		Total Hardness	mg/L		**6850**						**7490**			**5890**			7490	5890	1600
Site 10		Calcium	mg/L		**445**						**426**			**388**			445	388	57
Site 10		Magnesium	mg/L		**1390**						**1560**			**1200**			1560	1200	360

Site code		Analyte	Units	Guideline	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Max	Min	Range
Site 10	Dissolved	Aluminium	mg/L		<0.50						<0.50			<0.01					
Site 10		Arsenic	mg/L		<0.050						<0.050			**0.0013**			0.0013	<0.050	
Site 10		Cadmium	mg/L	0.0055	<0.0050						<0.0050			<0.0002					
Site 10		Chromium	mg/L		**0.014**						<0.010			<0.0005			0.0140	<0.0005	
Site 10		Copper	mg/L		<0.050						<0.050			<0.001					
Site 10		Iron	mg/L		**1.360**						<0.50			<0.005			1.3600	<0.005	
Site 10		Lead	mg/L		<0.010						<0.010			<0.0002					
Site 10		Manganese	mg/L		<0.010						<0.010			**0.001**			0.0010	<0.010	
Site 10		Mercury	mg/L		<0.0001						<0.0001			<0.0001					
Site 10		Nickel	mg/L		<0.050						<0.050			<0.0005					
Site 10		Selenium	mg/L		<0.10						<0.10			<0.002					
Site 10		Zinc	mg/L		<0.050						<0.050			<0.005					
Site 10	Total	Aluminium	mg/L		<0.50						<0.50			**0.04**			0.0400	<0.50	
Site 10		Arsenic	mg/L		<0.050						<0.050			**0.0016**			0.0016	<0.050	
Site 10		Cadmium	mg/L	0.0055	<0.0050						<0.0050			<0.0002			0.0000	<0.0002	
Site 10		Chromium	mg/L	0.0274	**0.014**						<0.010			**0.0005**			0.0140	<0.010	
Site 10		Copper	mg/L	0.0013	<0.050						<0.050			<0.001					
Site 10		Iron	mg/L		**1.240**						**0.51**			**0.051**			1.24	0.051	1.189
Site 10		Lead	mg/L	0.0044	<0.010						<0.010			<0.0002					
Site 10		Manganese	mg/L		**0.016**						<0.010			**0.0032**			0.0160	<0.010	
Site 10		Mercury	mg/L	0.0001	<0.0001						<0.0001			<0.0001					
Site 10		Nickel	mg/L	0.07	<0.050						<0.050			**0.0006**			0.0006	<0.050	
Site 10		Selenium	mg/L		<0.10						<0.10			<0.002					
Site 10		Zinc	mg/L	0.015	<0.050						<0.050			<0.005					
Site 10		Chl a	mg/m³	1.6	**4**						<1			**3**			4	<1	
Site 10		Ammonia	mg/L	0.005	**0.019**						<0.005			<0.005			0.0190	<0.005	
Site 10		Nitrite + Nitrate as N	mg/L	0.19	**0.046**						<0.002			<0.002			0.0460	<0.002	
Site 10		TN	mg/L	0.2	**0.050**						<0.05			<0.05			0.0500	<0.05	
Site 10		TP	mg/L	0.03	**0.011**						**0.006**			**0.024**			0.024	0.006	0.018

Appendix C- Laboratory sample results summary statistics – quarterly program

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 1	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 1		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 1		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 1	Phenolic Compound Surrogates	Phenol-d6	%		37.8	39.2	39	30.1	39.2	30.1	9.1
Site 1		2-Chlorophenol-D4	%		87.2	91.4	91	70.2	91.4	70.2	21.2
Site 1		2.4.6-Tribromophenol	%		108.0	122.0	112	79.9	122.0	79.9	42.1
Site 1	PAH Surrogates	2-Fluorobiphenyl	%		93.1	94.4	91.4	81.7	94.4	81.7	12.7
Site 1		Anthracene-d10	%		89.3	98.0	99	88.6	99.0	88.6	10.4
Site 1		4-Terphenyl-d14	%		93.9	105.0	91.3	111	111.0	91.3	19.7
Site 1	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 1		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 1		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 1		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 1		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 1	TPH(V)/ BTEX Surrogates	1.2-Dichloroethane-D4	%		105.0	97.3	107	104	107.0	97.3	9.7
Site 1		Toluene-D8	%		98.7	91.9	98.1	92.1	98.7	91.9	6.8
Site 1		4-Bromofluorobenzene	%		91.1	87.8	89.4	88.9	91.1	87.8	3.3
Site 1	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<6	<2	<9			
Site 1		Tripropyltin	%		133.0	66.0	58.1	120	133.0	58.1	74.9
Site 2	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 2		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 2		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 2	Phenolic Compound Surrogates	Phenol-d6	%		38.9	36.0	39	27.6	39.0	27.6	11.4
Site 2		2-Chlorophenol-D4	%		86.6	85.4	89.5	66.9	89.5	66.9	22.6
Site 2		2.4.6-Tribromophenol	%		114.0	116.0	104	79.3	116.0	79.3	36.7
Site 2	PAH Surrogates	2-Fluorobiphenyl	%		75.8	87.9	62.4	64.6	87.9	62.4	25.5
Site 2		Anthracene-d10	%		91.0	92.2	99.6	85.4	99.6	85.4	14.2
Site 2		4-Terphenyl-d14	%		96.9	100.0	108	109	109.0	96.9	12.1
Site 2	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 2		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 2		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 2		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 2		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 2	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		94.1	111.0	108	94.2	111.0	94.1	16.9
Site 2		Toluene-D8	%		92.9	94.0	95.4	95.6	95.6	92.9	2.7
Site 2		4-Bromofluorobenzene	%		87.8	107.0	89.3	93.9	107.0	87.8	19.2
Site 2	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<2	<2	<9			
Site 2		Tripropyltin	%		140.0	51.7	25.9	94.1	140.0	25.9	114.1
Site 3	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 3		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 3		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 3	Phenolic Compound Surrogates	Phenol-d6	%		42.0	35.8	39.4	33.6	42.0	33.6	8.4
Site 3		2-Chlorophenol-D4	%		90.4	83.5	87.8	69.2	90.4	69.2	21.2
Site 3		2.4.6-Tribromophenol	%		119.0	111.0	109	86.3	119.0	86.3	32.7
Site 3	PAH Surrogates	2-Fluorobiphenyl	%		87.6	81.5	93.1	77.6	93.1	77.6	15.5
Site 3		Anthracene-d10	%		97.0	92.5	103	91	103.0	91.0	12.0
Site 3		4-Terphenyl-d14	%		101.0	101.0	101	122	122.0	101.0	21.0
Site 3	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 3		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 3		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 3		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 3		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 3	)/BTEX Surrog	1.2-Dichloroethane-D4	%		99.6	109.0	97.1	101	109.0	97.1	11.9

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 3		Toluene-D8	%		97.9	89.9	86.7	97.3	97.9	86.7	11.2
Site 3		4-Bromofluorobenzene	%		92.9	86.0	80.4	97.7	97.7	80.4	17.3
Site 3	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<8	<2	<9			
Site 3		Tripropyltin	%		151.0	75.3	53.9	105	151.0	53.9	97.1
Site 4	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 4		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 4		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 4	Phenolic Compound Surrogates	Phenol-d6	%		40.1	36.8	42	41.2	42.0	36.8	5.2
Site 4		2-Chlorophenol-D4	%		88.2	85.7	94.5	93.3	94.5	85.7	8.8
Site 4		2.4.6-Tribromophenol	%		114.0	117.0	102	114	117.0	102.0	15.0
Site 4	PAH Surrogates	2-Fluorobiphenyl	%		70.0	80.4	77.5	99.7	99.7	70.0	29.7
Site 4		Anthracene-d10	%		71.8	98.9	101	108	108.0	71.8	36.2
Site 4		4-Terphenyl-d14	%		77.5	110.0	108	129	129.0	77.5	51.5
Site 4	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 4		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 4		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 4		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 4		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 4	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		102.0	134.0	102	102	134.0	102.0	32.0
Site 4		Toluene-D8	%		101.0	102.0	93.6	95.4	102.0	93.6	8.4
Site 4		4-Bromofluorobenzene	%		95.2	99.3	87.7	91.6	99.3	87.7	11.6
Site 4	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<2	<2	<10			
Site 4		Tripropyltin	%		102.0	79.5	47.1	98.2	102.0	47.1	54.9
Site 5	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 5		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 5		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 5		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 5	Phenolic Compound Surrogates	Phenol-d6	%		42.0	36.9	39.8	31.9	42.0	31.9	10.1
Site 5		2-Chlorophenol-D4	%		93.0	83.7	90.1	71.5	93.0	71.5	21.5
Site 5		2.4.6-Tribromophenol	%		117.0	117.0	99.7	88.5	117.0	88.5	28.5
Site 5	PAH Surrogates	2-Fluorobiphenyl	%		78.6	56.8	79.1	79	79.1	56.8	22.3
Site 5		Anthracene-d10	%		75.0	90.5	101	94.3	101.0	75.0	26.0
Site 5		4-Terphenyl-d14	%		80.2	99.7	108	128	128.0	80.2	47.8
Site 5	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 5		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 5		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 5		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 5		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 5	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		105.0	135.0	96.6	99.4	135.0	96.6	38.4
Site 5		Toluene-D8	%		96.4	89.7	86.1	99.9	99.9	86.1	13.8
Site 5		4-Bromofluorobenzene	%		92.2	95.5	81.6	99	99.0	81.6	17.4
Site 5	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	**111.0**	<2	<9	111.0	111.0	0.0
Site 5		Tripropyltin	%		108.0	68.8	79.9	98.7	108.0	68.8	39.2
Site 6	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 6		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 6		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 6	Phenolic Compound Surrogates	Phenol-d6	%		39.0	37.8	39.6	30.8	39.6	30.8	8.8
Site 6		2-Chlorophenol-D4	%		86.4	89.4	89.9	68.2	89.9	68.2	21.7
Site 6		2.4.6-Tribromophenol	%		117.0	114.0	100	83.7	117.0	83.7	33.3
Site 6	PAH Surrogates	2-Fluorobiphenyl	%		76.4	98.0	66.6	82.6	98.0	66.6	31.4
Site 6		Anthracene-d10	%		72.9	95.6	99.1	82.9	99.1	72.9	26.2
Site 6		4-Terphenyl-d14	%		79.6	105.0	107	116	116.0	79.6	36.4
Site 6	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 6		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 6		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 6		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 6		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 6	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		98.4	139.0	96.1	96.4	139.0	96.1	42.9
Site 6		Toluene-D8	%		95.0	97.1	86	100	100.0	86.0	14.0
Site 6		4-Bromofluorobenzene	%		89.5	95.6	79.7	99.5	99.5	79.7	19.8
Site 6	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<2	<2	<9			
Site 6		Tripropyltin	%		98.4	82.4	53.5	94.8	98.4	53.5	44.9
Site 7	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 7		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 7		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 7	Phenolic Compound Surrogates	Phenol-d6	%		45.3	38.0	41.7	27.6	45.3	27.6	17.7
Site 7		2-Chlorophenol-D4	%		98.7	89.2	88.3	61.4	98.7	61.4	37.3
Site 7		2.4.6-Tribromophenol	%		126.0	112.0	94.9	78.8	126.0	78.8	47.2
Site 7	PAH Surrogates	2-Fluorobiphenyl	%		86.8	88.0	88.8	73.8	88.8	73.8	15.0
Site 7		Anthracene-d10	%		81.6	89.5	94.5	76.3	94.5	76.3	18.2
Site 7		4-Terphenyl-d14	%		85.1	99.2	99.5	97.8	99.5	85.1	14.4
Site 7	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 7		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 7		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 7		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 7		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 7	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		97.3	146.0	114	105	146.0	97.3	48.7
Site 7		Toluene-D8	%		96.6	97.1	100	106	106.0	96.6	9.4
Site 7		4-Bromofluorobenzene	%		91.0	99.3	94.5	102	102.0	91.0	11.0
Site 7	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<2	<2	<9			
Site 7		Tripropyltin	%		109.0	95.9	51	99	109.0	51.0	58.0
Site 8	PAH	Naphthalene	µg/L	<70 µg/L	<1.0	<1.0	<1.0	<1.0			
Site 8		Acenaphthylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Acenaphthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Fluorene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Phenanthrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Benz(a)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 8		Chrysene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Benzo(a)pyrene	µg/L		<0.5	<0.5	<0.5	<0.5			
Site 8		Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8		Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1.0	<1.0			
Site 8	Phenolic Compound Surrogates	Phenol-d6	%		35.4	36.0	48.9	32.8	48.9	32.8	16.1
Site 8		2-Chlorophenol-D4	%		76.8	84.7	106	72.6	106.0	72.6	33.4
Site 8		2.4.6-Tribromophenol	%		107	109.0	101	86.8	109.0	86.8	22.2
Site 8	PAH Surrogates	2-Fluorobiphenyl	%		68.3	90.3	76.3	75.1	90.3	68.3	22.0
Site 8		Anthracene-d10	%		67	86.8	103	88.8	103.0	67.0	36.0
Site 8		4-Terphenyl-d14	%		71.4	97.9	108	122	122.0	71.4	50.6
Site 8	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20	<20	<20	<20			
Site 8		C10 - C14 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 8		C15 - C28 Fraction	µg/L	<10 µg/L	<100	<100	<100	<100			
Site 8		C29 - C36 Fraction	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 8		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50	<50	<50	<50			
Site 8	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		100	128.0	91.7	99.6	128.0	91.7	36.3
Site 8		Toluene-D8	%		96.9	94.2	79.9	102	102.0	79.9	22.1
Site 8		4-Bromofluorobenzene	%		92.8	101.0	74.5	101	101.0	74.5	26.5
Site 8	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2	<2	<2	<9			
Site 8		Tripropyltin	%		118	78.7	50.4	109	118.0	50.4	67.6
Site 9	PAH	Naphthalene	µg/L	<70 µg/L	<1.0		<1.0	<1.0			
Site 9		Acenaphthylene	µg/L		<1.0		<1.0	<1.0			
Site 9		Acenaphthene	µg/L		<1.0		<1.0	<1.0			
Site 9		Fluorene	µg/L		<1.0		<1.0	<1.0			
Site 9		Phenanthrene	µg/L		<1.0		<1.0	<1.0			
Site 9		Anthracene	µg/L		<1.0		<1.0	<1.0			
Site 9		Fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 9		Pyrene	µg/L		<1.0		<1.0	<1.0			
Site 9		Benz(a)anthracene	µg/L		<1.0		<1.0	<1.0			
Site 9		Chrysene	µg/L		<1.0		<1.0	<1.0			
Site 9		Benzo(b)fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 9		Benzo(k)fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 9		Benzo(a)pyrene	µg/L		<0.5		<0.5	<0.5			
Site 9		Indeno(1.2.3.cd)pyrene	µg/L		<1.0		<1.0	<1.0			
Site 9		Dibenz(a.h)anthracene	µg/L		<1.0		<1.0	<1.0			
Site 9		Benzo(g.h.i)perylene	µg/L		<1.0		<1.0	<1.0			
Site 9	Phenolic Compound Surrogates	Phenol-d6	%		38.7		41.1	35.2	41.1	35.2	5.9
Site 9		2-Chlorophenol-D4	%		84.2		87.9	74.7	87.9	74.7	13.2
Site 9		2.4.6-Tribromophenol	%		109		96.4	85.2	109.0	85.2	23.8
Site 9	PAH Surrogates	2-Fluorobiphenyl	%		71.8		65.8	81.5	81.5	65.8	15.7
Site 9		Anthracene-d10	%		65.1		102	89.9	102.0	65.1	36.9
Site 9		4-Terphenyl-d14	%		70.1		108	127	127.0	70.1	56.9
Site 9	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20		<20	<20			
Site 9		C10 - C14 Fraction	µg/L	<10 µg/L	<50		<50	<50			

Site Code		Analyte	Units	Guideline	Jan-10	Apr-10	Jul-10	Oct-10	Max	Min	Range
Site 9		C15 - C28 Fraction	µg/L	<10 µg/L	<100		<100	<100			
Site 9		C29 - C36 Fraction	µg/L	<10 µg/L	<50		<50	<50			
Site 9		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50		<50	<50			
Site 9	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		106		119	98	119.0	98.0	21.0
Site 9		Toluene-D8	%		103		102	94.4	103.0	94.4	8.6
Site 9		4-Bromofluorobenzene	%		98.9		97.8	92.1	98.9	92.1	6.8
Site 9	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2		<2	<9			
Site 9		Tripropyltin	%		101		64.8	87.1	101.0	64.8	36.2
Site 10	PAH	Naphthalene	µg/L	<70 µg/L	<1.0		<1.0	<1.0			
Site 10		Acenaphthylene	µg/L		<1.0		<1.0	<1.0			
Site 10		Acenaphthene	µg/L		<1.0		<1.0	<1.0			
Site 10		Fluorene	µg/L		<1.0		<1.0	<1.0			
Site 10		Phenanthrene	µg/L		<1.0		<1.0	<1.0			
Site 10		Anthracene	µg/L		<1.0		<1.0	<1.0			
Site 10		Fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 10		Pyrene	µg/L		<1.0		<1.0	<1.0			
Site 10		Benz(a)anthracene	µg/L		<1.0		<1.0	<1.0			
Site 10		Chrysene	µg/L		<1.0		<1.0	<1.0			
Site 10		Benzo(b)fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 10		Benzo(k)fluoranthene	µg/L		<1.0		<1.0	<1.0			
Site 10		Benzo(a)pyrene	µg/L		<0.5		<0.5	<0.5			
Site 10		Indeno(1.2.3.cd)pyrene	µg/L		<1.0		<1.0	<1.0			
Site 10		Dibenz(a.h)anthracene	µg/L		<1.0		<1.0	<1.0			
Site 10		Benzo(g.h.i)perylene	µg/L		<1.0		<1.0	<1.0			
Site 10	Phenolic Compound Surrogates	Phenol-d6	%		43.1		38.9	34.8	43.1	34.8	8.3
Site 10		2-Chlorophenol-D4	%		93.6		88.5	72.9	93.6	72.9	20.7
Site 10		2.4.6-Tribromophenol	%		121		103	95.3	121.0	95.3	25.7
Site 10	PAH Surrogates	2-Fluorobiphenyl	%		81.8		64.6	71.7	81.8	64.6	17.2
Site 10		Anthracene-d10	%		76.4		104	113	113.0	76.4	36.6
Site 10		4-Terphenyl-d14	%		82.2		111	130	130.0	82.2	47.8
Site 10	TPH	C6 - C9 Fraction	µg/L	<10 µg/L	<20		<20	<20			
Site 10		C10 - C14 Fraction	µg/L	<10 µg/L	<50		<50	<50			
Site 10		C15 - C28 Fraction	µg/L	<10 µg/L	<100		<100	<100			
Site 10		C29 - C36 Fraction	µg/L	<10 µg/L	<50		<50	<50			
Site 10		C10 - C36 Fraction (sum)	µg/L	<10 µg/L	<50		<50	<50			
Site 10	TPH(V)/BTEX Surrogates	1.2-Dichloroethane-D4	%		99.3		112	94.4	112.0	94.4	17.6
Site 10		Toluene-D8	%		97.8		94.2	99	99.0	94.2	4.8
Site 10		4-Bromofluorobenzene	%		92.2		86.6	95.4	95.4	86.6	8.8
Site 10	TBT	Tributyltin	ngSn/L	<0.006 µg/L	<2		<2	<9			
Site 10		Tripropyltin	%		111		68.9	97.8	111.0	68.9	42.1