



BAYWIDE WATER QUALITY MONITORING PROGRAM

PROGRESS REPORT No. 13 (JANUARY 2009)

FEBRUARY 2009

INTRODUCTION TO THE PROGRAM

This report summarises water quality data obtained for the Channel Deepening Project (CDP) Baywide Water Quality Monitoring Program at 11 sampling sites in Port Phillip Bay. Data is for January 2009. Monthly Progress Reports will be prepared throughout the dredging program and for two years thereafter.

Where extensive local water quality data is available, control charts (Shewhart and EWMA) have been developed (see Appendix 1). These charts provide a guide against which data can be compared. Where data is recorded beyond natural or expected variation, further investigation will be undertaken.

The information contained in this report is correct as available to EPA Victoria at the time of publication.

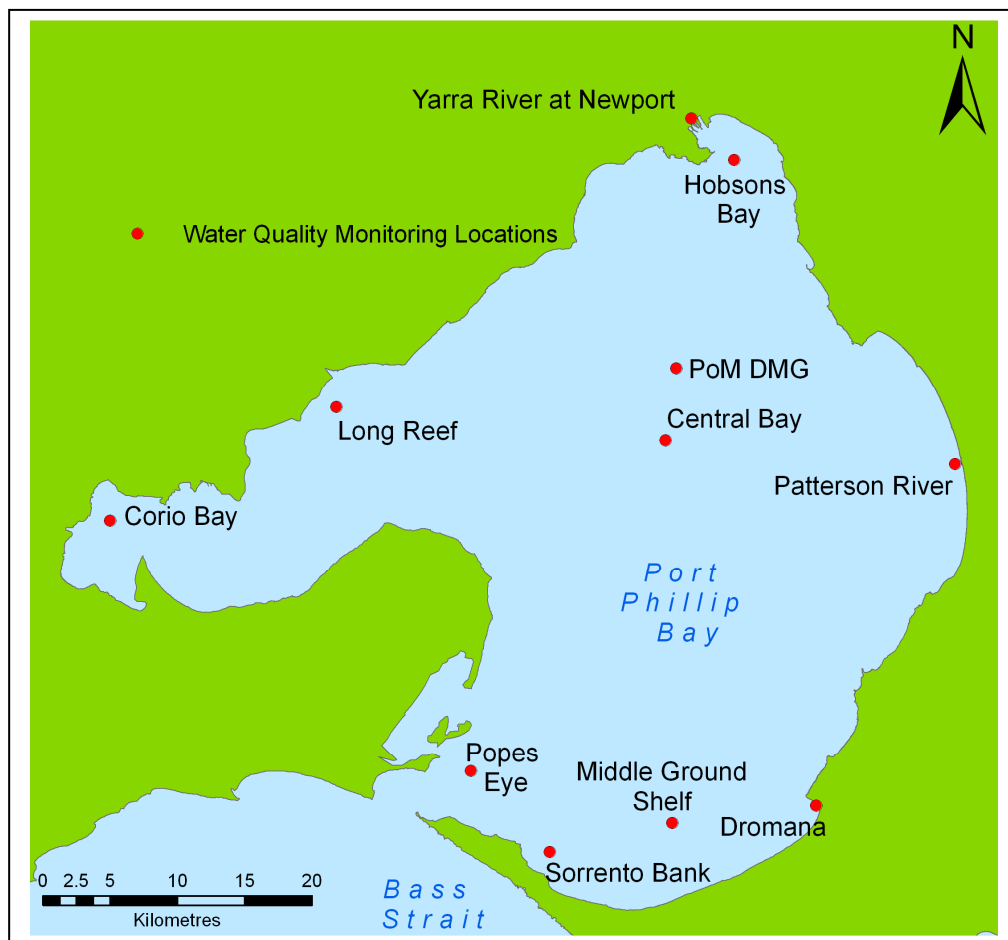


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

MATERIALS AND METHODS

The materials and methods for this program are described in the CDP Water Quality Detailed Design document CDP_ENV_MD_023 Rev 1.1 (PoMC 2008).

EXCEPTIONS

There was one new exception to the Water Quality detailed design document CDP_ENV_MD_023 Rev 1.1 during this reporting period. This is detailed in exception report ER090101 and outlined as follows:

- The Yarra River at Newport EWMA values for arsenic have been incorrectly reported in Progress Reports # 8-12 (August – December 2008). Previously presented data compared to the revised corrected EWMA values are presented in Table 9 as Appendix 3 of this report. Amended EWMA data provided in this report has not resulted in any alteration to EWMA exceedences.

The following previously issued exception report still applies to this progress report:

- ER080901: A variation to the Limit of Reporting for various parameters.

RESULTS AND DISCUSSION

All results presented in Tables 1 - 4 were assessed against the control limits listed in Tables 5 and 6 and where appropriate, compared to the SEPP objectives and ANZECC trigger levels of Table 7 (Appendix 1). Phytoplankton data is presented in Table 8 (Appendix 2).

Within this reporting period the EWMA control limits were exceeded six times. There were no exceedences of the Shewhart control limits (see Tables 1 - 4).

No significant events were observed during the field sampling that would affect these results.

As detailed in section 4.1.3 in the Water Quality detailed design document CDP_ENV_MD_023 Rev 1.1, samples were not taken at depth at the Yarra River site as the salinity difference between the near surface and depth was less than 10 ppt.

REFERENCES

PoMC 2008, Water Quality Detailed Design CDP_ENV_MD_023 Rev1.1, Port of Melbourne Corporation, September 2008.

TABLE 1 PHYSICO-CHEMICAL PARAMETERS (NST – No Sample Taken)

Date	Sampling Site	Depth m	Dissolved Oxygen		Salinity g/L	Secchi disc depth m	Temperature °C	Turbidity NTU	Total Suspended Solids ¹ mg/L	PAR micro Einsteins/m ² /sec
			mg/L	% saturation						
13/01/09	Yarra River at Newport	0.5	6.4	92	35.5	1.0	22.9	5.7	20.6	481.4
13/01/09	Yarra River at Newport	4.0	NST	NST	NST		NST	6.7	NST	16.7
13/01/09	Hobsons Bay	0.5	6.8	96	36.8	2.6	21.6	2.0	3.9	64.0
12/01/09	Central Bay	0.5	7.2	98	37.0	6.9	19.5	0.6	<1.5	168.0
12/01/09	PoM DMG	0.5	7.2	97	37.0	7.5	19.4	<0.5	<1.5	57.3
13/01/09	Corio Bay	0.5	7.2	100	37.9	5.1	20.6	0.7	<1.5	29.7
13/01/09	Long Reef	0.5	7.0	98	37.8	4.7	21.2	0.8	<1.5	58.3
12/01/09	Patterson River	0.5	7.3	99	36.9	>8.2 ²	19.5	<0.5	<1.5	125.8
12/01/09	Dromana	0.5	7.3	100	36.9	>6.8 ²	19.8	<0.5	<1.5	85.8
12/01/09	Middle Ground Shelf	0.5	7.2	99	36.8	9.1	19.8	<0.5	<1.5	1825.9
12/01/09	Sorrento Bank	0.5	7.7	104	35.9	>3.2 ²	19.9	<0.5	<1.5	88.8
12/01/09	Popes Eye	0.5	7.6	102	35.7	>13.3 ²	18.9	<0.5	<1.5	47.8

NOTES:

In situ data for temperature, turbidity and PAR are recorded across the depth profile. The result presented is for the specific depth noted. All other physico-chemical samples are taken at 0.5 m from surface, except Yarra River at Newport and Hobsons Bay where, if required, bottom samples are also collected.

Blue coloured cells indicate a result outside SEPP objectives (see Appendix 1, Table 7 for details).

1. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (see Exception Report ER080901)
2. Secchi disc visible on bottom.

TABLE 2A NUTRIENTS

Date	Sampling Site	Depth m	Ammonium µg/L		Nitrate µg/L	Nitrite ¹ µg/L	Nitrate plus Nitrite µg/L		Dissolved Organic Nitrogen µg/L	Total Nitrogen µg/L	
			Measured Value ¹	EWMA			Measured Value ¹	EWMA		Measured Value	EWMA
13/01/09	Yarra River at Newport	0.5	22.6	20.5	12.1	<1.2	12.1	29.8	141	241	239
13/01/09	Hobsons Bay	0.5	4.8	8.0	2.9	<1.2	2.9	8.1	151	194	196
12/01/09	Central Bay	0.5	4.7	5.6	2.0	<1.2	<2.4	1.9	144	169	144
12/01/09	PoM DMG	0.5	5.6	5.7	4.3	<1.2	4.3	2.9	121	148	142
13/01/09	Corio Bay	0.5	5.3	5.9	3.7	<1.2	3.7	2.5	166	199	187
13/01/09	Long Reef	0.5	6.1	13.2	2.9	<1.2	2.9	23.6	154	201	216
12/01/09	Patterson River	0.5	<4.5	6.2	2.2	<1.2	<2.4	6.4	115	140	162
12/01/09	Dromana	0.5	7.1	6.8	5.0	<1.2	5.0	4.4	117	142	140
12/01/09	Middle Ground Shelf	0.5	5.3	5.2	2.3	<1.2	<2.4	2.1	118	140	131
12/01/09	Sorrento Bank	0.5	<4.5	5.4	2.0	<1.2	<2.4	3.6	74	94	112
12/01/09	Popes Eye	0.5	4.8	6.1	3.4	<1.2	3.4	5.9	65	84	101

NOTES:

Orange coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

Green coloured cells indicate results above ANZECC trigger value only (see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6).

1. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (see Exception Report ER080901).



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TABLE 2B NUTRIENTS (CONT'D) – PHOSPHORUS AND SILICATE

Date	Sampling Site	Depth m	Phosphate µg/L		Organic Phosphorus ¹ µg/L	Total Phosphorus µg/L		Silicate µg/L
			Measured Value ¹	EWMA		Measured Value ¹	EWMA	
13/01/09	Yarra River at Newport	0.5	61.0	63.8	26	87	87	294
13/01/09	Hobsons Bay	0.5	61.4	67.7	20	81	88	141
12/01/09	Central Bay	0.5	49.8	51.0	<18	57	64	88
12/01/09	PoM DMG	0.5	51.5	50.8	<18	63	65	97
13/01/09	Corio Bay	0.5	57.9	64.2	<18	71	81	48
13/01/09	Long Reef	0.5	84.2	100.9	<18	102	123	98
12/01/09	Patterson River	0.5	50.6	56.3	<18	57	71	79
12/01/09	Dromana	0.5	41.8	39.5	<18	54	52	68
12/01/09	Middle Ground Shelf	0.5	41.1	40.9	<18	44	51	76
12/01/09	Sorrento Bank	0.5	11.2	25.0	<18	<18	34	39
12/01/09	Popes Eye	0.5	<7.5	15.9	<18	<18	25	34

NOTES:

Green coloured cells indicate results above ANZECC trigger value (see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6).

1. Limit of Reporting (LOR) has been amended where previously reported as Limit of Detection (see Exception Report ER080901).



TABLE 3 METALS, METALLOIDS AND ORGANOMETALLICS (NST – No Sample Taken; NAR - No Analysis Required)

Date	Sampling Site	Depth m	Arsenic µg/L		Tri-butyl Tin ¹ (TBT) µg/Lx10 ⁻³	Cadmium µg/L	Chromium µg/L	Copper µg/L	Mercury µg/L	Nickel µg/L	Lead µg/L	Zinc µg/L
			Measured Value	EWMA								
13/01/09	Yarra River at Newport - total	0.5	2.8	2.5	<2	<0.2	<0.5	<1	<0.1	1.9	0.6	<5
13/01/09	Hobsons Bay - total	0.5	2.7	2.7	<2	<0.2	0.9	<1	<0.1	1.3	<0.2	<5
12/01/09	Central Bay - total	0.5	2.9	2.8	NST	<0.2	<0.5	<1	<0.1	0.9	<0.2	<5
12/01/09	PoM DMG - total	0.5	2.4	2.6	NST	<0.2	<0.5	<1	<0.1	1.2	<0.2	<5
13/01/09	Corio Bay - total	0.5	2.9	2.8	NST	<0.2	<0.5	<1	<0.1	1.3	0.6	<5
13/01/09	Long Reef - total	0.5	2.8	2.9	NST	<0.2	<0.5	<1	<0.1	0.9	<0.2	<5
12/01/09	Patterson River - total	0.5	2.7	2.7	NST	<0.2	<0.5	<1	<0.1	1.0	<0.2	<5
12/01/09	Dromana - total	0.5	2.8	2.7	NST	<0.2	2.2	<1	<0.1	0.9	<0.2	<5
12/01/09	Middle Ground Shelf - total	0.5	3.0	2.6	NST	<0.2	<0.5	<1	<0.1	0.7	<0.2	<5
12/01/09	Middle Ground Shelf - dissolved	0.5	2.2	-	NST	NAR	NAR	NAR	NAR	NAR	NAR	NAR
12/01/09	Sorrento Bank - total	0.5	2.1	2.3	NST	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
12/01/09	Popes Eye - total	0.5	2.1	2.1	NST	<0.2	1.0	<1	<0.1	<0.5	<0.2	<5

NOTES:

Orange coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

Blue coloured cells indicate results above SEPP objectives (for metals, ANZECC triggers are the default objective when no SEPP value is specified; see Appendix 1, Table 7 for details). These results are within natural variation for Port Phillip Bay (see control limits, Appendix 1, Tables 5 and 6), unless **bolded** to indicate that no Shewhart control limit exists for metals at these sites.

1. TBT is only sampled from sub-surface levels at Yarra River at Newport and Hobsons Bay.



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TABLE 4 PHYTOPLANKTON AND ALGAL PIGMENTS (NST – No Sample Taken)

Date	Sampling Site	Depth m	Chlorophyll-a		Phaeophytin-a µg/L	Fluorescence (as <i>in situ</i> chlorophyll-a) mg/m ³	Total Phytoplankton cells/L	Diatoms cells/L	Dinoflagellates cells/L	Other Flagellates cells/L
			Measured Value µg/L	EWMA						
13/01/09	Yarra River at Newport	0.5	1.77	2.06	0.23	0.76	2.4E+06	6.5E+05	1.2E+05	1.6E+06
13/01/09	Yarra River at Newport	4.0	NST ¹	-	NST ¹	0.75				
13/01/09	Hobsons Bay	0.5	1.26	1.36	<0.18	0.56	1.1E+06	6.8E+05	4.5E+04	4.3E+05
12/01/09	Central Bay	0.5	0.54	0.64	<0.18	0.25	2.9E+05	9.0E+04	6.2E+03	1.9E+05
12/01/09	PoM DMG	0.5	0.55	0.56	<0.18	0.28	3.2E+05	1.2E+05	1.9E+04	1.7E+05
13/01/09	Corio Bay	0.5	0.70	0.66	<0.18	0.30	8.4E+05	5.8E+05	2.0E+04	2.4E+05
13/01/09	Long Reef	0.5	0.89	1.05	<0.18	0.38	6.1E+05	3.0E+05	4.3E+04	2.6E+05
12/01/09	Patterson River	0.5	0.35	0.80	<0.18	0.20	2.9E+05	9.8E+04	1.2E+04	1.8E+05
12/01/09	Dromana	0.5	0.28	0.62	<0.18	0.12	2.8E+05	7.2E+04	8.0E+03	2.0E+05
12/01/09	Middle Ground Shelf	0.5	0.29	0.50	<0.18	0.34	2.1E+05	4.4E+04	8.0E+03	1.6E+05
12/01/09	Sorrento Bank	0.5	0.51	0.61	<0.18	0.19	3.4E+05	1.8E+05	1.2E+04	1.5E+05
12/01/09	Popes Eye	0.5	0.31	0.49	<0.18	0.44	3.0E+05	1.5E+05	6.0E+03	1.4E+05

NOTES

Sedgewick count method for phytoplankton, diatoms, dinoflagellates, and other flagellates undertaken by using a vertical profile grab sample. For detailed cell counts based on individual species see Appendix 2.

Orange coloured cells indicate EWMA calculated results above EWMA control limits (see Appendix 1, Table 6 for details).

1. No algal pigment sample taken at Yarra River at Newport bottom waters.

APPENDIX 1

DERIVATION OF CONTROL LIMITS AND GUIDANCE VALUES

To define changes outside expected natural variability ('control limit'), control charts have been generated for all parameters where an extensive body of locally relevant water quality data exists (see Tables 5 and 6). The data used in developing control charts is validated data from 1994 onwards.

For other parameters where sufficient background data is not available, comparison is made to water quality objectives in State Environment Protection Policy (SEPP) Schedules F6 (Waters of Port Phillip Bay) and Schedule F7 (Waters of the Yarra Catchment).

Where no specific objective is listed in SEPP, the Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters (2001) are identified (see Table 7).

The derivation and application of the control limits and comparison values is set out in more detail in the Water Quality detailed design document CDP_ENV_MD_023 Rev 1.1 (available on the Channel Deepening Project website www.channelproject.com).

Specifically, two control charting techniques have been developed and employed in the analysis of water quality results:

- An Exponentially Weighted Moving Average (EWMA) control chart is used for assessment of longer-term changes in baseline results.
The EWMA is a statistic that averages the data in a way that gives less weight to data as they are further removed in time. To do this EWMA applies weighting factors which decrease exponentially over time. This gives relatively greater importance to recent observations while still not discarding older observations entirely.
EWMA is being used in this context to detect persistent changes from a baseline 'target' concentration, usually the historical mean of the data, which may reflect long term changes in water quality. An upper control limit for the EWMA has been calculated to assist in deciding whether a persistent change from the target value may have occurred
- A Shewhart control chart is used to compare short-term events, by comparing the measured result directly against the respective limit.

In the case of metals, EWMA and Shewhart control limits apply to the 'total' fraction, since the historical data they are derived from are 'total' metals. Conversely SEPP objectives and ANZECC guidelines apply to the 'dissolved' metal fraction. For transparency, this report highlights all metals exceedences whether total or dissolved.



APPENDIX 1 (CONT'D)

TABLE 5. SHEWHART CONTROL LIMITS FOR LISTED WATER QUALITY PARAMETERS

Sampling site	Total Nitrogen µg/L	Ammonium µg/L	Nitrate plus Nitrite µg/L	Total Phosphorus µg/L	Phosphate µg/L	Arsenic µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Lead µg/L	Mercury µg/L	Nickel µg/L	Zinc µg/L	TBT µg/L
Yarra River at Newport	383.31	88.78	182.90	138.91	107.54	4.75	0.20	0.58	3.08	2.79	0.10	4.29	12.77	0.02
Hobsons Bay	382.82	50.61	257.50	135.51	129.08	4.43	0.25	1.17	1.70	0.95	0.13	2.28	9.13	0.01
Central Bay	206.91	21.50	7.43	106.48	112.50	4.66	*	*	*	*	*	1.95	*	*
PoM DMG	217.07	7.81	28.33	107.98	76.61	4.73	*	*	*	*	*	2.82	*	0.02
Corio Bay	275.74	25.37	5.00	140.27	127.68	5.57	*	NA	*	*	*	1.90	*	NA
Long Reef	1035.88	999.28	512.03	536.16	445.31	4.56	*	NA	*	*	*	2.17	*	NA
Patterson River	367.57	30.57	366.52	111.81	87.58	3.56	*	NA	*	*	*	1.14	*	NA
Dromana	222.84	11.03	5.71	89.64	75.42	3.58	*	NA	*	*	*	1.06	*	NA
Middle Ground Shelf	185.93	10.66	2.71	96.82	65.33	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sorrento Bank	168.74	11.54	9.50	63.20	48.44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Popes Eye	209.84	14.74	42.71	471.38	148.04	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES

NA - No limit, as no historical data is available.

* - No limit, as greater than half historical data is below limits of reporting.

Source: Table 5 CDP_ENV_MD_023 Rev 1.1 (available on the Channel Deepening Project website www.channelproject.com).



TABLE 6. EWMA CONTROL LIMITS FOR LISTED WATER QUALITY PARAMETERS (Exponentially Weighted Moving Average)

Sampling site	Ammonium µg/L	Nitrate plus Nitrite µg/L	Total Nitrogen µg/L	Phosphate µg/L	Total Phosphorus µg/L	Chlorophyll- <i>a</i> µg/L	Arsenic µg/L
Yarra River at Newport	32.42	39.52	278.39	86.19	108.01	2.0	3.23
Hobsons Bay	19.45	39.53	266.22	85.72	105.32	3.9	2.98
Central Bay	9.90	3.61	168.10	72.32	84.08	1.1	2.86
PoM DMG	6.16	9.92	176.47	66.31	83.99	1.0	3.10
Corio Bay	10.70	2.31	224.48	100.12	115.66	1.4	3.66
Long Reef	219.05	83.74	629.12	238.83	305.50	6.8	3.20
Patterson River	13.65	42.75	243.10	69.75	89.34	2.2	2.59
Dromana	5.00	4.29	170.20	56.93	70.12	1.6	2.52
Middle Ground Shelf	7.02	2.29	156.09	50.94	63.85	0.8	N/A
Sorrento Bank	8.16	4.93	143.10	36.40	45.74	0.8	N/A
Popes Eye	8.20	12.73	145.12	36.75	120.94	0.8	N/A

NOTES

NA - No limit, as no historical data is available.

Source: Table 4 CDP_ENV_MD_023 Rev 1.1 (available on the Channel Deepening Project website www.channelproject.com).

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TABLE 7. SEPP OBJECTIVES AND ANZECC TRIGGER VALUES (N = NATURAL)

		Channel Deepening PARAMETER																													
Sampling Site	SEPP (WoV) schedule & segment	ANZECC Level of Protection	Dissolved Oxygen (% saturation)				Salinity variation	Temperature (°C)	Secchi disc depth (m)	Attenuation of PAR	Turbidity	Suspended Solids (mg/L)				Chlorophyll-a (ug/L)		Ammonium (ug/L)	Nitrate plus nitrite (ug/L)	Total nitrogen (ug/L)	Phosphate (ug/L)	Total Phosphorus (ug/L)	Arsenic (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Zinc (ug/L)	TBT (ug/L)
			Min for 1m below surface	Min 1m above bottom	Lower limit for 90th percentile	Min percentage concentration						Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile	Annual 90th percentile	Annual 50th percentile														
Yarra River at Newport	F6 Hobsons	95%	>90%	>90%			N ± 5%	N ± 1	>2	0.5	0.5 - 10					2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<10	0.006
	F7 Yarra Port					>60%		N ± 2					<20	<50	<25	<60			15	5	120	10	25	50	0.2	10	3	1	0.05	15	5
Hobsons Bay	F6 Hobsons	99%	>90%	>90%			N ± 5%	N ± 1	>2	0.5	0.5 - 10					2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<10	0.006
Corio Bay	F6 Corio		>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10					1.5	2.5	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<5	0.006
Long Reef	F6 Werribee		>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10					2.5	4.0	15	5	120	10	25	<3	5.5	<5	1.3	4.4	0.4	70	<5	0.006
Central Bay	F6 General		>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10					1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004
PoM DMG	F6 General		>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10					1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004
Patterson River	F6 Inshore	>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10					1.5	2.5	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
Dromana	F6 Inshore	>90%	>90%			N ± 5%	N ± 1	>3	0.45	0.5 - 10					1.5	2.5	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
Middle Ground Shelf	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10					1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
Sorrento Bank	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10					1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	
Popes Eye	F6 General	>90%		>90%		N ± 5%	N ± 1	>4	0.35	0.5 - 10					1.0	2.0	15	5	120	10	25	<3	<0.15	<5	0.3	2.2	0.1	7	<5	0.0004	

SEPP Waters of Victoria

N=natural background

SEPP Schedule F6 - Waters of Port Phillip Bay, and SEPP Schedule F7 - Waters of the Yarra Catchment objectives

Limit of reporting above objective

NOTES

Schedule F7 (Waters of the Yarra Catchment) is included for comparison of water quality objectives at the Yarra River at Newport site, as this site has been determined to be in a crossover area between schedules F6 and F7. Both schedule segments can be applicable to the site dependent on tide cycle and flow conditions in the Yarra mouth.

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APPENDIX 2

TABLE 8. PHYTOPLANKTON DATA

	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shelf	Sorrento Bank	Popes Eye
Collection Date	13/01/2009	13/01/2009	12/01/2009	12/01/2009	13/01/2009	13/01/2009	12/01/2009	12/01/2009	12/01/2009	12/01/2009	12/01/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
Genus	Species										
	Estimate Cells/L										
Total Phytoplankton	2.4E+06	1.1E+06	2.9E+05	3.2E+05	8.4E+05	6.1E+05	2.9E+05	2.8E+05	2.1E+05	3.4E+05	3.0E+05
Diatoms	6.5E+05	6.8E+05	9.0E+04	1.2E+05	5.8E+05	3.0E+05	9.8E+04	7.2E+04	4.4E+04	1.8E+05	1.5E+05
Dinoflagellates	1.2E+05	4.5E+04	6.2E+03	1.9E+04	2.0E+04	4.3E+04	1.2E+04	8.0E+03	8.0E+03	1.2E+04	6.0E+03
Other flagellates	1.6E+06	4.3E+05	1.9E+05	1.7E+05	2.4E+05	2.6E+05	1.8E+05	2.0E+05	1.6E+05	1.5E+05	1.4E+05
Diatoms											
<i>Amphora</i>	sp.	X			5.0E+03	X	2.0E+03	X	2.0E+03	2.0E+03	2.0E+03
<i>Bacillaria</i>	<i>paxillifera</i>				X						
<i>Bacteriastrium</i>	<i>elegans</i>					X					
<i>Cerataulina</i>	<i>pelagica</i>	X	X								
<i>Chaetoceros</i>	spp.	1.2E+05	3.9E+05	3.2E+04	3.0E+04	4.2E+05	2.3E+05	2.2E+04	2.0E+03	3.4E+04	2.0E+04
<i>Cocconeis</i>	spp.	3.0E+04	2.0E+04	4.0E+03	6.0E+03	1.0E+04	1.0E+04	1.2E+04	4.0E+03	1.0E+04	4.0E+03
<i>Coccinodiscus</i>	spp.	X							2.0E+03		
<i>Cylindrotheca</i>	<i>closterium</i>	2.0E+04	2.5E+04	6.0E+03	6.0E+03	2.0E+04	1.3E+04	1.2E+04	6.0E+03	8.0E+03	1.0E+04
<i>Dactylosolen</i>	<i>blavyanus</i>	1.0E+04	5.0E+03						X	2.0E+03	
<i>Dactylosolen</i>	<i>fragilissimus</i>		X					4.0E+03		X	1.8E+04
<i>Diploneis</i>	spp.										2.0E+03
<i>Ditylum</i>	<i>brightwellii</i>	X									
<i>Entomoneis</i>	sp.							2.0E+03		X	
<i>Fragilaria</i>	sp.					1.0E+04					
<i>Guinardia</i>	<i>flaccida</i>	X	X	6.0E+03	8.0E+03			4.0E+03		X	
<i>Hemiaulus</i>	<i>hauckii</i>	1.0E+04	5.0E+03	6.0E+03	1.6E+04			4.0E+03	2.0E+03	X	
<i>Leptocylindrus</i>	<i>danicus</i>		5.0E+04	6.0E+03	8.0E+03		X	2.0E+03			X
<i>Leptocylindrus</i>	<i>minimus</i>	X									1.8E+04
<i>Licmophora</i>	sp.		5.0E+03			1.0E+04	1.0E+04	2.0E+03	4.0E+03	2.0E+03	X
<i>Minidiscus</i>	<i>tricolatus</i>								4.0E+03		
<i>Naviculoid</i>	spp.	1.0E+04	1.0E+04			X	2.5E+03		4.0E+03	X	2.0E+03
<i>Nitzschia</i>	spp.	4.0E+04	1.0E+04	4.0E+03	4.0E+03	5.0E+03	1.3E+04	6.0E+03	2.0E+03	2.0E+03	4.0E+03
<i>Pleurosigma</i>	sp.	X	X			X					
<i>Proboscia</i>	<i>alata</i>									X	
<i>Pseudo-nitzschia</i>	<i>delicatissima</i> group		8.0E+02								8.0E+02
<i>Pseudo-nitzschia</i>	<i>pungens/multiseriis</i>	X	X								4.0E+02
<i>Pseudo-nitzschia</i>	<i>subpacific</i>										X
<i>Rhizosolenia</i>	spp.	X	X		X			X		X	
<i>Skeletonema</i>	<i>japonica/pseudocostatum</i>	8.0E+04	4.0E+04		X				1.2E+04		6.4E+04
<i>Striatella</i>	<i>unipunctata</i>					X					4.4E+04
<i>Thalassiosira</i>	sp.	X									
<i>Thalassiosira</i>	<i>cf. mala</i>	3.3E+05	1.2E+05	2.6E+04	4.6E+04	9.5E+04	2.8E+04	2.8E+04	2.8E+04	2.0E+04	2.4E+04

NOTES

“X” denotes genus identified, but species not determined in sample.

Blank cells denotes neither genus nor species were detected.

For table on VSQAP Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP_ENV_MD_012 Rev 1.1.

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TABLE 8. PHYTOPLANKTON DATA (CONT'D)

	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shell	Sorrento Bank	Popes Eye
Collection Date	13/01/2009	13/01/2009	12/01/2009	12/01/2009	13/01/2009	13/01/2009	12/01/2009	12/01/2009	12/01/2009	12/01/2009	12/01/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
Genus	Estimate Cells/L										
Total Phytoplankton	2.4E+06	1.1E+06	2.9E+05	3.2E+05	8.4E+05	6.1E+05	2.9E+05	2.8E+05	2.1E+05	3.4E+05	3.0E+05
Diatoms	6.5E+05	6.8E+05	9.0E+04	1.2E+05	5.8E+05	3.0E+05	9.8E+04	7.2E+04	4.4E+04	1.8E+05	1.5E+05
Dinoflagellates	1.2E+05	4.5E+04	6.2E+03	1.9E+04	2.0E+04	4.3E+04	1.2E+04	8.0E+03	8.0E+03	1.2E+04	6.0E+03
Other flagellates	1.6E+06	4.3E+05	1.9E+05	1.7E+05	2.4E+05	2.6E+05	1.8E+05	2.0E+05	1.6E+05	1.5E+05	1.4E+05
Dinoflagellates											
<i>Alexandrium margalefi</i>						X			X		
<i>Alexandrium pseudogonyaulax</i>			2.0E+02	3.0E+02							
<i>Ceratium furca</i>						X					
<i>Ceratium macroceros</i>			X								
<i>Ceratium tenue</i>			X	X			X		X		
<i>Ceratium tripos</i>			X	X							
<i>Dinophysis acuminata</i>		1.5E+02	X	5.5E+02			X				
<i>Gonyaulax spp.</i>		X									X
<i>Gymnodinium spp.</i>	6.0E+04	2.5E+04	4.0E+03	1.4E+04	1.5E+04	1.8E+04	1.0E+04	2.0E+03	2.0E+03	6.0E+03	6.0E+03
<i>Gyrodinium spp.</i>	X					X			X		X
<i>Heterocapsa rotundata</i>	6.0E+04	1.0E+04	2.0E+03	4.0E+03		1.0E+04	2.0E+03	6.0E+03	4.0E+03	4.0E+03	
<i>Noctiluca scintillans</i>			X	5.0E+01			5.0E+01		X	X	
<i>Oblea sp.</i>			X			X					
<i>Peridinium spp.</i>	X	X	X	X		7.5E+03			2.0E+03		
<i>Proocentrum gracile</i>		5.0E+03	X	X	X	X				2.0E+03	
<i>Protoceratium reticulatum</i>			X	X			X				
<i>Protoperidinium spp.</i>	X	X		X		X	X	X	X		
<i>Scrippsiella spp.</i>	X	5.0E+03		X	5.0E+03	7.5E+03					
Chrysophytes											
<i>Calycomonas sp.</i>			2.0E+03			5.0E+03	4.0E+03	1.4E+04	2.0E+03		
<i>Dinobryon spp.</i>						2.5E+03	2.0E+03		X		
Prymnesiophytes											
<i>Calcipappus caudatus</i>							2.0E+03		2.0E+03		
<i>Chrysochromulina spp.</i>	1.6E+05	6.5E+04	2.8E+04	1.4E+04	5.5E+04	6.0E+04	3.2E+04	3.8E+04	3.0E+04	2.2E+04	2.0E+04
<i>Emiliania huxleyi</i>	1.0E+04	1.5E+04	1.8E+04	3.6E+04	5.0E+03	1.5E+04	1.4E+04	8.0E+03	1.8E+04	4.8E+04	2.8E+04
Cryptophytes											
<i>Hemiselmis sp.</i>	4.5E+05	8.0E+04	5.8E+04	3.6E+04	2.0E+04	4.8E+04	4.6E+04	4.6E+04	4.4E+04	2.2E+04	3.6E+04
<i>Leucocryptos marina</i>											X
<i>Plagioselmis prolonga</i>	5.0E+05	1.3E+05	4.0E+04	3.8E+04	5.5E+04	4.3E+04	3.0E+04	3.8E+04	2.8E+04	2.4E+04	2.8E+04
<i>Teleaulax acuta</i>	1.2E+05	3.0E+04	1.2E+04	8.0E+03	2.5E+04	7.5E+03	8.0E+03	6.0E+03	8.0E+03	4.0E+03	1.0E+04
Chlorophytes											
<i>Staurastrum spp.</i>								2.0E+03			
Prasinophytes											
<i>Pyramimonas spp.</i>	2.4E+05	6.5E+04	2.6E+04	2.4E+04	4.5E+04	4.3E+04	2.4E+04	2.4E+04	2.0E+04	2.2E+04	1.4E+04
<i>Tetraselmis spp.</i>	1.1E+05	4.5E+04	6.0E+03	1.6E+04	3.0E+04	3.8E+04	1.2E+04	1.6E+04	1.0E+04		X
Euglenophyta											
<i>Euglena spp.</i>							2.0E+03	X			
<i>Eutreptiella spp.</i>	X		2.0E+03	2.0E+03	5.0E+03		4.0E+03	2.0E+03	X	4.0E+03	2.0E+03
Other											
<i>Unidentified bicosocoids</i>						X					
<i>Unidentified choanoflagellates</i>						2.5E+03		4.0E+03			
Comparative data in the report											
VSQAP Phytoplankton action levels in cells per litre (DPI, 2008)	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shell	Sorrento Bank	Popes Eye
Taxa	Warning to growers										
<i>Pseudo-nitzschia spp.</i>	50 000	X	800							800	400
<i>Rhizosolenia cf chunii</i>	10 000	X	X	X			X		X	X	
<i>Alexandrium catenella</i>	100										
<i>Alexandrium minutum</i>	100										
<i>Alexandrium tamarense</i>	100										
<i>Dinophysis acuminata</i>	1 000		150	X	550		X				
<i>Dinophysis caudata</i>	1 000										
<i>Dinophysis fortii</i>	1 000										
<i>Gymnodinium catenatum</i>	100										
<i>Karenia mikimotoi</i>	1 000										
<i>Karenia brevis</i>	1 000										
<i>Proocentrum lima</i>	1 000										

NOTES

“X” denotes genus identified, but species not determined in sample.

Blank cells denotes neither genus nor species were detected.

For table on VSQAP Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP_ENV_MD_012 Rev 1.1.



APPENDIX 3

TABLE 9. SUMMARY OF CHANGES TO ARSENIC EWMA VALUES* REPORTED IN PROGRESS REPORTS #8 - 12 (AUGUST – DECEMBER 2008).

Date	Sampling Site	Depth m	Arsenic µg/L		
			Measured Value	Reported EWMA	Revised EWMA
12/08/2008	Yarra River at Newport	0.5	3.1	2.33	2.75
18/09/2008	Yarra River at Newport	0.5	2.3	2.33	2.66
14/10/2008	Yarra River at Newport	0.5	2.5	2.36	2.63
12/11/2008	Yarra River at Newport	0.5	2.4	2.37	2.58
08/12/2008	Yarra River at Newport	0.5	1.9	2.28	2.45

*NOTES

Incorrect EWMA data was originally published in Progress Reports No.8-12 due to a transcription error (see also Exception Report ER090101 for details).