



# BAYWIDE WATER QUALITY MONITORING PROGRAM

## PROGRESS REPORT No.16 (APRIL 2009)

MAY 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 April 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.

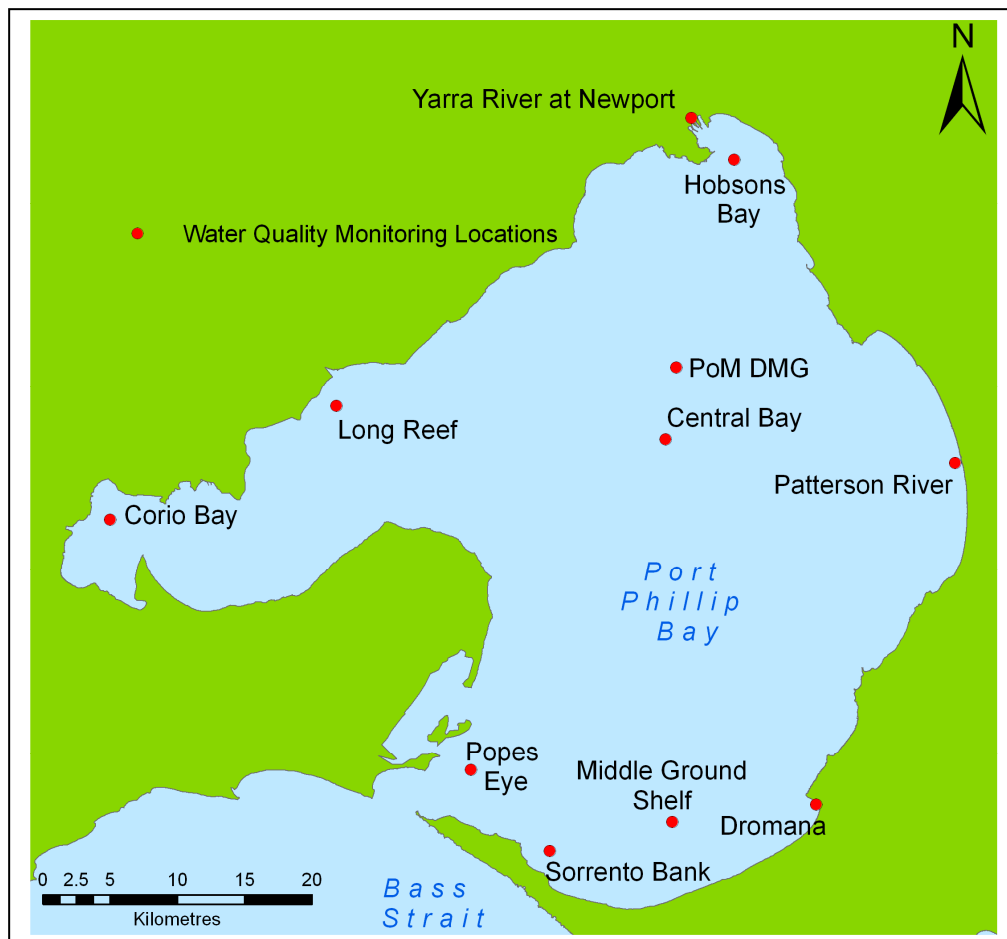


FIGURE 1 MAP OF SAMPLING SITES IN PORT PHILLIP BAY

## MATERIALS AND METHODS

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

### EXCEPTIONS

There were three new exceptions to the Detailed Design (PoMC 2008) during this reporting period, outlined as follows:

- ER090401: Dissolved Oxygen (DO) samples were not analysed by the laboratory within specified holding times, although they are considered valid for reporting.
- ER090402: PAR data in April 2009 was recorded using a spherical (scaler) rather than flat (planar) PAR sensor.
- ER090403: A variation in the LOR for nitrate plus nitrite.

The following, previously issued exception report still applies:

- ER080901: A variation to the LOR 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 four times and there was one exceedence of Shewhart control (see Tables 1 - 4).

During this sampling period there are a number of events that are worth noting:

- The presence of strong winds and rough conditions in Port Phillip Bay during the sampling period may have contributed to the reduced water clarity and the accuracy of the results for secchi disc depth at some sites.
- There has been a change in laboratory for the reporting of metals analysis. Duplicate samples are currently being collected and analysed across all sites by the original laboratory to ensure comparability between laboratories. These results will be reported in the next Milestone Report.
- A back-up CTD multi-sensor probe was used to collect *in-situ* data this month while the regular CTD is undergoing annual calibration. The back-up CTD has a spherical (scaler) rather than flat (planar) PAR sensor which is capable of detecting light from all directions. This has resulted in higher PAR readings (see Exception Report ER090402).

As described in section 4.1.3 of the Detailed Design (PoMC 2008), 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 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, 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 <sup>1</sup> mg/L	PAR <sup>5</sup>  micro Einsteins/m <sup>2</sup> /sec
			mg/L	% saturation						
15/04/09	Yarra River at Newport	0.5	7.0	93	36.8	0.75	18.2	8.2	14.1	9875.6
15/04/09	Yarra River at Newport	15.0	NST <sup>3</sup>	NST <sup>3</sup>	NST <sup>3</sup>		NST <sup>3</sup>	14.2 <sup>4</sup>	NST <sup>3</sup>	0.8
15/04/09	Hobsons Bay	0.5	7.3	96	37.6	3.00	17.7	2.3	3.9	477.6
14/04/09	Central Bay	0.5	7.1	95	37.6	6.50	18.3	<0.5	<1.5	8987.2
14/04/09	PoM DMG	0.5	7.0	93	37.6	4.25	18.2	0.5	<1.5	6557.6
16/04/09	Corio Bay	0.5	7.1	92	38.7	3.00	16.8	2.0	3.5	6899.5
16/04/09	Long Reef	0.5	7.1	91	37.9	5.00	16.3	0.7	<1.5	2441.1
14/04/09	Patterson River	0.5	7.1	94	37.4	7.25	18.3	<0.5	<1.5	8200.1
14/04/09	Dromana	0.5	7.2	96	37.3	5.50	18.3	<0.5	<1.5	2850.0
14/04/09	Middle Ground Shelf	0.5	7.2	96	37.2	2.50	18.3	1.3	2.3	10319.0
14/04/09	Sorrento Bank	0.5	7.3	95	36.1	>3.75 <sup>2</sup>	17.7	<0.5	<1.5	642.7
16/04/09	Popes Eye	0.5	7.1	93	37.3	7.00	17.4	<0.5	<1.5	8410.6

**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 salinity difference between the near surface and depth is greater than 10 ppt, bottom samples are also collected.

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

Green coloured cells indicate results above ANZECC trigger value only (see Appendix 1, Table 7 for details).

1. Limit of Reporting (LOR) has been amended where previously reported at Limit of Detection (see Exception Report ER080901).
2. Secchi disc visible on bottom.
3. No sample taken at depth as the salinity difference between the near surface and depth was less than 10 ppt.
4. ANZECC guidelines recommend a turbidity range of 0.5-10 NTU for estuarine and marine waters but acknowledge that higher values may be found in estuarine and inshore coastal waters due to wind-induced re-suspension or to the input of turbid water from the catchment.
5. Scalar rather than planar sensor used in the determination of PAR therefore data is not directly comparable to existing dataset (see Exception Report ER090402).

TABLE 2A NUTRIENTS

Date	Sampling Site	Depth m	Ammonium µg/L		Nitrate <sup>1</sup> µg/L	Nitrite <sup>1</sup> µg/L	Nitrate plus Nitrite µg/L		Dissolved Organic Nitrogen µg/L	Total Nitrogen µg/L	
			Measured Value <sup>1</sup>	EWMA			Measured Value <sup>2</sup>	EWMA		Measured Value	EWMA
15/04/09	Yarra River at Newport	0.5	10.5	20.3	7.8	<1.2	7.8	22.7	122	209	242
15/04/09	Hobsons Bay	0.5	4.8	7.5	2.8	<1.2	2.8	5.4	114	151	183
14/04/09	Central Bay	0.5	4.8	5.9	2.5	<1.2	2.5	2.2	113	142	147
14/04/09	PoM DMG	0.5	<4.5	5.9	1.7	<1.2	1.7	2.9	116	146	149
16/04/09	Corio Bay	0.5	<4.5	5.9	<1.2	<1.2	<1.2	2.1	162	206	204
16/04/09	Long Reef	0.5	<4.5	14.9	2.0	<1.2	2.0	23.9	124	155	239
14/04/09	Patterson River	0.5	<4.5	6.1	2.1	<1.2	2.1	4.2	115	149	158
14/04/09	Dromana	0.5	<4.5	6.2	1.5	<1.2	1.5	3.3	105	131	140
14/04/09	Middle Ground Shelf	0.5	4.8	5.9	1.9	<1.2	1.9	2.1	110	138	138
14/04/09	Sorrento Bank	0.5	4.5	5.6	3.9	<1.2	3.9	3.2	90	111	115
16/04/09	Popes Eye	0.5	5.7	6.5	2.0	<1.2	2.0	4.6	116	138	113

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 at Limit of Detection (see Exception Report ER080901).
2. LOR has been amended from <2.4µg/L in previous reports to <1.2µg/L (see Exception Report ER090403 and ER080901).

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

Date	Sampling Site	Depth m	Phosphate µg/L		Organic Phosphorus <sup>1</sup> µg/L	Total Phosphorus µg/L		Silicate µg/L
			Measured Value	EWMA		Measured Value	EWMA	
15/04/09	Yarra River at Newport	0.5	53.1	60.7	28	81	86	149
15/04/09	Hobsons Bay	0.5	51.7	59.5	21	72	78	61
14/04/09	Central Bay	0.5	42.2	48.2	<18	56	62	69
14/04/09	PoM DMG	0.5	47.0	49.4	<18	60	64	91
16/04/09	Corio Bay	0.5	57.7	62.9	23	81	82	100
16/04/09	Long Reef	0.5	48.6	135.2	<18	66	160	71
14/04/09	Patterson River	0.5	47.0	51.2	<18	59	66	76
14/04/09	Dromana	0.5	34.6	37.4	<18	47	50	62
14/04/09	Middle Ground Shelf	0.5	34.0	39.6	<18	46	50	57
14/04/09	Sorrento Bank	0.5	9.8	18.9	<18	20	29	41
16/04/09	Popes Eye	0.5	34.0	16.0	<18	47	26	60

NOTES:

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 at Limit of Detection (see Exception Report ER080901).

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

Date	Sampling Site	Depth m	Arsenic µg/L		Tri-butyl Tin <sup>1</sup> (TBT) µg/Lx10 <sup>-3</sup>	Cadmium µg/L	Chromium µg/L	Copper µg/L	Mercury µg/L	Nickel µg/L	Lead µg/L	Zinc µg/L
			Measured Value	EWMA								
15/04/09	Yarra River at Newport - total	0.5	3.2	2.7	<2	<0.2	<b>1.0</b>	<1	<0.1	1.2	0.6	<5
15/04/09	Yarra River at Newport - dissolved	0.5	2.8	-	NAR	NAR	<0.5	NAR	NAR	NAR	NAR	NAR
15/04/09	Hobsons Bay - total	0.5	3.0	2.8	<2	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
15/04/09	Hobsons Bay – dissolved	0.5	3.0	-	NAR	NAR	NAR	NAR	NAR	NAR	NAR	NAR
14/04/09	Central Bay - total	0.5	2.8	2.8	NST	<0.2	0.6	<1	<0.1	0.5	<0.2	<5
14/04/09	PoM DMG - total	0.5	2.9	2.7	NST	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
16/04/09	Corio Bay - total	0.5	3.4	3.1	NST	0.2	0.7	<1	<0.1	0.9	0.2	<5
16/04/09	Corio Bay – dissolved	0.5	3.2	-	NAR	NAR	NAR	NAR	NAR	NAR	NAR	NAR
16/04/09	Long Reef - total	0.5	2.9	2.9	NST	<0.2	<0.5	<1	<0.1	0.6	<0.2	<5
14/04/09	Patterson River - total	0.5	2.9	<b>2.8</b>	NST	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
14/04/09	Dromana - total	0.5	2.9	<b>2.7</b>	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
14/04/09	Middle Ground Shelf - total	0.5	2.8	2.7	NST	<0.2	<0.5	<1	<0.1	0.5	<0.2	<5
14/04/09	Sorrento Bank - total	0.5	2.1	2.3	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5
16/04/09	Popes Eye - total	0.5	2.7	2.2	NST	<0.2	<0.5	<1	<0.1	<0.5	<0.2	<5

NOTES

**Yellow** coloured cells indicate measured results above the Shewhart control limit (See Appendix 1, Table 5 for details).

**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.



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

Date	Sampling Site	Depth m	Chlorophyll-a µg/L		Phaeophytin-a µg/L	Fluorescence (as <i>in situ</i> chlorophyll-a) mg/m <sup>3</sup>	Total Phytoplankton cells/L	Diatoms cells/L	Dinoflagellates cells/L	Other Flagellates cells/L
			Measured Value	EWMA						
15/04/09	Yarra River at Newport	0.5	5.13	2.78	0.91	1.23	1.4E+06	7.2E+05	1.3E+05	5.4E+05
15/04/09	Yarra River at Newport	15.0	NST <sup>1</sup>	-	NST <sup>1</sup>	1.28				
15/04/09	Hobsons Bay	0.5	1.08	1.26	<0.18	0.82	3.1E+06	2.4E+06	1.1E+05	5.6E+05
14/04/09	Central Bay	0.5	1.05	0.76	<0.18	0.30	6.4E+05	3.0E+05	8.0E+04	2.6E+05
14/04/09	PoM DMG	0.5	1.01	0.75	<0.18	0.46	9.5E+05	6.8E+05	3.0E+04	2.5E+05
16/04/09	Corio Bay	0.5	2.54	1.34	0.32	0.80	6.6E+06	6.2E+06	8.0E+04	3.8E+05
16/04/09	Long Reef	0.5	1.06	1.34	<0.18	0.58	3.6E+06	3.3E+06	7.0E+04	2.6E+05
14/04/09	Patterson River	0.5	0.91	0.76	<0.18	0.31	7.6E+05	3.5E+05	4.5E+04	3.7E+05
14/04/09	Dromana	0.5	0.94	0.64	<0.18	0.44	1.1E+06	6.2E+05	7.0E+04	3.7E+05
14/04/09	Middle Ground Shelf	0.5	1.02	0.60	<0.18	0.46	6.0E+05	3.5E+05	2.7E+04	2.3E+05
14/04/09	Sorrento Bank	0.5	0.83	0.67	<0.18	0.56	3.7E+05	1.6E+05	1.8E+04	1.9E+05
16/04/09	Popes Eye	0.5	0.88	0.64	<0.18	0.34	4.8E+05	2.9E+05	1.5E+04	1.7E+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.

The chlorophyll a values are assessed against the 90<sup>th</sup> percentile objective in SEPP (WoV) Schedule F6.

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

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) is 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](http://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.



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 are available.

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

Source: Table 5 CDP\_ENV\_MD\_023 Rev 1.1 (available on the Channel Deepening Project website [www.channelproject.com](http://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 are available.

Source: Table 4 CDP\_ENV\_MD\_023 Rev 1.1 (available on the Channel Deepening Project website [www.channelproject.com](http://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	0.006
Hobsons Bay	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
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	95%	>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	99%	>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	99%	>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	99%	>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

ANZECC trigger values not highlighted

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.



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	15/04/2009	15/04/2009	14/04/2009	14/04/2009	16/04/2009	16/04/2009	14/04/2009	14/04/2009	14/04/2009	14/04/2009	16/04/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
<b>Genus</b>	<b>Species</b>										
<b>Total Phytoplankton</b>	1.4E+06	3.1E+06	6.4E+05	9.5E+05	6.6E+06	3.6E+06	7.6E+05	1.1E+06	6.0E+05	3.7E+05	4.8E+05
<b>Diatoms</b>	7.2E+05	2.4E+06	3.0E+05	6.8E+05	6.2E+06	3.3E+06	3.5E+05	6.2E+05	3.5E+05	1.6E+05	2.9E+05
<b>Dinoflagellates</b>	1.3E+05	1.1E+05	8.0E+04	3.0E+04	8.0E+04	7.0E+04	4.5E+04	7.0E+04	2.7E+04	1.8E+04	1.5E+04
<b>Other flagellates</b>	5.4E+05	5.6E+05	2.6E+05	2.5E+05	3.8E+05	2.6E+05	3.7E+05	3.7E+05	2.3E+05	1.9E+05	1.7E+05
<b>Diatoms</b>											
<i>Amphora</i> sp.	5.0E+03				X		5.0E+03	X	X	X	X
<i>Ardissonea</i> <i>crystallina</i>						X					
<i>Asteromphalus</i> <i>sarcophagus</i>		X	1.0E+04	1.5E+04			1.0E+04	1.0E+04	X	3.3E+03	3.0E+03
<i>Bacillaria</i> <i>paxillifera</i>					X		X	X	X		
<i>Bacteriastrium</i> <i>elegans</i>	X			X			X	X	X		2.1E+04
<i>Cerataulina</i> <i>pelagica</i>	1.0E+04	1.0E+04	1.3E+04	1.5E+04			X	5.0E+03	X		3.0E+03
<i>Chaetoceros</i> spp.	3.0E+04	1.3E+05	5.7E+04	1.2E+05	3.2E+05	3.9E+05	1.1E+05	2.2E+05	8.0E+04	5.0E+04	6.6E+04
<i>Cocconeis</i> spp.	1.0E+04	5.0E+03	3.3E+03		2.5E+04	1.5E+04			3.3E+03	6.0E+03	3.0E+03
<i>Coscinodiscus</i> spp.	X	X	3.3E+03	X			X	5.0E+03	X		X
<i>Cylindrotheca</i> <i>closterium</i>	3.3E+03	3.0E+04	1.3E+04	1.5E+04	2.0E+04	5.0E+03	2.5E+04	6.0E+04	1.0E+04	1.6E+04	9.0E+03
<i>Dactyliosolen</i> <i>blavyanus</i>	X	X	6.7E+03	X	X	X	5.0E+03	2.0E+04	6.7E+03	X	X
<i>Dactyliosolen</i> <i>fragilissimus</i>		X					X				
<i>Ditylum</i> <i>brightwellii</i>	X	X	X	X			X	X	X	X	X
<i>Entomoneis</i> sp.	1.0E+04			X			X	1.5E+04	1.0E+04	4.0E+03	X
<i>Eucampia</i> <i>zodiacus</i>		2.0E+04	1.7E+04	3.5E+04		X	1.0E+04	1.0E+04	1.0E+04	4.0E+03	3.0E+03
<i>Fragilaria</i> sp.	1.5E+04				1.5E+04	X	X	X			X
<i>Fragiliopsis</i> spp.						X	X	X	X		X
<i>Grammotophora</i> <i>marina</i>	5.0E+03				X		X	X			
<i>Guinardia</i> <i>flaccida</i>		X	X	X			X	X	X		X
<i>Hemiaulus</i> <i>hauckii</i>		1.0E+04	X	1.0E+04		X	1.0E+04	X	1.0E+04	4.0E+03	1.2E+04
<i>Leptocylindrus</i> <i>danicus</i>	X	2.0E+04	3.7E+04	1.0E+04		X	4.0E+04	1.5E+05	8.3E+04	1.4E+04	6.0E+04
<i>Licmophora</i> sp.			3.3E+03		5.0E+03	5.0E+03					3.0E+03
<i>Naviculoid</i> spp.	1.5E+04	5.0E+03			5.0E+03	1.5E+04	X	X	X	8.0E+03	2.4E+04
<i>Nitzschia</i> spp.	1.0E+04	5.0E+03	X	5.0E+03	1.0E+04	1.5E+04	1.5E+04	3.5E+04	6.7E+03	X	1.5E+04
<i>Pleurosigma</i> sp.	X	X	1.3E+04	X	X	X	X	5.0E+03	X	2.0E+03	X
<i>Proboscia</i> <i>alata</i>	X	5.0E+03		X			1.0E+04	X	X	X	X
<i>Pseudo-nitzschia</i> <i>delicatissima</i> group		2.4E+03		1.6E+03	1.6E+03	1.0E+03	4.0E+02	4.0E+02	4.0E+02	X	2.0E+02
<i>Pseudo-nitzschia</i> <i>pungens/multiseri</i>	X	6.0E+02	1.4E+03	2.6E+03	X	X	3.2E+03	2.6E+03	1.0E+03	8.0E+02	4.0E+02
<i>Rhizosolenia</i> spp.	X	5.0E+03	3.3E+04	1.5E+04	X	X	1.5E+04	1.0E+04	1.0E+04	2.0E+03	1.2E+04
<i>Skeletonema</i> <i>japonica/pseudocostatum</i>	4.8E+05	2.0E+06	6.7E+04	3.8E+05	5.5E+06	2.7E+06	6.0E+04	1.5E+04	6.7E+03	X	X
<i>Striatella</i> <i>unipunctata</i>	X										X
<i>Thalassionema</i> sp.		X	3.3E+03	X			X	2.0E+04	3.3E+03		1.2E+04
<i>Thalassiosira</i> sp.		X		X		5.0E+03	X	X	X		X
<i>Thalassiosira</i> cf. <i>mala</i>	1.3E+05	1.5E+05	2.0E+04	6.0E+04	2.6E+05	1.3E+05	2.5E+04	6.0E+04	1.0E+05	4.8E+04	4.2E+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 Shelf	Sorrento Bank	Popes Eye
Collection Date	15/04/2009	15/04/2009	14/04/2009	14/04/2009	16/04/2009	16/04/2009	14/04/2009	14/04/2009	14/04/2009	14/04/2009	16/04/2009
Count Method	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick	Sedgewick
<b>Genus</b>	<b>Estimate Cells/L</b>										
<b>Total Phytoplankton</b>	1.4E+06	3.1E+06	6.4E+05	9.5E+05	6.6E+06	3.6E+06	7.6E+05	1.1E+06	6.0E+05	3.7E+05	4.8E+05
<b>Diatoms</b>	7.2E+05	2.4E+06	3.0E+05	6.8E+05	6.2E+06	3.3E+06	3.5E+05	6.2E+05	3.5E+05	1.6E+05	2.9E+05
<b>Dinoflagellates</b>	1.3E+05	1.1E+05	8.0E+04	3.0E+04	8.0E+04	7.0E+04	4.5E+04	7.0E+04	2.7E+04	1.8E+04	1.5E+04
<b>Other flagellates</b>	5.4E+05	5.6E+05	2.6E+05	2.5E+05	3.8E+05	2.6E+05	3.7E+05	3.7E+05	2.3E+05	1.9E+05	1.7E+05
<b>Dinoflagellates</b>											
<i>Alexandrium margalefi</i>									X		
<i>Amphidinium spp.</i>			3.3E+03								
<i>Ceratium fusus</i>			X	X				X			X
<i>Ceratium macroceros</i>	X		X	X							
<i>Ceratium tenue</i>	X	X	1.0E+04	X			X	5.0E+03	X	X	X
<i>Ceratium tripos</i>					X		X				
<i>Dinophysis acuminata</i>							1.5E+02				
<i>Gonyaulax spp.</i>						X				X	
<i>Gymnodinium spp.</i>	8.5E+04	7.5E+04	4.7E+04	3.0E+04	6.5E+04	3.0E+04	2.5E+04	4.5E+04	2.3E+04	1.2E+04	1.2E+04
<i>Gyrodinium spp.</i>	5.0E+03		6.7E+03	X	5.0E+03			5.0E+03			X
<i>Heterocapsa rotundata</i>	3.5E+04	3.0E+04	1.0E+04	X	1.0E+04	2.5E+04	1.5E+04	1.5E+04	3.3E+03	6.0E+03	3.0E+03
<i>Oblea sp.</i>			X								
<i>Ostreopsis siamensis</i>		X									
<i>Peridinium spp.</i>	5.0E+03		X	X	X	X	X	X		X	
<i>Polykrykos schwartzii</i>	X	X			X	X	X				
<i>Prorocentrum spinifera</i>			3.3E+03								
<i>Prorocentrum cordatum</i>						5.0E+03					
<i>Prorocentrum dentatum</i>				X							
<i>Prorocentrum gracile</i>						5.0E+03	X				
<i>Prorocentrum rhathymum</i>					2.0E+02						
<i>Prorocentrum triestinum</i>								X			
<i>Protoperidinium spp.</i>	X	X	X	X	X	5.0E+03	5.0E+03	X	X		X
<i>Scrippsiella spp.</i>	X			X	X	X		X			X
<i>Takayama pulchella</i>		1.5E+02				1.3E+03	5.0E+01			1.5E+02	1.0E+02
<i>Torodinium sp.</i>								X			
<b>Chrysophytes</b>											
<i>Calycomonas sp.</i>			6.7E+03					5.0E+03			6.0E+03
<b>Prymnesiophytes</b>											
<i>Calciopappus caudatus</i>				5.0E+03							
<i>Chrysochromulina spp.</i>	3.5E+04	2.0E+04	4.3E+04	4.0E+04	2.5E+04	3.0E+04	6.0E+04	6.5E+04	1.7E+04	2.6E+04	2.1E+04
<i>Emiliania huxleyi</i>	5.0E+04	5.5E+04	5.7E+04	4.0E+04	5.5E+04	4.0E+04	8.0E+04	9.0E+04	3.7E+04	3.2E+04	4.2E+04
<i>Gephyrocapsa oceanica</i>		5.0E+03		5.0E+03				5.0E+03		2.0E+04	
<i>Pleurochrysis carterae</i>						X					
<b>Cryptophytes</b>											
<i>Hemiselmis sp.</i>	7.5E+04	1.0E+05	1.3E+04	1.0E+04	1.5E+04	2.5E+04	5.5E+04	1.5E+04	3.0E+04	1.8E+04	1.8E+04
<i>Leucocryptos marina</i>	1.0E+04	X	3.3E+03		5.0E+03	5.0E+03	X	5.0E+03			
<i>Plagioselmis prolunga</i>	1.3E+05	1.7E+05	6.0E+04	7.5E+04	9.5E+04	7.5E+04	8.0E+04	8.0E+04	7.0E+04	4.0E+04	4.5E+04
<i>Teleaulax acuta</i>	7.0E+04	7.0E+04	1.3E+04	1.5E+04	5.0E+04	2.0E+04	1.0E+04	3.0E+04	1.7E+04	1.8E+04	1.2E+04
<b>Prasinophytes</b>											
<i>Pyramimonas spp.</i>	1.2E+05	9.5E+04	4.7E+04	4.5E+04	9.0E+04	5.0E+04	6.5E+04	5.0E+04	4.7E+04	2.4E+04	2.1E+04
<i>Tetraselmis spp.</i>	3.5E+04	3.0E+04	6.7E+03	X	4.5E+04	1.0E+04	1.0E+04	2.0E+04	1.3E+04	8.0E+03	9.0E+03
<b>Euglenophyta</b>											
<i>Eutreptiella spp.</i>	1.5E+04	1.0E+04		1.0E+04		X	5.0E+03	5.0E+03		2.0E+03	
<b>Other</b>											
<i>Apedinella spinifera</i>			3.3E+03								
<i>Ebria tripartita</i>				X			X				
<i>Dictyocha fibula</i>			6.7E+03	X			X			2.0E+03	X
<i>Dictyocha octonaria</i>			3.3E+03					X			
<i>Unidentified amoeba</i>										2.0E+03	

VQSAP Phytoplankton action levels in cells per litre (DPI, 2008)	Warning to growers	Comparative data in the report										
		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 spp.</i>	50 000	X	3000	1400	4200	1600	1000	3600	3000	1400	800	600
<i>Rhizosolenia cf chunii</i>	10 000											
<i>Alexandrium catenella</i>	100											
<i>Alexandrium minutum</i>	100											
<i>Alexandrium tamarense</i>	100											
<i>Dinophysis acuminata</i>	1 000							150				
<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>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 VQSAP Phytoplankton action levels refer to Algal Blooms – Detailed Design,

CDP\_ENV\_MD\_012 Rev 1.1.

