

Analysis of Port Phillip Bay Tides Jan 2000 – Dec 2009

Introduction

Many people expressed concern that deepening the shipping channel a further 5 metres at the Entrance to Port Phillip Bay would permanently alter the hydrodynamics of the Bay and (among other things) cause coastal erosion. Submissions stating these concerns to the Independent Planning Panel which assessed the Supplementary Environment Effects Study were ignored on the basis of 'expert advice' in the Channel Deepening Project (CDP) Supplementary Environmental Effects Study¹ which concluded:

The effect of dredging at the Entrance of Port Phillip Bay was predicted to have a minimal impact on tidal regimes within the Bay and PoMC's hydrodynamic expert witness Dr. David Provis stated that any changes would be "imperceptible" (expert evidence during Panel Hearing). Subsequently, the Channel Deepening Project (CDP) Supplementary Environmental Effects Study² concluded that:

"Dredging will have a very small impact, less than 0.01 m, on tidal water levels in Port Phillip Bay." and ***"Sea level change, including astronomical tide and storm surge, due to dredging will be small with low water being about 10 mm lower and 6 mm higher at high water."***

This opinion has been brought into question by erosion of beaches and cliff faces around the Bay since completion of dredging, particularly with the loss of an entire beach at Portsea.

During and subsequent to dredging at the Entrance, the National Tidal Centre (NTC) reported on tidal data from gauges in the Bay and at Lorne³. The NTC⁴ asserted that: ***"Generally the high tides and low tides within Port Phillip Bay were 1 cm higher and 1 cm lower, respectively than those prior to dredging"***⁵.

This Port Phillip Baykeeper report analyses tidal records for the region between January 2000 and December 2009 in order to:

- assess the level of confidence that can be afforded to the NTC conclusion (above);
- differentiate between sea level rises attributable to extreme weather events and changes due to dredging; and
- assess the adequacy of the 12 month tidal data collection period specified in the CDP Environment Management Plan, particularly in relation to assertions that the data does not link dredging with coastal erosion.

¹ SEES Appendix 45 Cardno Lawson & Treloar, 2007b.

² SEES Appendix 45 Cardno Lawson & Treloar, 2007b.

³ See Figure 1.

⁴ Final Report, September 2009

⁵ Executive summary of the National Tide Centre Report, September 2009



Figure 1. Map of Port Phillip Bay and surrounds with locations of the tide gauges operated by the Port of Melbourne Corporation to be used for the tide height assessment.

Summary

Lorne tide station provide a useful 'control site' as this would be unaffected by dredging.

A marked increase in Average Monthly Highest Tide can be attributed to extreme weather events, whereas Average Daily Highest Tide are more representative of the basic (non-weather related) tidal regime.

All sites (including Lorne) show a marked increase in Average Monthly Highest Tide, suggesting an increase in extreme weather events across the region.

Average Monthly Highest Tide results highlight the influence of random extreme weather events, whereas Average Daily Highest Tide is inherently more representative of the basic (non-weather related) tidal regime.

Comparison of Average Monthly Highest Tide and Average Daily Highest Tide at Lorne shows a 65 mm increase in Average Monthly Highest Tides translates to a 2 mm increase in Average Daily Highest Tide. This shows that extreme weather events caused only a minimal increase on Average Daily Highest Tide.

The 'minimal increase' in Average Daily Highest Tide recorded at Lorne is not reflected at sites in the south of PPB, which recorded much greater ADHT increases varying from 40 – 100 mm.

There is minimal change in pre and post dredging Average Daily Highest Tide at Lorne and Williamstown, but much greater than 10mm increases at all southern PPB sites.

As there is considerable variation in levels across the PPB sites, 'generalised' statements referring to a single tidal level in PPB do not represent the reality of localised sites in the Bay.

The National Tidal Centre admits that "***The actual change in extreme high tide heights will emerge when the uncertainty decreases over a number of years.***"⁶

The limited post-dredging data collection period provides no basis on which to conclude that dredging has not increased tide levels beyond the predicted level, nor that dredging is not implicated in recent coastal erosion.

To achieve reasonable certainty in conclusions derived from the data, ongoing tidal data collection and analysis for at least the next 2 years and a detailed analysis of wind patterns over the pre and post dredging periods is warranted.

Analysis Method

This report assesses the respective impacts of extreme weather events and dredging at the Entrance to PPB on high tide levels in PPB. Have sites in the Bay recorded greater non-weather related increases than Lorne (the control site)? To examine this question, analysis of tidal records across the region (from Lorne to Williamstown) was conducted.

Analysis of Average Monthly Highest Tide is considered the most appropriate measure to assess the influence of extreme weather events. Whereas, Average Daily Highest Tide is the most appropriate measure to assess the non-weather related tidal regime and any associated influence of dredging.

We created a numerical presentation of the data to present a clear measure of the change recorded at each station. September 14th 2008 (completion of Entrance dredging) was adopted as the most appropriate date to define pre and post dredging scenarios⁷ as effects on PPB tides would be fully evident after then (as opposed to start of dredging or part-way through).

Accordingly, we averaged the 'Highest Monthly' and 'Highest Daily' tides from:

- January 2000 to 30 September 2008 (to represent prior to CDP); and
- 1 October 2008 to December 2009 (to represent post CDP).

Chart 1⁸ was created to compare pre and post dredging *Average Monthly Highest Tide* at all sites as the best measure of extreme weather events.

Chart 2, was created to compare pre and post dredging *Average Daily Highest Tide* at all sites to assess change in the basic (non-weather related) tidal regime; and to enable

⁶ NTC Final Report September 2009. Executive Summary. P.4

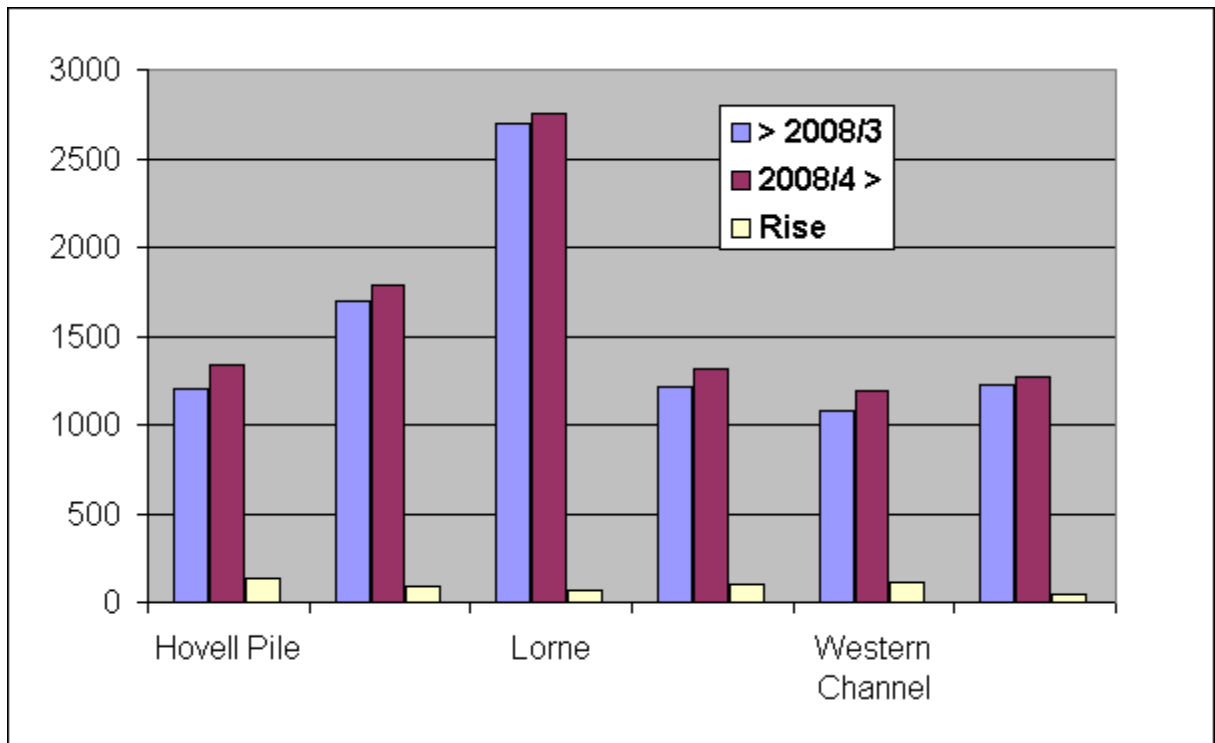
⁷ Dredging at the Entrance to Port Phillip is reported as concluding in mid September 2008

⁸ created from data supplied by National Tidal Centre (via Sue Pennicuik's office)

comparison of this change with the Average Monthly Highest Tide (extreme weather related) figures.

Chart 1: Comparison of pre & post dredging Average Monthly Highest Tide

	Hovell Pile	Lonsdale	Lorne	Queenscliff	West Channel	Williamstown
> 2008/3	1200	1699	2692	1210	1078	1223
2008/4 >	1333	1784	2757	1315	1186	1272
Rise	133	85	65	105	108	49



Observations/comments on Chart 1: Average Monthly Highest Tides

The greatest increases have been experienced at sites near the Entrance.

The rise recorded at Williamstown is miniscule compared to all other PPB sites which show considerable variation in levels.

The rise at Lorne (considered by National Tidal Centre to be indicative of the region⁹) is substantially lower than levels recorded at sites near the Entrance, but higher than Williamstown.

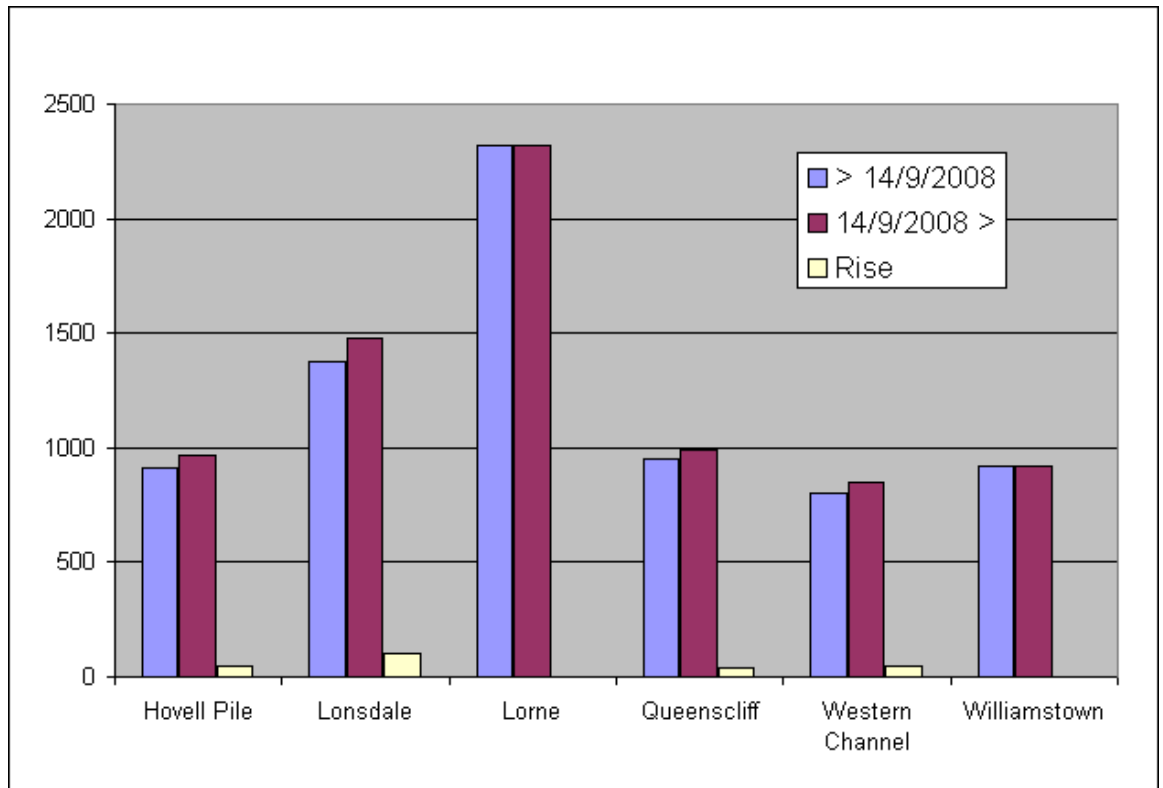
The increased post-dredging level at Lorne can be attributed to extreme weather events, whereas increases within the Bay can be attributed to extreme weather and dredging.

⁹ NTC Final Report p.4: “Tidal levels observed at Lorne helped to identify background regional changes.”

Chart 2 was created to enable comparison of pre-dredging Average Daily Highest Tides (ADHT) with post-dredging ADHT.¹⁰

Chart 2: Comparison of pre & post dredging Average Daily Highest Tide

	Hovell Pile	Lonsdale	Lorne	Queenscliff	West Channel	Williamstown
> 14/9/2008	915	1378	2316	953	804	918
14/9/2008 >	966	1478	2318	993	852	920
Rise	51	100	2	40	48	2



Observations / comments on Chart 2: Average Daily Highest Tides

All sites (including Lorne) recorded significantly lower Average Daily Highest Tide than Average Monthly Highest Tide. This demonstrates that Average Daily Highest Tides are more representative of the basic (non-weather related) tidal regime.

Comparison of pre and post dredging Average Monthly Highest Tides at Lorne shows a substantial increase of 65 mm, whereas Average Daily Highest Tide at the same station recorded an increase of only 2 mm. This suggests that extreme weather events have had only a minimal influence on Average Daily Highest Tides in the region.

¹⁰ Figures in chart are rounded to the nearest millimetre

The Average Daily Highest Tides at all sites in the south of the Bay are significantly greater than the “1 cm” referred to in the NTC report, and vary considerably (100 mm at Lonsdale, 51 mm at Hovell Pile, 48 mm at West Channel, and 40 mm at Queenscliff).

All sites across the region recorded a rise in Average Daily Highest Tides. But the results for Lorne and Williamstown are miniscule compared to all sites in the south of the Bay.

Discussion of National Tide Centre Findings

The Executive Summary of the NTC Final Report (September 2009) stated:

“It was noted that observed change in high tide at Hovell Pile, while lower than the changes at Williamstown and West Channel Pile, was higher than predicted in the SEES but in line with the predicted overall pattern of observed changes across the Bay.”¹¹

Comment: As the Baykeeper analysis found tide levels at *Hovell Pile* to be much higher than *Williamstown*, this statement is difficult to comprehend. If the change at Hovell Pile was **lower than Williamstown** how can it be **higher than predicted in the SEES** and **in line with the predicted overall pattern... across the Bay?** Chart 2 shows Williamstown has recorded a 2 mm rise in Average Daily Highest Tide, whereas Hovell Pile has recorded a 51 mm increase.

The Executive Summary of the NTC Final Report (September 2009) stated:

“Extreme tides occur infrequently. Twelve months of observations limit the ability to accurately calculate the changes in extreme high tide height. Therefore, the uncertainty associated with quantifying these changes are larger by an order of magnitude than the actual predicted changes in the SEES. The actual change in extreme high tide heights will emerge when the uncertainty decreases over a number of years.”¹²

Comment: This admission of uncertainty casts doubt upon the level of confidence that can be placed on the conclusions reached in the NTC Report; and therefore on subsequent assertions that dredging is not implicated in coastal erosion. Ongoing data collection and analysis for at least the next 2 years is warranted.

“Hydrodynamic computer modelling experiments using controlled tidal, meteorological and oceanographic conditions were used to predict the effect of channel deepening on combined tide and storm surge levels within PPB (CLT, 2007b). However, in practice meteorological conditions cannot be controlled and so precise assessment of the effect of the CDP on combined tide and surge levels will likely require many years of observations.”¹³

Comment: This statement confirms the view that monitoring and reporting on tides for only 12 months after dredging was completed is inadequate for the purpose of assessing the effects of the CDP on tides and the potential for tide-related coastal erosion. A

¹¹ NTC Report Sept 2009, Executive Summary. p. 4

¹² NTC Report Sept 2009, Executive Summary. p. 4

¹³ NTC Report Sept 2009. p. 8

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further implication is that a detailed analysis of wind patterns over the pre and post dredging periods is warranted.

Whilst increased tide heights, especially in the south of the Bay may be contributing to the recently reported increase in erosion at some beaches, the reported increase in swell (surge from Bass Strait) since Entrance dredging should also be investigated, but is outside the scope of this paper.