



ASSOCIATION OF BAYSIDE MUNICIPALITIES

Final Report | 2013

Port Phillip Bay
Managing Better Now program

REPORT 01

COASTAL PROCESSES AFFECTING PORT PHILLIP BAY – PRELIMINARY DATA COLLECTION AND GAP ANALYSIS



This report has been prepared by Cardno Victoria Pty Ltd for the Association of Bayside Municipalities as part of the Managing Better Now program.

Association of Bayside Municipalities

The Association of Bayside Municipalities represents the ten councils with frontage to Port Phillip Bay. As coastal councils we are acutely aware of the need to protect and manage Port Phillip Bay for our local communities, and for the benefit of all Victorians, tourists and the unique ecosystems it supports.

As the appointed Committee of Management for much of the Port Phillip Bay coast, councils play a vital role in the environmental management of Port Phillip Bay, as the foreshore manager, strategic land use planning authority; asset manager; and service provider to Parks Victoria or other Committees of Management, and more.

The ABM vision is a healthy Port Phillip Bay that is valued and cared for by all Victorians.

ABM Member Councils:



Acknowledgements

The Association of Bayside Municipalities acknowledges funding from Member councils and state government to enable the Managing Better Now program. Thank you to the staff from ABM Member Councils and Melbourne Water for providing technical input and feedback on the reports.

The Association of Bayside Municipalities recognising the substantial support from Cardno in preparing the reports, and presenting the outputs and recommendations over many years.

Disclaimer

The Managing Better Now report series (the publication) is intended as a general reference guide, providing information on coastal processes affecting Port Phillip Bay. While due care has been taken in the compilation of the publication, the Association of Bayside Municipalities does not guarantee that the publication is without flaw (including error, omission or inaccuracy). Users of the publication need to make their own enquiries to ensure fit for purpose. The Association of Bayside Municipalities will not be liable for any loss, damage or other consequences arising from the use of this publication.

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EXECUTIVE SUMMARY

The *Managing Better Now* program is an initiative of the Association of Bayside Municipalities.

Launched in 2013, the program aimed to better understand the dynamics and coastal processes of Port Phillip Bay using data modelling and analysis to:

- Improve knowledge of coastal processes in Port Phillip Bay, and their effects on vulnerable sections of the coast.
- Understand present and future risks and hazards.
- Inform the management of coastal processes impacting Port Phillip Bay 'now' and into the future.
- Contribute to a future coastal hazard assessment for Port Phillip Bay.

Outputs from the Managing Better Now program are designed to support better decision making, clearer investment, management and planning by ABM Member Councils and other bay stakeholders in:

- beach protection,
- local coastal hazard and risk assessment,
- foreshore and infrastructure management,
- maintenance planning and response to weather extremes, and
- coastal climate adaptation.

Using a 'step by step' approach, the program was undertaken in phases with work proceeding as funding and resources were secured.

Phases 1 and 2 examined the programs, strategies and approaches used to manage the coastline, beaches and immediate foreshore areas, identifying gaps in knowledge. Phases 3, 4 and 5 gathered existing information and invested in data modelling and analysis of new essential data, mapping and modelling – compiling a series of reports aimed at better understand the dynamics of Port Phillip Bay.

As coastal managers, the ABM recognises the importance of using the best available information, and values working in partnership to improve understanding of the processes and systems affecting Port Phillip Bay

The following reports comprise the Managing Better Now series, and are available on the ABM website at www.abm.org.au.

REPORT Snapshots



Report #1: Coastal Processes Affecting Port Phillip Bay - preliminary data collection and gap analysis

Identification of existing spatial and non-spatial information to inform a coastal hazard assessment. This included spatial data layers, over 200 technical reports, images and 60 strategies and plans relevant to Port Phillip Bay. More than 200 GIS data layers were identified and stored on an online GIS portal, made available to ABM councils.



Report #2: Coastal Processes Affecting Port Phillip Bay – preliminary modelling and mapping of coastal asset location and proximity to the Port Phillip Bay shoreline; and GIS-based assessment of width and volume of erodible land along Port Phillip Bay.

- **Part 1:** Preliminary modelling and mapping of coastal asset location and proximity to the Port Phillip shoreline. Purpose of this study was to use readily available spatial information layers identified in Report 1 to locate and map coastal assets at a bay-wide scale, and improve understanding of the proximity of assets to the Port Phillip Bay shoreline. This work was not intended to be a comprehensive study or replace a local hazard study. It provided a demonstration of the type of analysis that can be undertaken using readily available spatial data layers, informing local studies by individual coastal land managers such as the effects of coastal storms on sections of shoreline, the effects of coastal inundation on parts of the coast, the quality of drainage networks and associated infrastructure to model water flow, availability of information for assets of significance, their values, etc.
- **Part 2:** Spatial Analysis of area (width) and volume of erodible land along Port Phillip Bay. Three methodologies were used to demonstrate the calculation of area and volume of sand between the mean sea level (taken as the shoreline) and three different landward extents. The landward extents are based on existing infrastructure such as roads or houses; horizontal distances (eg, within 5 metres, 10 metres, etc.); or vertical elevation (eg, 0.5 metres, 1.0 metres, etc.) from the shoreline. Information about physical processes or hazards, including sediment transport rates, wave impacts, shoreline erosion rates or other such information was not available. The approach used is of generic and demonstrative nature and can be applied around Port Phillip Bay; and substantially enhanced if coupled with information about coastal processes and coastal hazard information.



Report #3: Port Phillip Bay Sea Level

Analysis of existing historical sea level data for Port Phillip Bay measuring sea levels over an extended period at multiple locations. Data was collected from Port of Melbourne Corporation, National Tidal Centre, Victorian Regional Channel Authority and Melbourne Water. Data was subjected to extreme value analysis to develop values for sea level with Annual Exceedance Probabilities at 1%, 2%, 5% and 10% (corresponding to Annual Recurrence Intervals of 100, 50, 20 and 10 years).

The results are intended to support the setting of values for planning and design, not replace decisions made by the appropriate responsible authorities. Results may be useful in establishing regional variations; undertaking assessments of the appropriate values in setting planning benchmarks and design criteria; investigating potential risks; supporting planning, design and assessment of future coastal vulnerability considering climate change.



Report #4: Port Phillip Bay Wave Climate

Wave modelling for the whole of Port Phillip Bay using a tested and consistent approach. The modelling incorporated annual and seasonal occurrence of wave conditions, highlighting the marked seasonal variability in wave conditions over Port Phillip Bay resulting from seasonal wind changes. The longshore component of wave power was also computed for the entire shoreline providing insights into the annual and seasonal variability of potential sediment transport around Port Phillip Bay.

Modelling results can be used to understand phenomena observed on a specific beach, or to review broad bay-wide scale processes.

In addition to the data presented in the report, detailed frequency of occurrence matrices for each of the 248 data extraction points have been provided as tables which can be accessed via a Geographic Information System. Contact the ABM for further information.



Report #5: Port Phillip Bay Storm Bite Analysis

Building on the previous studies of waves and sea levels in Port Phillip Bay, this project modelled likely volumes and extent of storm bite erosion on 20 beach profiles in Port Phillip Bay between Little River and Sorrento, under varying storm conditions. Results inform changes in beach profile following an individual storm event, and the magnitude of the storm event.

This report provides a first-pass risk assessment of coastal erosion that can be used to identify and prioritise areas of concern; focus more detailed studies on areas of intolerable risk level; and to understand what level of coastal erosion might be expected in a 'typical' or an 'extreme' storm event.

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01. Introduction

1.1 Context

This report documents the findings of Phase 1 of the Association of Bayside Municipalities' *Port Phillip Bay Managing Better Now* Program.

Phase 1 of the Managing Better Now program identified and collated, where possible, spatial data layers, technical reports, strategies and plans, images and other information for the Port Phillip Bay. More than 200 GIS data layers were identified, primarily from state and local government sources. Key data layers are stored in an online GIS portal, accessible via secure login. In addition, over 200 technical reports and more than 60 strategies and plans were identified and collated if copies of those documents were available.

1.2 Aims

The key aim of Phase 1 was to identify available spatial and non-spatial information suitable to inform an immediate *Port Phillip Bay coastal processes assessment* and a future *Port Phillip Bay Coastal Hazard Assessment*. Key stakeholders were identified and representatives invited to attend technical reference group meetings in July, September and November 2013. Project stakeholders and other sources of information were approached to:

- Identify existing spatial data layers and their availability for this project.
- Identify, and where possible, collate available technical reports and coastal management plans.
- Identify, and where possible, collate information about historical aerial photography, oblique photos, 'happy snaps' and other sources of information.
- Identify information about available models developed to better understand the processes shaping the bay.
- Identify key information gaps.

An important aspect of Phase 1 was to share information amongst project participants, while adhering to copyright and confidentiality requirements.

02. Information sources

Authorities directly managing (parts of) Port Phillip Bay or undertaking work and research in or around the bay were identified and either contacted, or their websites visited and searched for information relating to the aims of this project. These can be divided into three broad groups:

- Managing authorities: local and state government authorities, Melbourne Water, and Port of Melbourne Corporation.
- Research institutions including the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Universities, Geoscience Australia as well as consultancies.
- Libraries and archives.

Information sources identified and contacted:

State Government:

- Department of Environment and Primary Industries, including:
 - » Information Services Branch:
 - › Vicmap
 - › Coordinated Imagery Program (CIP)
 - › Airphoto archive (Laverton)
 - » Future Coasts Program
 - » (former) Office of the Environmental Monitor
 - » Risk and Infrastructure
 - » Coastal Management Reform Team
 - » Central Coastal Board
 - » Programs & Assets
- Land VIC / Title office
- Parks Victoria

Department of Transport, Planning and Local Infrastructure

- Coastal Planning
- GIS
 - » Transport
 - » Heritage Victoria Municipal Association of Victoria
- Public Record Office of Victoria
- Melbourne Water
- Victorian Coastal Council
- Committees of Management
- Catchment Management Authorities (Corangamite and Port Phillip & Western Port)
- Lifesaving Victoria
- Port of Melbourne Corporation

Federal Government

- CSIRO
- Geoscience Australia
 - » Smartline Coastal Geomorphic Mapping
 - » National Exposure Information System
- Australian Spatial Data Directory

Local Government (primarily via Crowdsport website www.abm.crowdsport.com.au)

- Bayside City Council
- Kingston City Council
- Frankston City Council
- Mornington Peninsula Shire Council
- Borough of Queenscliffe
- Greater Geelong City Council
- Wyndham City Council
- Hobsons Bay City Council
- Port Phillip City Council
- Melbourne City Council

Libraries and Universities

- State Library
- National Archive
- Melbourne University (library)
- Monash University (library)
- Deakin University (library)

Consultancy reports

- Beca
- Bird
- AECOM
- Aurecon
- Cardno / Lawson & Treloar
- CSIRO
- GHD
- KPMG
- Maunsell
- Miner (A.S.)
- Oldfield
- Riedel
- Rosengren
- SKM
- URS
- Vantree
- Watertech
- Worley Parsons

03. Results

Liaison with key staff at a number of authorities and website and database searches identified hundreds of individual documents, data layers, photos and other information. Over 100 individual documents, photos and links were added on the Crowdsport website. The website (abm.crowdspot.com.au) was set up by the Association of Bayside Municipalities at the beginning of Phase 1 (Figure 1).

The information gathered can be broadly categorised as spatial and non-spatial. Spatial data is defined as GIS data layers, non-spatial information as reports, management plans, photos, etc.

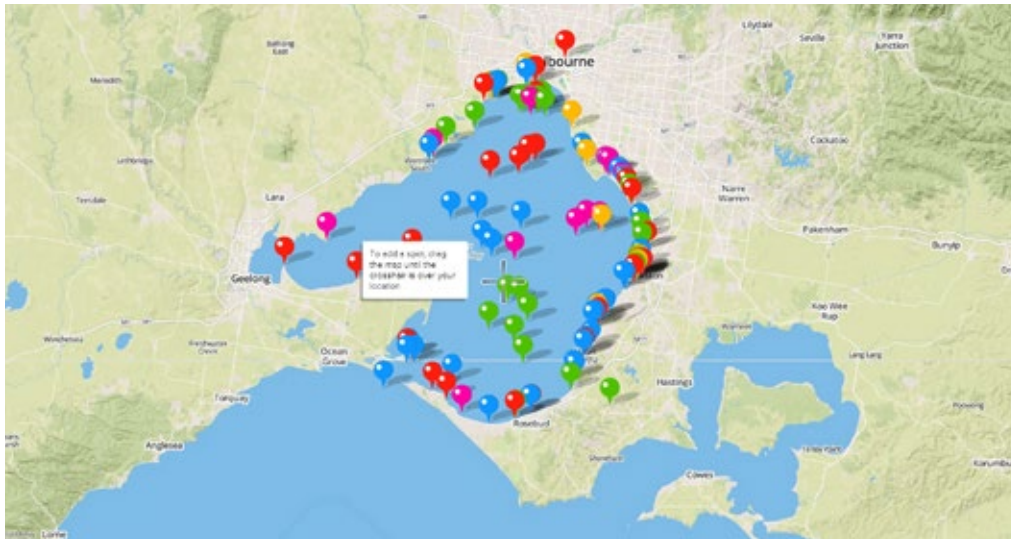


Figure 1: Crowdsport Website (abm.crowdspot.com.au).

3.1 Spatial Information (GIS data layers)

More than 200 separate GIS layers were identified in Phase 1. This included predominantly layers available from the Victorian State Government as well as local and federal government authorities. Those layers contain information about a wide range of themes, such as infrastructure, property and planning, natural and heritage assets, weather and climate information and many more.

The Victorian government's data portal (www.data.vic.gov.au) has more than 500 GIS data layers available for public access at no cost. These layers cover a wide range of themes and geographies across Victoria. The federal government provides a search facility via the Australian Spatial Data Directory (asdd.ga.gov.au) to discover information (metadata) throughout Australia.

Other, more specific information is available from respective authorities, such as Catchment Management and Water Authorities or local government.

In addition to those freely available data, a number of GIS data layers were identified that are not publicly available but may be made available upon request.

3.1.1. Key GIS Data Layers

A number of key GIS data layers are deemed required for the next Phase of the Managing Better Now program – preliminary assessment of coastal hazard impacts. The data includes information about elevation, geology, key infrastructure, sea level and wind data, assets and administrative boundaries. A more detailed description of those layers, their spatial extent, possible applications and their limitations is given below.

3.1.1.1. Coastal Elevation

DESCRIPTION

GIS data layer showing the elevation of the land. The data were captured as part of the State Government's Future Coasts Program. Land elevation has an on ground (horizontal) resolution of 1m x 1m. Contours are available at 0.5m intervals.

SOURCE

These data are available from DEPI / Vicmap & Future Coasts Program, via request to DEPI (Email: data.vsd@dse.vic.gov.au). The data are not directly available from the DEPI data portal, partly due to the large file size.

Further information is available from: <http://www.dse.vic.gov.au/property-titles-and-maps/maps-imagery-and-data/data/vicmap/vicmap-products/vicmap-elevation>.

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 2a). They were captured to approximately 10m above Australian Height Datum (AHD), but higher elevations in urban areas (eg, Port Phillip Bay area) are available (Figure 2b).

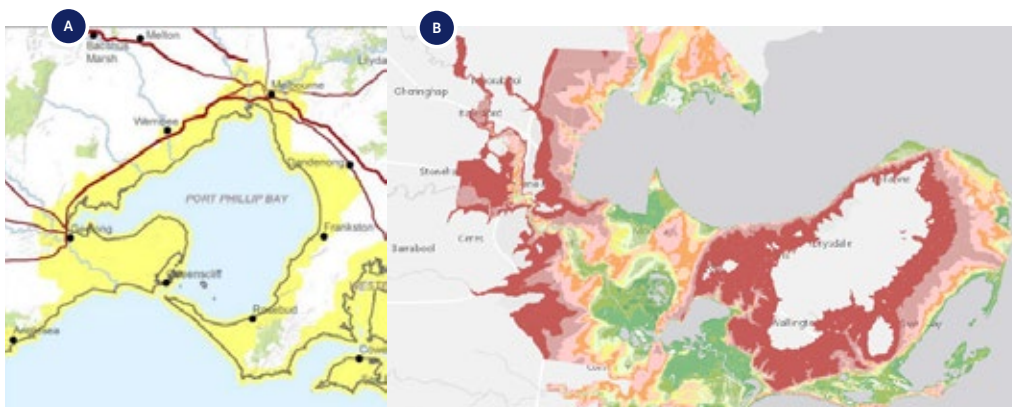


Figure 2: a) Spatial extent of Vicmap Coastal Elevation LiDAR dataset
Figure 2: b) Elevation of the Bellarine Peninsula.

APPLICATIONS

- Assessment of land elevation.
- Identification of low-lying areas.
- Foreshore profiles.
- Slope and direction (aspect) of slope.
- Key dataset for
 - » Inundation modelling
 - » Terrestrial flood modelling
 - » Storm demand modelling

LIMITATIONS

This dataset contains a high level of detail, and is therefore large in file size. This can lead to lengthy data processing and requires sophisticated resources. The vertical accuracy must be considered when used for inundation and flood modelling. The data are typically used as raster datasets.

3.1.1.2. Bathymetry

GIS data layer showing the depth of water (bathymetry). The data were captured as part of the State Government's Future Coasts Program. The dataset has a horizontal resolution of 2.5m x 2.5m. This dataset is restricted and available by application to DEPI (Email: data.vsd@ds.vic.gov.au).

A lower resolution (20m x 20m) version of the dataset is also available. This dataset is unrestricted.

SOURCE

DEPI / Vicmap & Future Coasts Program, via request to DEPI (ie, not directly available from the www.data.vic.gov.au website, partly due to the large file size of the datasets).

SPATIAL EXTENT

The data are available for the entire Victorian coastline to approximately to -20m below AHD. The data are also available for part of Port Phillip Bay (Figure 3). Some estuaries and lakes along the Victorian coast are not included.

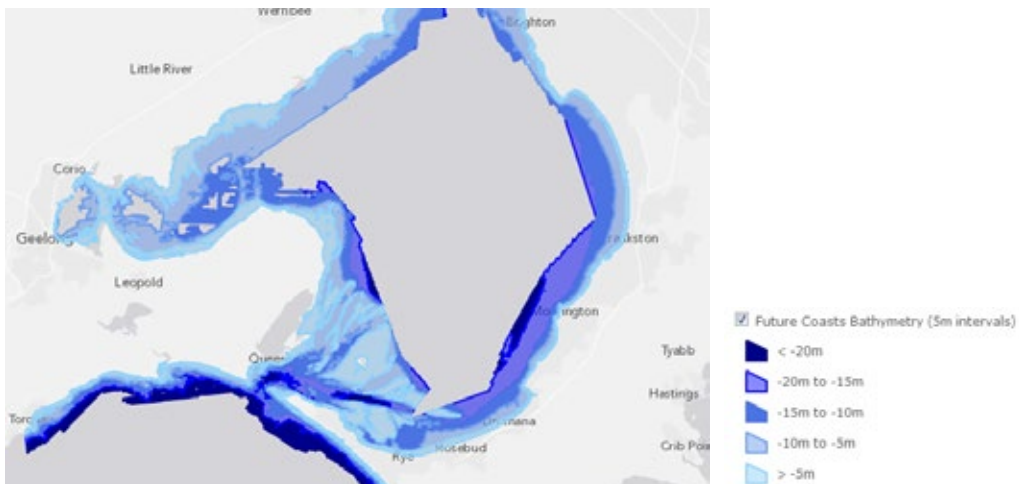


Figure 3: Spatial extent of DEPI Future Coasts bathymetry to approximately -20m water depth.

APPLICATIONS

- Assessment of water depth.
- Profiles.
- Slope and direction (aspect) of slope.
- Modelling bay processes.

LIMITATIONS

Highly detailed dataset, therefore large in file size which can lead to lengthy data processing. It requires sophisticated resources for processing.

3.1.1.3. Coastal Inundation

DESCRIPTION

Statewide coastal inundation datasets. Eight GIS datasets were created using CSIRO modelling and the Vicmap Coastal Elevation LiDAR dataset. It was developed for application at catchment to regional scale but is not suitable for application at local scale.

Further information is available at:

<http://www.climatechange.vic.gov.au/adapting-to-climate-change/future-coasts/victorian-coastal-inundation-dataset>.

SOURCE

DEPI (Future Coasts Program), available from www.data.vic.gov.au.

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 4).

APPLICATIONS

2nd pass assessment of areas potentially subject to inundation as a result of rising sea level and a 1 in 100 year storm tide, for 2009, 2040, 2070 and 2100.

LIMITATIONS

Applicable for use at catchment to regional scales but not at local scale (detail less than 1:75,000).

No consideration of local features, such as (coastal protection) structures.

The datasets, in particular storm tide layers, are considered to overestimate the spatial extent of the coastal inundation in some areas and should therefore not be utilised for an assessment at the local scale.

The maps do not give an indication of the lengths of inundation during a storm and may therefore give the impression of long periods or even permanent inundation, where inundation may last only a few hours or less.

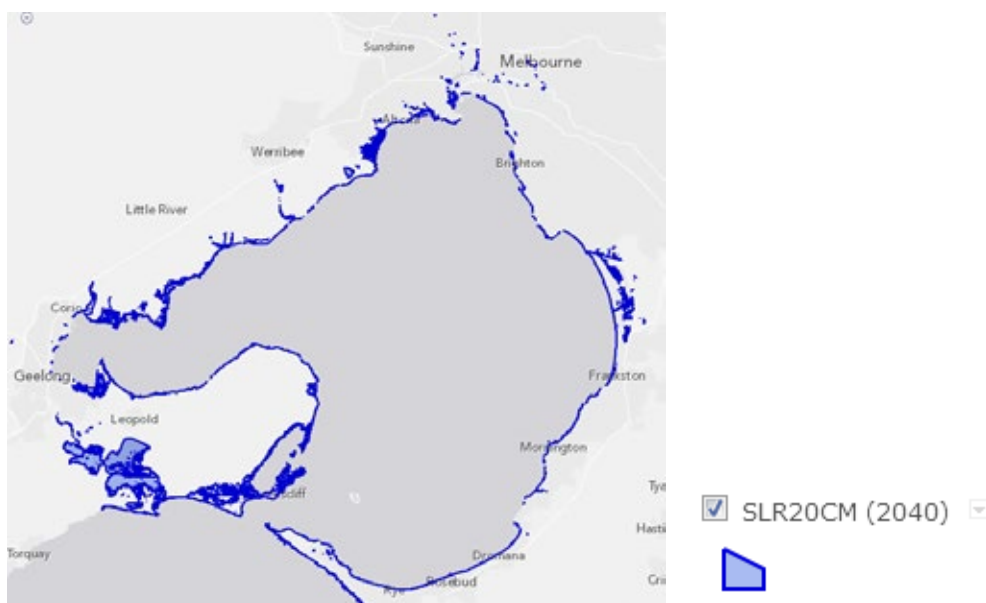


Figure 4: Spatial extent of DEPI Future Coasts bathymetry to approximately -20m water depth.

3.1.1.4. Coastal (protection) Structures

DESCRIPTION

Coastal (protection) structures (seawalls, groynes, revetments, breakwaters, wharfs) around Port Phillip Bay. The information was captured in 2008 and updated in 2011, using high-resolution aerial photography. It has been found that some structures were not captured in 2011 and are therefore missing in the dataset. This is most likely because a) they were not present at the time of capture or b) could not be identified on the aerial image available.

SOURCE

DEPI (Future Coasts Program).

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 5).

APPLICATIONS

Modelling coastal erosion and coastal inundation impacts.

LIMITATIONS

The locational information was captured from existing aerial photography in 2011. Structures built or removed since then may not be included or accurately shown in the GIS dataset. Field verification is recommended prior to using the dataset for a detailed coastal hazard assessment.



Figure 5: Coastal Protection structures in northern Port Phillip Bay. This information is available for the entire bay.

3.1.1.5. Coastal Levees

DESCRIPTION

Coastal levees around Port Phillip Bay. Similar to the coastal protection structures layer, this information was captured in 2011, using high-resolution aerial photography.

SOURCE

DEPI (Future Coasts Program).

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 6).

APPLICATIONS

Modelling of coastal inundation and riverine flooding in coastal areas (eg, modelling of presence / absence of those structures).

LIMITATIONS

The locational information was captured from existing aerial photography in 2011. Levees built or removed since then may not be included or accurately shown in the GIS dataset. Field verification is recommended prior to using the dataset for a detailed coastal hazard assessment.



Figure 6: Coastal Levees in Port Phillip Bay.

3.1.1.6. Geology and Geomorphology

DESCRIPTION

Geology and Geomorphology describes the sub-surface and surface of the land. This information can be used to better understand the erosion resistance of different sections of the bay (eg, sandy beach vs. erosion resistant cliff).

The information is captured at broad scales (often statewide at 1:250,000) but can be further informed if additional information, such as geotechnical surveys, are available for key local areas. The more detailed information would typically be documented in technical reports for individual locations.

SPATIAL EXTENT

The data available for Victoria, including Port Phillip Bay at varying scales (Figure 7 & Figure 8):

- Geology: 1:250,000.
- Geomorphology (Smartline): between 1:25,000 and approximately 1:250,000.

APPLICATIONS

- Identification of erodible vs non-erodible sections of the Port Phillip Bay coast (eg soft sand vs hard bedrock).
- Suitable dataset for combining with land elevation information, for example to identify low-lying erodible areas of the bay.

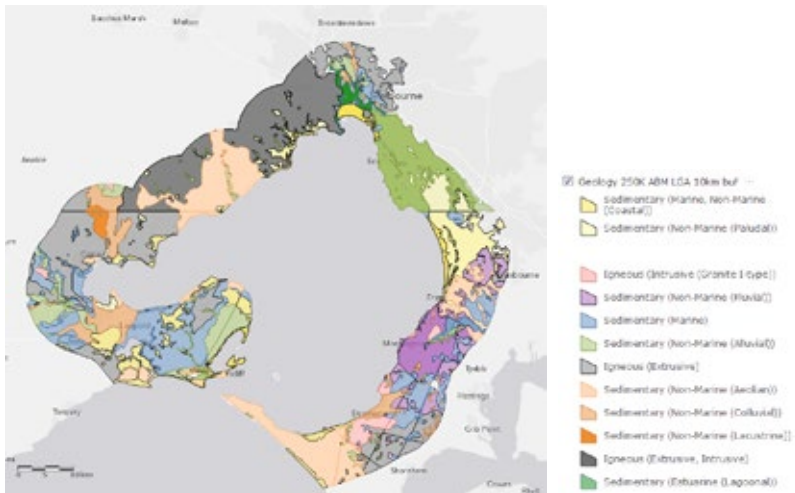


Figure 7: Geology of the Port Phillip Bay. Source: Geoscience Australia 250k Geology Map.

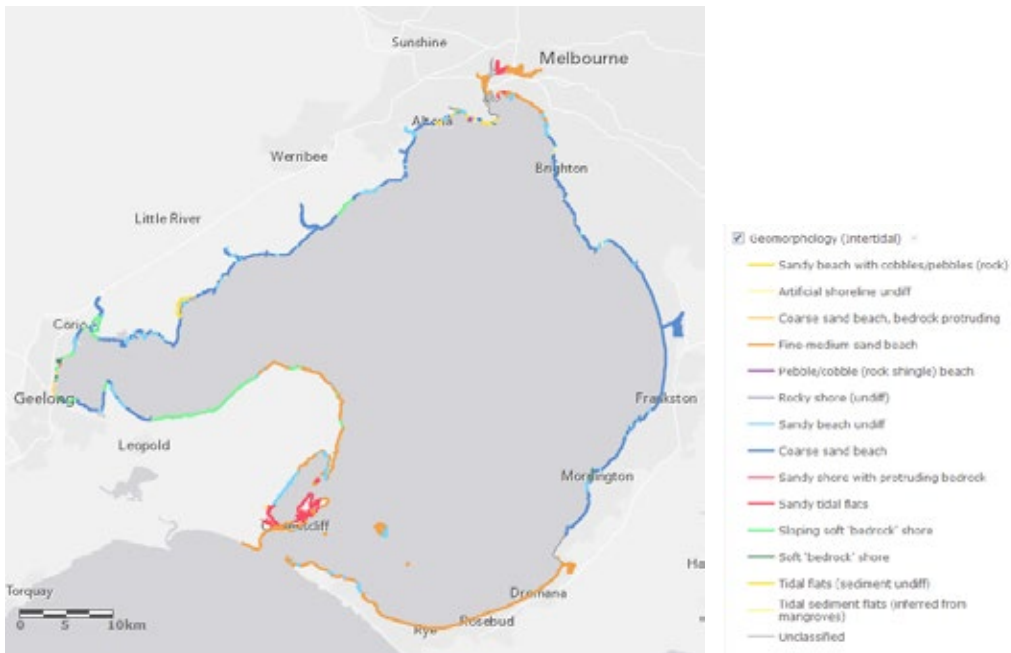


Figure 8: Geomorphological Mapping of the PPB Coastline (Source: Geoscience Australia, 2009 (Smartline Project)).

LIMITATIONS

Broad scale datasets which do not necessarily contain detailed local information about sub-surface geology to determine available erodible sand volumes.

3.1.1.7. Public Land Management

DESCRIPTION

GIS dataset based on Vicmap property information plus land management information.

SOURCE

DEPI (Vicmap Program).

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 9).

APPLICATIONS

- Identification of land manager, reserve information and legal information.
- Suitable to identify land managers of areas affected by coastal hazards. The dataset contains a number of attributes by which different types of information can be displayed.

Further information: data.vic.gov.au (public land management).

LIMITATIONS

According to the available documentation, the dataset contains some errors and should therefore be used with caution. Otherwise, the dataset provides a useful overview of various aspects of public land management.

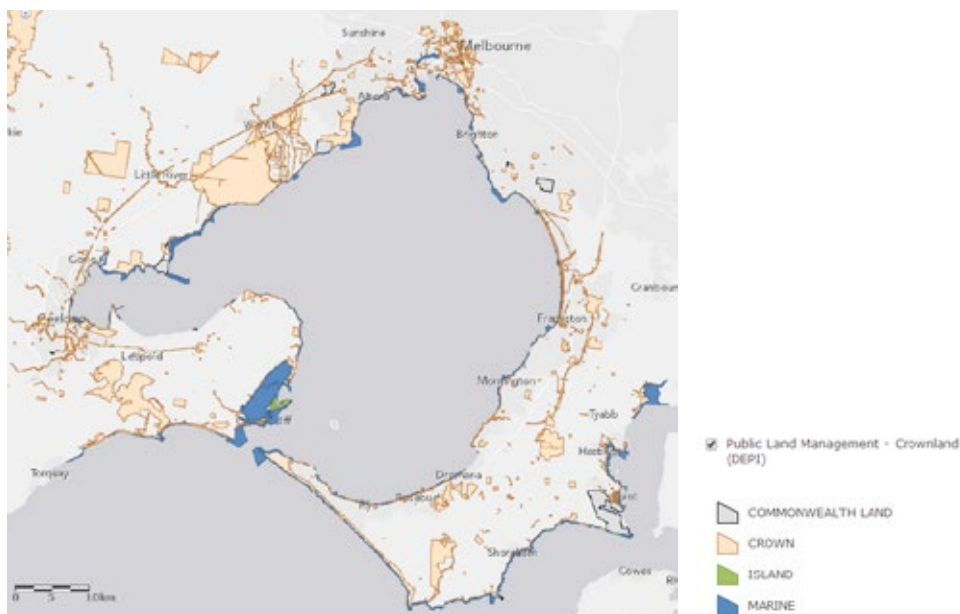


Figure 9: Public Land Management around Port Phillip Bay.

3.1.1.8. Planning Zones and Overlays

DESCRIPTION

Authoritative Statewide Vicmap Planning GIS Dataset, including Planning Zones and Planning Overlays.

SOURCE

DEPI Vicmap Program.

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 10).

APPLICATIONS

Identification of planning zones and planning overlays.

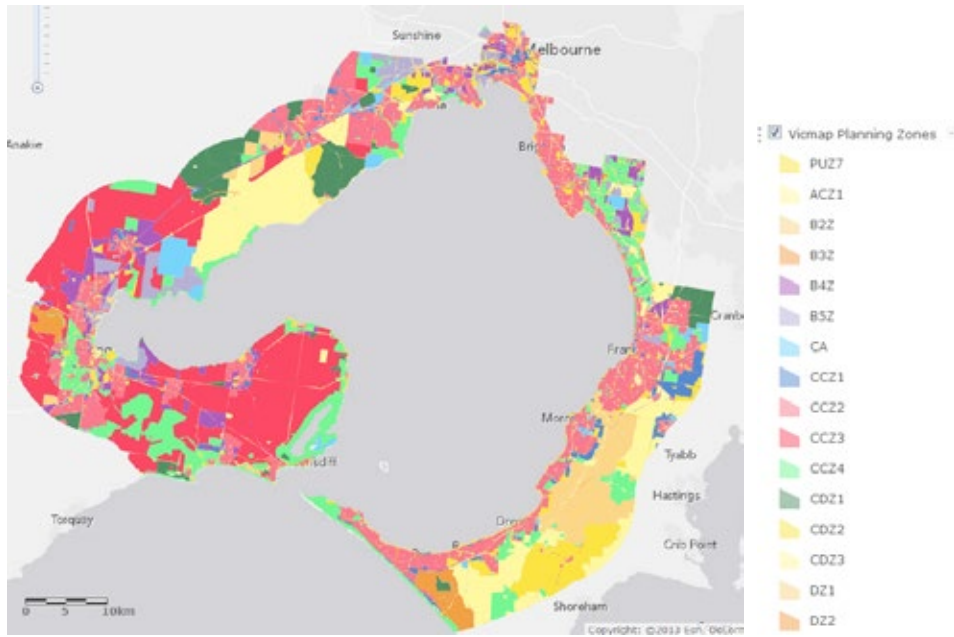


Figure 10: Vicmap Planning Zones.

3.1.1.9. Property & Address

DESCRIPTION

Description and information of individual properties and their addresses, for example crown or freehold land.

SOURCE

DEPI (Vicmap) in cooperation with local government.

SPATIAL EXTENT

The data are available for the entire Victorian coastline, including Port Phillip Bay (Figure 11).

APPLICATIONS

Identification of number of different types of properties at risk from coastal hazards. This information can be combined with data about the value of the land/asset.



Figure 11: Vicmap Property & Address.

3.1.1.10. Current and historical aerial photography

DESCRIPTION

Current and some historical aerial photography is available in GIS format (ie, scanned and spatially referenced).

SOURCE

DEPI (Vicmap / Coordinated Imagery Program).

SPATIAL EXTENT

The data are available for Victoria, including Port Phillip Bay. The spatial extent varies with the individual capture date.

APPLICATIONS

Comparison of shoreline position at the time a photo was taken (broad assessment of shoreline change over time).

High resolution, spatially referenced imagery can be used to capture information (eg, protection structures, assets, spatial extents of natural assets, etc.) and create new GIS data layers.

LIMITATIONS

High resolution images can be large in size and may therefore require sophisticated viewing / processing software.

- Cloud cover (especially old images).
- Historical aerial imagery is often lacking a good spread of reference points (eg, road intersections, buildings, etc.) to accurately reference the image.

3.1.1.11. Administrative Boundaries

DESCRIPTION

Series of administrative boundary layers. These are available as part of the Vicmap Admin dataset series and includes DEPI, local government, postcode, parish, township and other boundaries.

Further information is available from: www.data.vic.gov.au.

SOURCE

DEPI (Vicmap).

SPATIAL EXTENT

Available for various areas of Victoria (depending on the extent of the boundary), including Port Phillip Bay.

APPLICATIONS

Identification of land managers and administrative boundaries.

3.1.1.12. Infrastructure

DESCRIPTION

Series of infrastructure layers showing for example different levels of the road network, ie, local, regional and state roads.

SOURCE

DEPI (Vicmap).

SPATIAL EXTENT

Depending on spatial layer, but typically includes Port Phillip Bay.

APPLICATIONS

These layers can be used for a range of applications, for example to identify a) infrastructure at risk from coastal hazards, b) infrastructure possibly blocking flow of water, c) infrastructure suitable for example for emergency management purposes.

LIMITATIONS

Possibly accuracy and completeness of individual layers (confirm with custodian).

3.1.1.13. Vicmap Features of Interest

DESCRIPTION

Miscellaneous features (150+ different features) combined in Vicmap Features of Interest dataset. These include emergency centres, education, care, administrative and power facilities, community centres and many more.

SOURCE

DEPI (Vicmap).

Additional Information:

<http://www.dse.vic.gov.au/property-titles-and-maps/maps-imagery-and-data/data/vicmap/vicmap-products/vicmap-features-of-interest>

http://www.dse.vic.gov.au/___data/assets/pdf_file/0003/192927/Vicmap-Features-of-Interest-Subfeature-Completeness-Report-September-2013.pdf

http://www.dse.vic.gov.au/___data/assets/pdf_file/0004/192928/VM_Feature_Catalogue072013.pdf

SPATIAL EXTENT

Victoria, including Port Phillip Bay.

APPLICATIONS

In combination with hazard assessments, to identify features at risk from inundation or erosion.

LIMITATIONS

Varying degree of completeness of individual features.

3.2 GIS Portal

A number of the data layers identified were loaded into a cloud-based GIS Portal. Two thematic maps were set up, with information about a) the 'Physical Environment' and b) 'Administrative Layers', with some overlap between them (Figure 12 & Figure 13). Additional theme maps can be created, either using the existing layers or adding other datasets.

Other ways to view this information, for example for a less technical audience, is to save the GIS data as layered PDF files (individual data layers can be switched on or off inside the PDF file), or alternatively in Google Earth KMZ format (Figure 14).

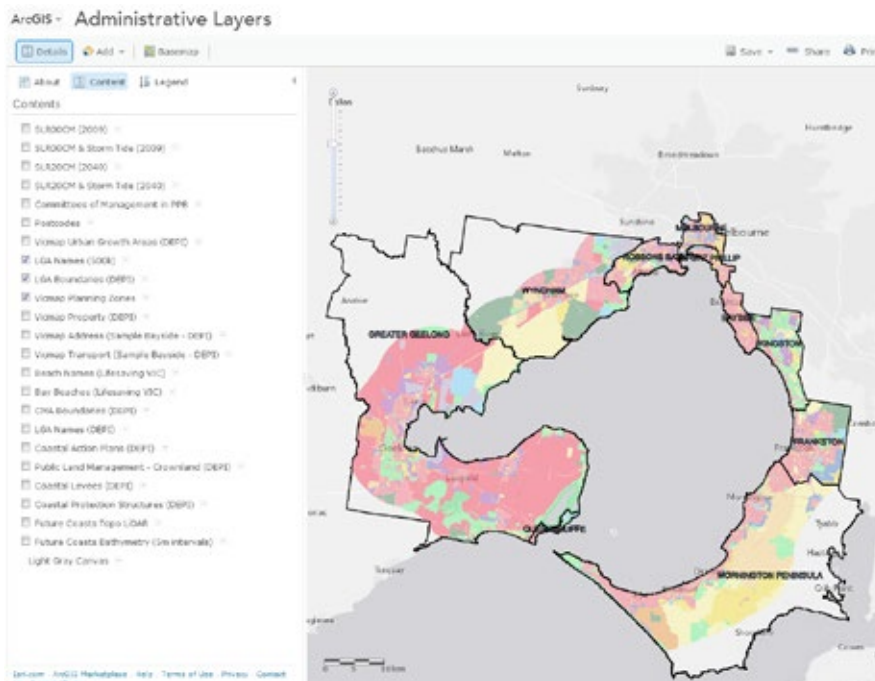


Figure 12: ArcGIS online website containing a series of Administrative data layers collated as part of Phase 1.

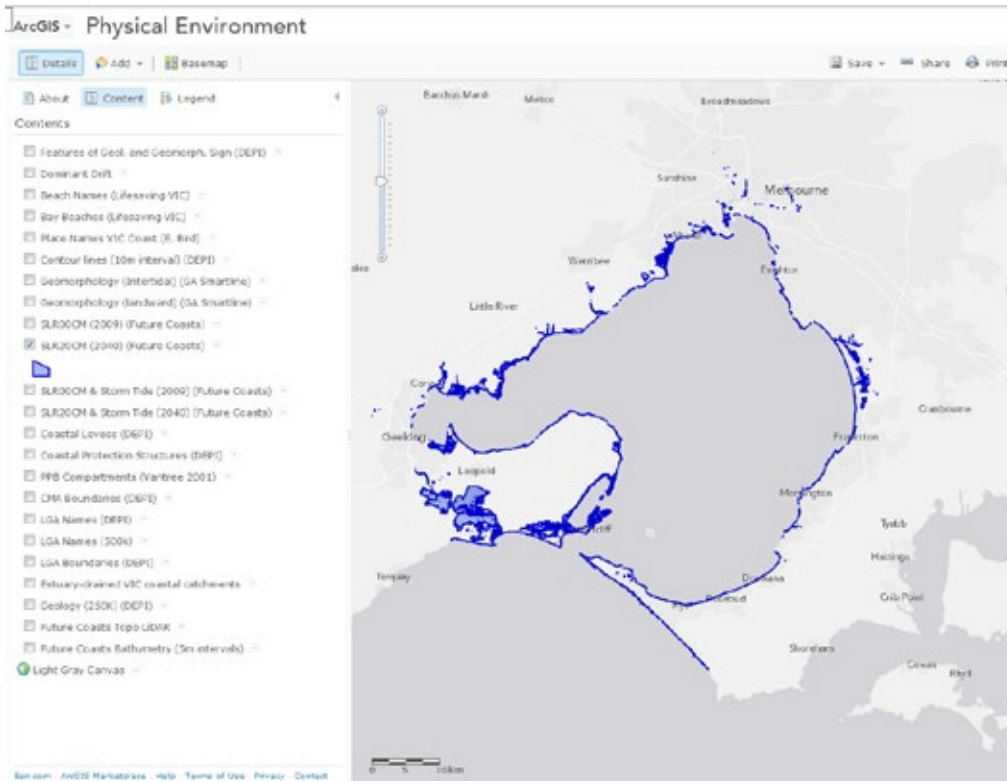


Figure 13: ArcGIS online website containing a series of data layers describing the Physical Environment collated as part of Phase 1.

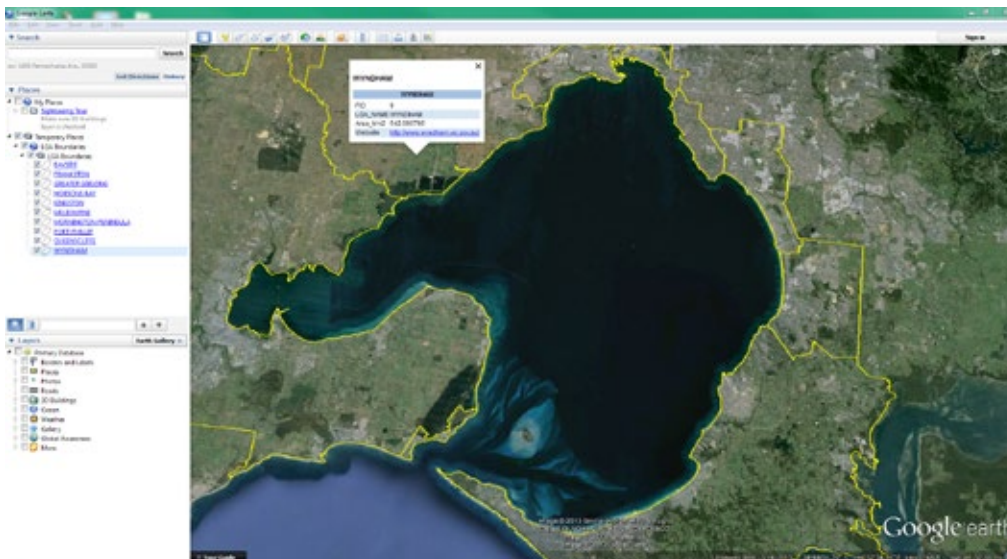


Figure 14: GIS Layer shown in Google Earth.

3.3 Technical Reports

More than 200 technical reports were identified in addition to the GIS data layers. In some cases these reports may be sources for additional spatial information since they are often accompanied by GIS data layers as part of the project deliverable. This is increasingly the case for those more recently finalised. On the other hand, older reports often only contain maps or diagrams that are not necessarily available in GIS format.

The main sources for technical reports can be summarised as:

- State government.
- Local government (eg, via their websites and the Crowdspot website).
- Libraries and archives.
- Consultants (predominantly as PDF document on government websites).

As outlined in Section 3.1, available information about reports is stored in a Microsoft Excel spreadsheet and can be linked to the GIS by their geographical location.

3.4 Strategies & Plans

Over 60 strategies and plans were identified. These were largely sourced from local government, the Central Coastal Board and the Victorian Coastal Council and are stored in a Microsoft Excel spreadsheet.

3.5 Historical aerial photography

Aerial photography has been captured for the greater Melbourne area for many decades. However, only images captured in the last few decades are generally available in GIS compatible format. Older images are mostly only available as hardcopy from DEPI / Land Victoria. Some local government and other authorities have made efforts to convert historical aerial photos to GIS readable formats. Land Victoria commenced a project to scan the historical aerial photo library. This is anticipated to take a few years before delivering the information electronically and online.

3.6 Photos

A number of photos (happy snaps / beach photos) were identified, largely via state/federal library or state/federal archive catalogues. The year of capture was recorded for a number of those photos.

3.7 Summary

In summary, a substantial amount of information exists for Port Phillip Bay. Most of the information that could be identified or has been contributed by the technical reference group or others is relevant for different phases of the project.

The following general observations were made:

- Spatial data collated to date largely covers the entire bay, or parts thereof. Much of this information is of good quality (eg, Vicmap datasets, Future Coasts land elevation and water depth information, aerial photography).
- Technical reports address primarily local issues and small sections of the bay
- Strategies and plans address both, local as well as bay-wide issues.

04. Key data gaps

A number of spatial data layers already exist that are required to inform an immediate *Port Phillip Bay coastal processes assessment* and a future *Port Phillip Bay Coastal Hazard Assessment*.

These include, but are not limited to:

- Elevation & bathymetry (water depth).
- Surface geology & geomorphology.
- Coastal protection structures.
- Infrastructure & assets (including drainage).
- Property and address information.
- (current) aerial photography.
- Strategies and plans.
- Wind.
- Water level.

However, other information that would add significant value to such study does not seem to be available yet, or is not available in a suitable format. This includes, but is not limited to:

- Understanding the processes shaping the bay, including predominant wind direction, average wave energy direction, sediment transport, storm bite, as well as a good understanding of the effectiveness of protection structures. Having such information available would address the data gathering / modelling needs addressed elsewhere (eg, Victorian Adaptation and Sustainability Partnership Grants 2013 application).
- Historical airphotos in digital / GIS format providing historical data that could then be associated with particular events such as coastal storms.
- Detailed information about the behaviour of beaches (eg, by means of regular beach profiles).

05. Conclusions

The activities undertaken during Phase 1 have shown that a substantial amount of information is already available for Port Phillip Bay (GIS data layers, reports, strategies, plans, images and photos). It appears however, that some information gaps still exist, in particular to improve the understanding of processes shaping the bay as a whole.

While many investigations have been undertaken with a focus on small spatial areas, it appears that 'bigger picture' studies to understand the bay as a system have not been undertaken in great quantity or detail, and processes shaping the bay are not yet fully understood.

It is therefore highly recommended to investigate avenues to fill these information gaps.

Based on the findings of Phase 1, several actions are proposed. These can be broadly divided into

- a) using existing information for a preliminary assessment of assets potentially at risk, and;
- b) collecting new information to improve our understanding of bay-wide processes driving coastal change and therefore further enhancing the value of existing data.

Having a more detailed understanding of the processes shaping the bay, in combination with existing information provides an opportunity to further the knowledge of coastal practitioners, and therefore being able to better manage the coast as a system, rather than a local scale.

In the long-term, having this information and addressing the risks at hand, now and in the future, can support coastal decision making processes and provides opportunities to embed information into existing and new policy, plans and processes.

06. Proposed actions

With a wealth of information already available, the next proposed steps aim to use the data already collected; and fill data gaps required to improve our understanding of regional coastal processes, as well as their effects on vulnerable sections of the coast.

Five proposed actions (next steps) are outlined below (6.1), and their key information requirements, outputs, applications and limitations documented. Several questions were considered developing these action:

- What is at risk (assets, infrastructure, natural values)?
- Where are assets located geographically?
- What are the chances of assets being at risk?
- Who is responsible for the management of land and those assets affected?
- What is required to reduce the risk to those assets?

6.1 Summary of proposed Actions

- ACTION 1** GIS analysis to consider the land adjacent to the coastline at nominally 10 m increments. Spatial overlay with other existing asset and land management information. This approach will assess the number of different assets and their respective geographic location that are potentially at risk from a hazard. This approach considers existing protection structures, geology, land elevation and land managers. This Action is NOT linked to a particular hazard event.
- ACTION 2** GIS analysis – calculation of width and available erodible sand volume of 'land buffer' between 0 m AHD contour and seaward-most infrastructure around Port Phillip Bay.
- ACTION 3** Analysis of existing historical information to improve understanding of coastal processes and hazards impacting the coast in the past.
- ACTION 4** Beach profile monitoring surveys to monitor beaches around Port Phillip Bay.
- ACTION 5** Development of bay-wide coastal models to understand processes driving shoreline change at bay-wide scale.

Note: The actions proposed were discussed at the ABM Technical Reference Group meeting (6 November, 2013).

ACTION 1

DESCRIPTION

Using GIS, simulate the landward movement of erodible sections of the shoreline, nominally at 10 m intervals. The outputs will be spatially combined with existing information about assets and land managers. The approach takes into consideration the elevation of the land, existing protection structures, land elevation and geology. This approach uses information collated as part of Phase 1 of the Prospectus.

PURPOSE

Undertake preliminary GIS analysis of the potential risk to assets near the coast within specified hazard zones (nominally at 10 m intervals).

APPLICATION

Identification of areas that are not naturally or artificially protected (eg, hard rock coastline or protection structures). Assessment of assets at risk in those areas undertaken at 10m buffer (or hazard) intervals to approximately 100-150m inland.

INPUT (GIS DATA)

- DEPI Coastline
- DEPI Future Coasts Topographic LiDAR DEM
- Geoscience Australia Smartline coastal geomorphic mapping
- Geoscience Australia geology mapping
- Land Management Assets
- DEPI Vicmap Cadastre
- DEPI Vicmap Roads
- DEPI Vicmap Features of Interest
- Natural assets

OUTPUT

- GIS vector layers showing location of assets, hazard zones and land manager.
- Summary statistics.
- Asset type most affected.
- Number of assets per hazard zone, summarised eg, by local government area or land manager.

LIMITATIONS

The key assumption is the landward movement of the shoreline over time.

No consideration is given to wind/wave direction or magnitude. This approach is not linked to a particular hazard event.

COST

Up to \$10,000 ex GST, depending on effort required.

SPATIAL EXTENT / GEOGRAPHY

Port Phillip Bay.

PARTNERS / USERS

DEPI, Local Government, Melbourne Water

Provides users, (possibly including community) with better understanding of assets at risk without linkage to a particular event

ACTION 2

DESCRIPTION

GIS-based assessment of width and volume of land between 0 m AHD contour and seaward most infrastructure (determination of width and available erodible volume of 'natural coastal buffer').

PURPOSE

To use GIS and existing information to determine the width or 'buffer' of land and its (sediment) volume between the 0 m AHD contour and infrastructure along the coast.

This approach uses information collated as part of Phase 1 of the Managing Better Now program.

INPUT

- DEPI Future Coasts Topographic LiDAR
- DEPI current aerial imagery (georeferenced)
- DEPI aerial imagery at time of Topo LiDAR capture (2007)
- Protection structures
- Geology
- DEPI Vicmap Cadastre
- DEPI Vicmap Roads
- DEPI Vicmap Features of Interest
- Land managers
- Other infrastructure information

OUTPUT

GIS data layer containing information about width and volume of the coastal buffer and respective land managers.

APPLICATION

Improved understanding of ability of current 'buffer' to protect assets in the event of hazards.

Develop management plan Actions to maintain/improve coastal 'buffer'.

LIMITATIONS

Potentially large dataset due to number of profiles.

Outputs and results are valid for time of data capture.

No consideration is given to wind/wave direction or magnitude. This approach is not linked to a particular hazard event.

COST

Up to \$10,000 ex GST depending on effort required.

SPATIAL EXTENT / GEOGRAPHY

Port Phillip Bay.

PARTNERS / USERS

DEPI, Local Government, Committees of Management, Coastcare (DEPI)

ACTION 3

DESCRIPTION

- a. Analysis of existing historical information to improve understanding of coastal processes and hazards impacting the coast in the past.
 - b. Beach profile monitoring (future, long-term).
- Action 3a uses information collated as part of Phase 1, plus additional information from archives, historical societies, libraries and local government to improve the understanding of occurrence, frequency and magnitude of historical events.

Action 3b collects new baseline data to improve the general understanding of coastal processes and beach behaviour.

PURPOSE

Identify past hazards and their magnitude in Port Phillip Bay based on existing historical information.

This will add to our understanding of areas potentially at risk in the future.

Based on past and current understanding, collect baseline data for a number of beaches. The purpose is to establish a robust, long-term program to collect information useful for coastal management.

APPLICATION

Action 3a provides mapped information about historical coastal hazards. Ideally, informs of areas at risk in the past.

Action 3b improves understanding of processes and hazard impacts. Development of beach profile database over time. Information to be linked with weather / storm events.

INPUT

Action 3a:

- All available historical information.
- DEPI existing aerial imagery (scanned and geo-referenced).
- DEPI aerial imagery archives.
- Information about beach nourishment projects.
- Action 3b:
- Identification of suitable beaches for monitoring.
- Setup of reference points.
- Volunteers to undertake surveys.
- Funds to purchase equipment.
- Use of smartphone app.

OUTPUT

Action 3a – Map of Port Phillip Bay showing geographic location of storm events, rates of erosion as points on a map. Output detail depends on the information available.

Action 3b – Beach profile information, collected on eg, quarterly basis, plus before and after significant events.

LIMITATIONS

Action 3a – Uncertainty of the level of detailed historical information about storm events available.

Action 3b – Long-term commitment of participants; storage of collected information in central location (eg, University library, State Library) and distribution to other central locations.

COST

Daily rate, depending on effort required.

SPATIAL EXTENT / GEOGRAPHY

Port Phillip Bay.

PARTNERS / USERS

DEPI, Local Government, MW, Committees of Management, Coastcare (DEPI), University, volunteers

Provide users (including community) with an understanding of past events. Can provide insight into past hazards and how the coast was affected immediately after the event and how/if it changed long-term. Also, assess how protective structures have caused or contributed to coastal dynamics to change.

Involvement of and contribution from community, improved understanding of the coast and processes shaping the coast

ACTION 4

DESCRIPTION

The purpose of this Action is to develop a bay-wide consistent methodology to:

- Determine 1% AEP wave heights and average wave energy direction for Port Phillip Bay. The resolution of this model is 50-100m horizontal and therefore suitable for application at local scale. It extends from Point Edwards to Sorrento.
- Determine 1% AEP sea level. The resolution of the model is 1-2km horizontal and is suitable for application at local scale. It extends from Point Edwards to Sorrento.
- Review of protection structures and their effectiveness in protecting the coast.

Note: AEP refers to Annual Exceedance Probability. The probability (expressed as a percentage) that an event (eg large wave height or high water level) will be equalled or exceeded in a given year.

PURPOSE

Actions 1, 2, and 3 propose the use of existing and readily available information. However, those Actions do not take into account those physical processes causing coastal change in Port Phillip Bay such as waves and sea levels. Action 4 proposes to use existing information about sea level and winds, and to model these physical processes. This will help better understand the currently poorly understood physical processes, at bay-wide scale.

The outputs of this action will provide uniform and consistent information for coastal practitioners to use in assessing coastal processes. Developing a standardised and authoritative model will help with better understanding coastal processes, at a local as well as bay-wide scale. The current practice of developing separate model for individual beach process assessment will therefore be significantly reduced.

In order to determine the level of detail required of these models to be meaningful and applicable for a range of tasks, information was collated from local and state government to better understand the coastal issues the bay is facing. Key issues identified centered around beach and cliff erosion, overtopping of structures, inundation of low-lying areas and wetlands and an understanding of sediment transport regimes within and across coastal process cells.

INPUT

- Historical winds (Bureau of Meteorology)
- Historical sea level (Tide gauges)
- Department of Sustainability and Environment Future Coasts Topography (land elevation)
- Department of Sustainability and Environment Future Coasts Bathymetry (water depth)
- GIS Layer of coastal protection structures

OUTPUT

GIS grid layer(s) at nominally 50-100m resolution for waves (high-resolution required for more localised assessments) and 1-2km resolution for sea level (lower resolution sufficient due to less variation across the bay) for Port Phillip between Point Edwards and Sorrento:

The expected outputs are:

- Approximate maximum significant wave height (annual and seasonal) at 50-100m spatial resolution in GIS format.
- Average wave energy direction (annual and by seasonal) at 50-100m spatial resolution in GIS format.
- Sea level (still water level) at 1-2km spatial resolution.

APPLICATION

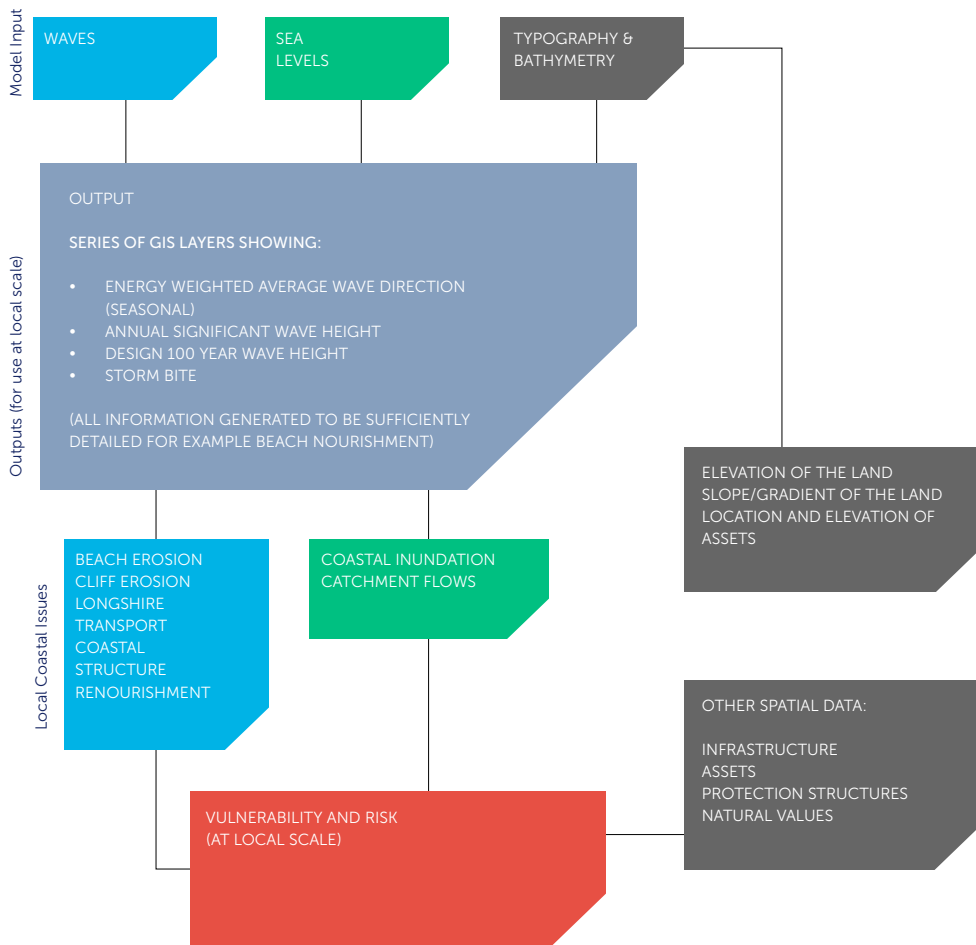
Bay-wide authoritative model for coastal hazard assessment. Can be used in combination with other Actions for a more detailed assessment of impacts.

Model outputs will be sufficiently detailed for assessments at local scale, for example for beach nourishment projects. They would reduce the need for new baseline modelling in subsequent (local) projects, reducing the cost of future projects.

Having this kind of information available is expected to contribute to enhancing technical skills and knowledge of coastal risks and vulnerability.

LIMITATIONS

The models would be developed for existing sea level only at this stage. No consideration would be given to future climate change and sea level scenarios at this stage.



COST

1% AEP wave heights: Approximately \$15,000 - \$20,000 ex GST.

1% AEP sea level: Approximately \$15,000 - \$20,000 ex GST.

Storm Bite / coastal erosion: Approximately \$25,000 - \$35,000 ex GST.

SPATIAL EXTENT / GEOGRAPHY

Port Phillip Bay (Point Edwards to Sorrento).

PARTNERS / USERS

DEPI, Local Government, MW, Ports authorities, consultants.

