



BAYWIDE WATER QUALITY MONITORING PROGRAM

PROGRESS REPORT No. 20 (AUGUST 2009)

SEPTEMBER 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 August 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.

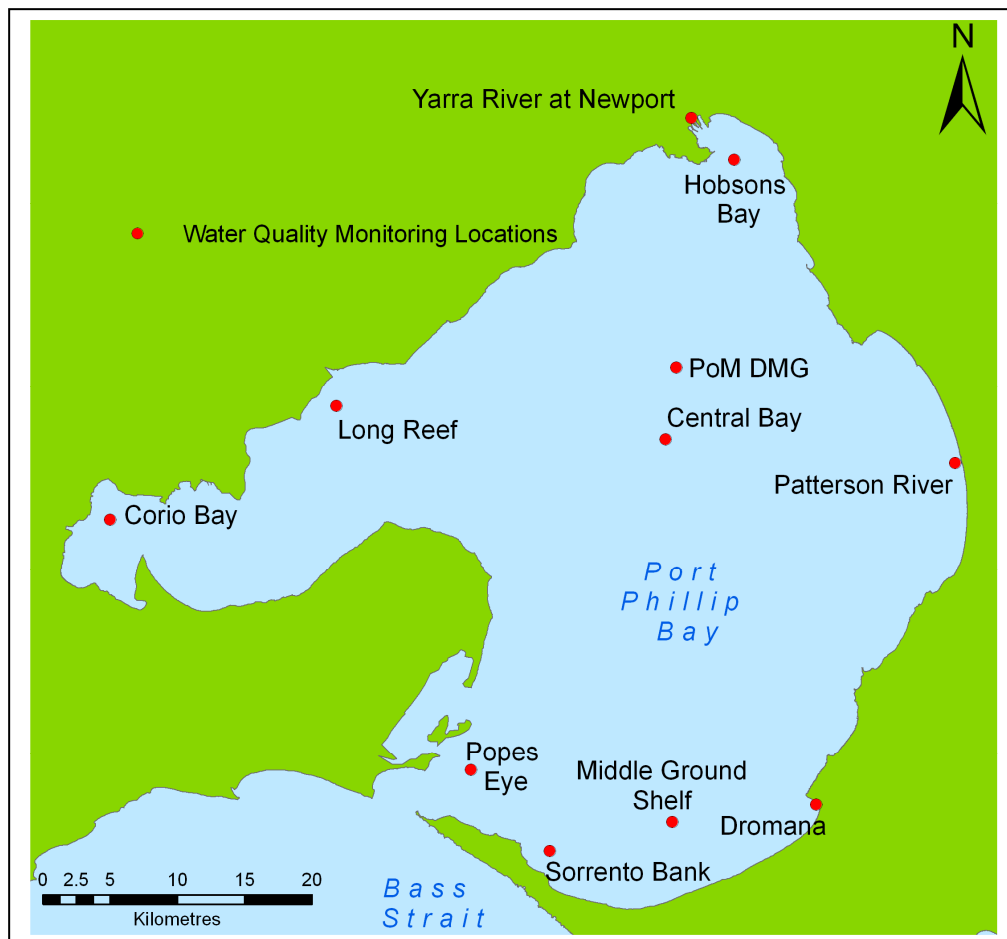


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

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 2.0 (PoMC 2009).

EXCEPTIONS

There was one new exception to the Detailed Design (PoMC 2009) during this reporting period, outlined as follows:

- ER090801: The monitoring for August 2009 commenced during the first week of August and finished in the second week of August.
- ER090802: Table 7 (SEPP objectives and ANZECC trigger values) has been amended.

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 five times. There were no exceedences of the Shewhart control limits (see Tables 1 - 4).

The presence of strong winds and rough conditions at the Central Bay site on 11/08/09 hampered the collection of phytoplankton samples. These samples were collected on 13/08/09.

As described in PoMC (2009) 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.

Where dissolved metal results exceeded total metal results, the results were within acceptable levels of inter-sample variation.

REFERENCES

PoMC 2009, Water Quality Detailed Design CDP_ENV_MD_023 Rev 2.0, Port of Melbourne Corporation, May 2009.

TABLE 1 PHYSICO-CHEMICAL PARAMETERS (NST – No Sample Taken; NVR – No Valid Result)

Date	Sampling Site	Depth m	Dissolved Oxygen		Salinity g/L	Secchi disc depth m	Temperature °C	Turbidity NTU	Total Suspended Solids mg/L	PAR micro Einsteins/m ² /sec
			mg/L	% saturation						
05/08/09	Yarra River at Newport	0.5	8.2	93	32.5	1.3	11.7	3.54	5.6	299.1
05/08/09	Yarra River at Newport	10.0	NST ³	NST ³	NST ³		NST ³	1.74	NST ³	3.1
05/08/09	Hobsons Bay	0.5	8.3	96	36.7	3.3	11.4	1.13	2.2	225.9
11/08/09	Central Bay	0.5	8.3	95	37.1	11.0	10.8	0.23	<1.5	34.0
13/08/09	PoM DMG	0.5	8.3	94	37.0	8.5	10.6	0.35	<1.5	58.2
05/08/09	Corio Bay	0.5	8.4	97	37.6	>6.1 ¹	10.8	0.37	<1.5	279.9
05/08/09	Long Reef	0.5	8.5	97	37.4	>5.7 ¹	10.6	0.36	<1.5	296.3
11/08/09	Patterson River	0.5	8.2	94	37.1	>4.9 ¹	10.7	0.24	<1.5	135.6
13/08/09	Dromana	0.5	8.4	96	36.7	>6.7 ¹	11.1	0.30	<1.5	60.0
11/08/09	Middle Ground Shelf	0.5	8.3	95	36.7	5.9	11.1	0.66	1.5	68.5
11/08/09	Sorrento Bank	0.5	8.2	95	36.4	>3.4 ¹	11.6	0.51	<1.5	180.3
11/08/09	Popes Eye	0.5	8.2	97	36.4	NST ²	12.7	0.41	<1.5	66.0

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 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. Secchi disc visible on bottom.
2. No valid result due to the tide impact on secchi disc trajectory
3. No sample taken at depth as the salinity difference between the near surface and depth was less than 10 ppt.



BAYWIDE WATER QUALITY MONITORING – PROGRESS REPORT No. 20

TABLE 2A NUTRIENTS

Date	Sampling Site	Depth m	Ammonium µg/L		Nitrate µg/L	Nitrite µg/L	Nitrate plus Nitrite µg/L		Dissolved Organic Nitrogen µg/L	Total Nitrogen µg/L	
			Measured Value	EWMA			Measured Value	EWMA		Measured Value	EWMA
05/08/09	Yarra River at Newport	0.5	4.9	25.3	59.5	<1.2	59.5	53.2	160	260	273
05/08/09	Hobsons Bay	0.5	5.7	8.2	11.4	<1.2	11.4	12.4	111	152	177
11/08/09	Central Bay	0.5	6.0	5.6	<1.2	<1.2	<1.2	2.1	105	120	136
13/08/09	PoM DMG	0.5	5.5	5.6	1.4	<1.2	1.4	2.3	97	120	138
05/08/09	Corio Bay	0.5	6.2	6.0	1.4	<1.2	1.4	2.3	165	199	188
05/08/09	Long Reef	0.5	7.4	25.5	1.9	<1.2	1.9	32.4	141	170	237
11/08/09	Patterson River	0.5	5.7	5.9	1.2	<1.2	1.2	2.9	106	126	146
13/08/09	Dromana	0.5	5.7	5.7	1.8	<1.2	1.8	3.4	104	126	130
11/08/09	Middle Ground Shelf	0.5	5.7	5.6	2.0	<1.2	2.0	2.4	85	109	129
11/08/09	Sorrento Bank	0.5	5.4	5.5	1.9	<1.2	1.9	4.8	71	94	106
11/08/09	Popes Eye	0.5	7.1	6.4	4.1	1.3	5.3	7.8	82	108	103

NOTES:

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



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

Date	Sampling Site	Depth m	Phosphate µg/L		Organic Phosphorus µg/L	Total Phosphorus µg/L		Silicate µg/L
			Measured Value	EWMA		Measured Value	EWMA	
05/08/09	Yarra River at Newport	0.5	32.5	52.4	29	61	77	362
05/08/09	Hobsons Bay	0.5	42.8	59.3	<18	60	78	106
11/08/09	Central Bay	0.5	35.7	43.3	<18	48	56	82
13/08/09	PoM DMG	0.5	33.3	44.0	<18	45	57	90
05/08/09	Corio Bay	0.5	55.0	60.0	<18	72	77	55
05/08/09	Long Reef	0.5	73.0	111.3	21	94	132	80
11/08/09	Patterson River	0.5	41.0	48.3	<18	55	62	86
13/08/09	Dromana	0.5	28.2	33.8	<18	44	46	82
11/08/09	Middle Ground Shelf	0.5	25.9	36.0	<18	39	47	70
11/08/09	Sorrento Bank	0.5	19.0	18.9	<18	30	29	50
11/08/09	Popes Eye	0.5	22.1	12.9	<18	34	22	54



TABLE 3A TOTAL METALS, METALLOIDS AND ORGANOMETALLICS (NST – No Sample Taken)

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								
05/08/09	Yarra River at Newport	0.5	2.0	2.4	<2	<0.2	0.5	2	<0.1	0.9	0.6	11
05/08/09	Hobsons Bay	0.5	2.2	2.5	<2	<0.2	<0.5	<1	<0.1	0.6	0.3	<5
11/08/09	Central Bay	0.5	2.2	2.5	NST	<0.2	<0.5	<1	<0.1	0.5	0.2	<5
13/08/09	PoM DMG	0.5	2.2	2.5	NST	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
05/08/09	Corio Bay	0.5	2.2	2.7	NST	<0.2	<0.5	1	<0.1	0.8	0.4	<5
05/08/09	Long Reef	0.5	2.1	2.5	NST	<0.2	<0.5	<1	<0.1	0.7	<0.2	<5
11/08/09	Patterson River	0.5	2.2	2.5	NST	<0.2	<0.5	<1	<0.1	0.6	0.4	<5
13/08/09	Dromana	0.5	2.1	2.4	NST	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
11/08/09	Middle Ground Shelf	0.5	2.2	2.5	NST	<0.2	<0.5	<1	<0.1	0.6	0.3	<5
11/08/09	Sorrento Bank	0.5	2.0	2.1	NST	<0.2	0.6	<1	<0.1	<0.5	<0.2	<5
11/08/09	Popes Eye	0.5	1.9	2.0	NST	<0.2	<0.5	<1	<0.1	0.6	0.5	<5

Notes:

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

TABLE 3B DISSOLVED METALS, METALLOIDS AND ORGANOMETALLICS

Date	Sampling Site	Depth m	Arsenic µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Mercury µg/L	Nickel µg/L	Lead µg/L	Zinc µg/L
05/08/09	Yarra River at Newport	0.5	1.9	<0.2	<0.5	<1	<0.1	0.8	0.3	8
05/08/09	Hobsons Bay	0.5	2.2	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
11/08/09	Central Bay	0.5	2.2	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
13/08/09	PoM DMG	0.5	2.3 ¹	<0.2	<0.5	<1	<0.1	0.6 ¹	<0.2	<5
05/08/09	Corio Bay	0.5	2.2	<0.2	<0.5	1	<0.1	0.8	0.3	<5
05/08/09	Long Reef	0.5	2.2 ¹	<0.2	<0.5	<1	<0.1	0.7	<0.2	<5
11/08/09	Patterson River	0.5	2.2	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
13/08/09	Dromana	0.5	2.1	<0.2	<0.5	2 ¹	<0.1	0.5	<0.2	<5
11/08/09	Middle Ground Shelf	0.5	2.0	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
11/08/09	Sorrento Bank	0.5	2.0	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
11/08/09	Popes Eye	0.5	1.9	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5

Notes:

Green coloured cells indicate results above ANZECC trigger values (for metals, ANZECC triggers are the default objective when no SEPP value is specified; see Appendix 1, Table 7 for details).

1. Dissolved result greater than total result but within acceptable levels of inter-sample variation.



BAYWIDE WATER QUALITY MONITORING – PROGRESS REPORT No. 20

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	EWMA						
05/08/09	Yarra River at Newport	0.5	0.80	1.85	<0.18	0.23	2.4E+05	3.1E+04	3.0E+04	1.8E+05
05/08/09	Yarra River at Newport	10.0	NST ¹	NST ¹	NST ¹	0.21				
05/08/09	Hobsons Bay	0.5	0.57	1.48	<0.18	0.17	1.0E+05	3.3E+04	1.4E+04	5.8E+04
11/08/09	Central Bay ²	0.5	0.41	0.69	<0.18	0.09	4.3E+04	7.4E+03	5.2E+03	3.0E+04
13/08/09	PoM DMG	0.5	0.52	0.74	<0.18	0.16	8.6E+04	2.2E+04	1.4E+04	5.0E+04
05/08/09	Corio Bay	0.5	0.78	1.09	<0.18	0.14	3.0E+05	1.5E+05	2.8E+04	1.2E+05
05/08/09	Long Reef	0.5	0.60	1.05	<0.18	0.16	2.9E+05	6.0E+04	5.6E+04	1.7E+05
11/08/09	Patterson River	0.5	0.49	0.74	<0.18	0.16	2.1E+05	4.0E+04	2.4E+04	1.5E+05
13/08/09	Dromana	0.5	0.56	0.74	<0.18	0.10	2.9E+05	9.1E+04	3.4E+04	1.7E+05
11/08/09	Middle Ground Shelf	0.5	1.10	0.84	<0.18	0.34	2.8E+05	6.7E+04	2.6E+04	1.8E+05
11/08/09	Sorrento Bank	0.5	0.67	0.78	<0.18	0.23	2.5E+05	6.8E+04	2.3E+04	1.6E+05
11/08/09	Popes Eye	0.5	0.83	0.64	<0.18	0.27	1.2E+05	2.1E+04	1.0E+04	8.4E+04

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.
2. Phytoplankton samples at Central Bay collected on 13/08/09

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 2.0 (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, SEPP objectives, EWMA and Shewhart control limits apply to the 'total' fraction, since the historical data they are derived from are 'total' metals. Conversely, ANZECC guidelines apply to the 'dissolved' metal fraction.



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 2.0 (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 2.0 (available on the Channel Deepening Project website www.channelproject.com).

BAYWIDE WATER QUALITY MONITORING – PROGRESS REPORT No. 20

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

Sampling Site	Policy Categories		Dissolved Oxygen (% saturation)				Salinity variation	Temperature (°C)	Secchi disc depth (m)	Attenuation of PAR	Turbidity (NTU)	Suspended Solids (mg/L)	Chlorophyll-a (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)	
	SEPP (WoV) schedule & segment	ANZECC Level of Protection	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
Yarra River at Newport	F6 Hobsons	95%	>90%	>90%			N ± 5%	N ± 1	>2	0.5				2.5	4.0	<3	<5.5	<5	<1.3	<4.4	<0.4	<70	<10	<0.006
	F7 Yarra Port					>60%		N + 2			<20	<50	<25	<60			<13	<0.2	<1	<1.3	<3.4	<0.05	<11	<8
Hobsons Bay	F6 Hobsons		>90%	>90%			N ± 5%	N ± 1	>2	0.5				2.5	4.0	<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				1.5	2.5	<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				2.5	4.0	<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				1.0	2.0	<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				1.0	2.0	<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				1.5	2.5	<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				1.5	2.5	<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				1.0	2.0	<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				1.0	2.0	<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				1.0	2.0	<3	<0.15	<5	<0.3	<2.2	<0.1	<7	<5	<0.0004	
SEPP Waters of Victoria		SEPP Schedule F6 - Waters of Port Phillip Bay, and SEPP Schedule F7 - Waters of the Yarra Catchment objectives											Limit of reporting above SEPP objective											
N=natural background		ANZECC trigger values not highlighted											Limit of reporting above ANZECC trigger value											

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.

The precautionary principle was used to determine the inclusion of either the marine or freshwater trigger values for F7 Yarra Port.

BAYWIDE WATER QUALITY MONITORING – PROGRESS REPORT No. 20

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
Collection Date	5/08/2009	5/08/2009	13/08/2009	13/08/2009	5/08/2009	5/08/2009	11/08/2009	13/08/2009	11/08/2009	11/08/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
Genus	Species									
Total Phytoplankton	2.4E+05	1.0E+05	4.3E+04	8.6E+04	3.0E+05	2.9E+05	2.1E+05	2.9E+05	2.8E+05	2.5E+05
Diatoms	3.1E+04	3.3E+04	7.4E+03	2.2E+04	1.5E+05	6.0E+04	4.0E+04	9.1E+04	6.7E+04	6.8E+04
Dinoflagellates	3.0E+04	1.4E+04	5.2E+03	1.4E+04	2.8E+04	5.6E+04	2.4E+04	3.4E+04	2.6E+04	2.3E+04
Other flagellates	1.8E+05	5.8E+04	3.0E+04	5.0E+04	1.2E+05	1.7E+05	1.5E+05	1.7E+05	1.8E+05	1.6E+05

Diatoms		Estimate Cells/L									
<i>Achnanthes</i>	sp.						X				
<i>Amphora</i>	sp.	X		4.0E+02	X	2.0E+03	2.5E+03		5.0E+02	5.0E+02	X
<i>Ardissonea</i>	<i>crystallina</i>	X									
<i>Attheya</i>	sp.									2.0E+03	
<i>Bacillaria</i>	<i>paxillifera</i>	X	X								
<i>Chaetoceros</i>	spp.	6.0E+03	1.0E+03	4.0E+02	X	6.0E+03	2.5E+03	6.0E+03		2.0E+03	2.0E+03
<i>Cocconeis</i>	spp.	2.0E+03	1.0E+03	4.0E+02	8.0E+02	1.4E+04	2.5E+03	2.0E+03	1.0E+04	2.0E+03	6.0E+03
<i>Coscinodiscus</i>	sp.			X			X				
<i>Cylindrotheca</i>	<i>closterium</i>	2.0E+03		1.2E+03	X	2.2E+04	1.8E+04	1.0E+04	1.2E+04	1.0E+04	2.0E+03
<i>Dactyliosolen</i>	sp.	2.5E+02	X		1.0E+03			X	X		
<i>Dactyliosolen</i>	<i>fragilissimus</i>						X	X			2.0E+03
<i>Diploneis</i>	sp.		1.0E+03		8.0E+02				1.0E+03		
<i>Entomoneis</i>	sp.	X	X	X	X		5.0E+02	X	2.0E+03		X
<i>Eucampia</i>	<i>zodiacus</i>	X	X				X				
<i>Fallacia</i>	sp.								4.0E+03		
<i>Fragilaria</i>	sp.	X			8.0E+02	2.0E+03	X				5.0E+02
<i>Grammotophora</i>	<i>marina</i>										2.0E+03
<i>Guinardia</i>	<i>flaccida</i>	2.0E+03	X	4.0E+02	5.0E+02			X	X	5.0E+02	X
<i>Hemiaulus</i>	sp.	2.0E+03	1.2E+04	8.0E+02	X			4.0E+03	2.0E+03		2.0E+03
<i>Leptocylindrus</i>	<i>danicus</i>							X			
<i>Leptocylindrus</i>	<i>minimus</i>								X	X	
<i>Licmophora</i>	sp.	2.0E+03		2.0E+02		3.8E+04	5.0E+02	X	2.0E+03	X	X
<i>Lioloma</i>	sp.					5.0E+02					
<i>Meunieria</i>	<i>membranacea</i>				1.0E+03						X
<i>Minidiscus</i>	<i>tricolatus</i>	2.0E+03	6.0E+03	2.8E+03	4.8E+03	6.0E+03	7.5E+03	6.0E+03	2.0E+03	2.0E+03	6.0E+03
<i>Minutocellus</i>	sp.					4.0E+03	2.5E+03				
<i>Naviculoid</i>	spp.	X	1.0E+03		X		5.0E+02				2.0E+03
<i>Nitzschia</i>	sp.	2.0E+03		X	4.0E+03	2.6E+04	1.8E+04		2.6E+04	8.0E+03	4.0E+03
<i>Nitzschia</i>	<i>longissima</i>					6.0E+03					
<i>Nitzschia</i>	<i>sigmoidea</i>										
<i>Plagiotropis</i>	sp.										X
<i>Pleurosigma</i>	sp.	X			8.0E+02			X	X	X	5.0E+02
<i>Proboscia</i>	<i>alata</i>	X	1.0E+03	X					X		
<i>Pseudo-nitzschia</i>	<i>delicatissima</i> group	1.5E+02				X			1.0E+03		X
<i>Pseudo-nitzschia</i>	<i>fraudulenta/australis</i>									X	
<i>Pseudo-nitzschia</i>	<i>pungens/multiseriis</i>	X	2.0E+02					X		X	X
<i>Pseudosolenia</i>	<i>calcar-avis</i>									X	
<i>Rhizosolenia</i>	spp.	2.5E+02	1.0E+03	X	5.0E+02		X	X	X	X	X
<i>Rhizosolenia</i>	<i>setigera</i>		X			5.0E+02	X		X	X	
<i>Skeletonema</i>	<i>japonicum/pseudocostatum</i>	X	2.0E+03			1.0E+04	X				
<i>Stauroneis</i>	sp.		X		X					X	X
<i>Striatella</i>	<i>unipunctata</i>	X				X					X
<i>Synedra</i>	sp.	X								X	
<i>Thalassionema</i>	sp.				5.0E+02						
<i>Thalassiosira</i>	sp.	2.0E+03	2.0E+03		1.6E+03	2.0E+03	2.5E+03	2.0E+03	4.0E+03		5.0E+02
<i>Thalassiosira</i>	<i>cf. mala</i>	8.0E+03	5.0E+03	8.0E+02	4.8E+03	1.0E+04	2.5E+03	1.0E+04	2.4E+04	4.0E+04	3.8E+04

NOTES

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

Blank cells denotes neither genus nor species were detected.

For table on VSOM Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP_ENV_MD_012 Rev 2.0.

BAYWIDE WATER QUALITY MONITORING – PROGRESS REPORT No. 20

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 Shelf	Sorrento Bank	Popes Eye
Collection Date		5/08/2009	5/08/2009	13/08/2009	13/08/2009	5/08/2009	5/08/2009	11/08/2009	13/08/2009	11/08/2009	11/08/2009	11/08/2009
Count Method		Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
Genus		Estimate Cells/L										
Total Phytoplankton		2.4E+05	1.0E+05	4.3E+04	8.6E+04	3.0E+05	2.9E+05	2.1E+05	2.9E+05	2.8E+05	2.5E+05	1.2E+05
Diatoms		3.1E+04	3.3E+04	7.4E+03	2.2E+04	1.5E+05	6.0E+04	4.0E+04	9.1E+04	6.7E+04	6.8E+04	2.1E+04
Dinoflagellates		3.0E+04	1.4E+04	5.2E+03	1.4E+04	2.8E+04	5.6E+04	2.4E+04	3.4E+04	2.6E+04	2.3E+04	1.0E+04
Other flagellates		1.8E+05	5.8E+04	3.0E+04	5.0E+04	1.2E+05	1.7E+05	1.5E+05	1.7E+05	1.8E+05	1.6E+05	8.4E+04
Dinoflagellates												
<i>Alexandrium pseudogonyaulax</i> sp.				X	X							
<i>Ceratium fusus</i>		X	X							X	X	X
<i>Ceratium macroceros</i>		X	5.0E+02	2.0E+02	X					X	X	
<i>Ceratium pentagonum</i>												X
<i>Ceratium tenue</i>			5.0E+02		X		X	X		X	X	X
<i>Ceratium</i> sp.		X										
<i>Dinophysis acuminata</i>			X	X		5.0E+01	5.0E+01	X				
<i>Dinophysis caudata</i>												X
<i>Dinophysis tripos</i>									X			X
<i>Diplopelta bomba</i>										X		
<i>Gonyaulax</i> spp.						2.0E+03	5.0E+02					
<i>Gymnodinium</i> spp.		4.0E+03	6.0E+03	1.2E+03	7.2E+03	1.8E+04	3.5E+04	2.0E+03	1.2E+04	4.0E+03		3.0E+03
<i>Gyrodinium</i> spp.		8.0E+03	1.0E+03	1.6E+03	8.0E+02	2.0E+03	2.5E+03		1.0E+04	4.0E+03	2.0E+03	
<i>Heterocapsa rotundata</i>		1.8E+04	4.0E+03	2.0E+03	4.0E+03	6.0E+03	1.5E+04	2.2E+04	1.2E+04	1.8E+04	2.0E+04	7.0E+03
<i>Noctiluca scintillans</i> sp.		X	5.0E+01	X	X	X	1.0E+02		X	5.0E+01	X	X
<i>Pendinium</i> sp.									X			
<i>Prependinium meureri</i>							X				X	
<i>Prorocentrum cordatum</i>			5.0E+02									
<i>Prorocentrum emarginatum</i>											1.0E+02	
<i>Prorocentrum gracile</i>			X	X	8.0E+02						X	X
<i>Protopendinium</i> spp.		2.5E+02	1.0E+03	2.0E+02	8.0E+02		X		X	X	X	X
<i>Pyrophacus</i> spp.												X
<i>Scripsiella</i> spp.				X	8.0E+02		2.5E+03	X	X		5.0E+02	
<i>Takayama pulchella</i>										5.0E+01		
Chrysophytes												
<i>Calycomonas</i> sp.		1.2E+04	3.0E+03	2.0E+03	3.2E+03	8.0E+03	1.0E+04	4.0E+03	1.6E+04	2.0E+03	8.0E+03	1.0E+03
<i>Ochromonas</i> spp.		6.0E+03				2.0E+03	2.5E+03		4.0E+03			
Prymnesiophytes												
<i>Chrysochromulina</i> spp.		2.0E+03	2.0E+03	1.6E+03	3.2E+03	2.0E+03	1.3E+04	1.0E+04	2.0E+03	1.4E+04	6.0E+03	2.0E+03
<i>Emiliania huxleyi</i>		4.0E+03	4.0E+03	6.4E+03	8.8E+03	1.2E+04		1.2E+04	6.0E+03	1.2E+04	3.8E+04	2.8E+04
<i>Gephyrocapsa oceanica</i>												1.0E+03
Cryptophytes												
<i>Hemiselmis</i> sp.		3.6E+04	1.5E+04	7.6E+03	9.6E+03	2.8E+04	3.0E+04	2.2E+04	3.2E+04	3.8E+04	3.6E+04	1.8E+04
<i>Leucocryptos marina</i>		1.4E+04	5.0E+03	4.0E+02	2.4E+03		2.5E+03	6.0E+03	2.0E+03	8.0E+03	2.0E+03	2.0E+03
<i>Plagioselmis prolonga</i>		8.4E+04	1.7E+04	1.0E+04	9.6E+03	4.4E+04	7.3E+04	4.4E+04	9.6E+04	7.6E+04	5.6E+04	2.3E+04
<i>Rhodomonas salina</i>										2.0E+03	2.0E+03	
<i>Teleaulax acuta</i>		4.0E+03	1.0E+03	8.0E+02	3.2E+03	8.0E+03	5.0E+03	1.8E+04		1.2E+04	4.0E+03	1.0E+03
Prasinophytes												
<i>Pyramimonas</i> spp.		6.0E+03	3.0E+03		8.0E+02	6.0E+03	7.5E+03	1.2E+04	8.0E+03	4.0E+03	2.0E+03	2.0E+03
<i>Tetraselmis</i> spp.		8.0E+03	4.0E+03	4.0E+02	8.0E+02	2.0E+03	1.0E+04	1.0E+04	2.0E+03	1.2E+04	6.0E+03	
Euglenophyta												
<i>Eutreptiella</i> spp.		2.0E+03	1.0E+03	8.0E+02	4.0E+03		2.5E+03	4.0E+03	2.0E+03			2.0E+03
Other												
<i>Apedinella spinifera</i>							2.5E+03					
<i>Dictyocha octonaria</i>		X						4.0E+03				
<i>Stephanoeca</i> sp.												
<i>Heterosigma</i> sp.					5.0E+02							
Unidentified amoeba							5.0E+03					
Unidentified bodonids			2.0E+03		8.0E+02	6.0E+03						3.0E+03
<i>Mesodinium rubrum</i>			1.0E+03	4.0E+02	3.2E+03	2.0E+03	7.5E+03			2.0E+03		1.0E+03
VSOM Phytoplankton action levels in cells per litre (DPI, 2009)												
		Comparative data in the report										
Taxa	Warning to growers	Yarra River at Newport	Hobsons Bay	Central Bay	PoM DMG	Corio Bay	Long Reef	Patterson River	Dromana	Middle Ground Shelf	Sorrento Bank	Popes Eye
<i>Pseudo-nitzschia</i> spp.	100 000	150	200			X		X	1000	X	X	X
<i>Rhizosolenia cf chunii</i>	10 000											
<i>Alexandrium catenella</i>	200											
<i>Alexandrium minutum</i>	200											
<i>Alexandrium tamarense</i>	200											
<i>Dinophysis acuminata</i>	1 000		X	X		50	50	X				
<i>Dinophysis caudata</i>	1 000											X
<i>Dinophysis fortii</i>	1 000											
<i>Gymnodinium catenatum</i>	1000											
<i>Karenia mikimotoi</i>	100 000											
<i>Karenia brevis</i>	1 000											
<i>Prorocentrum 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 VSOM Phytoplankton action levels refer to Algal Blooms – Detailed Design, CDP_ENV_MD_012 Rev 2.0