

**Port of Hastings Development Project**  
An Alternative Port Concept Design (Option 'D')  
Rationale, General Description and High Level Appraisal

Port of Hastings Development Authority

February 2015

**Draft for Discussion Purposes (Revision 1)**

8A030019

Document title Port of Hastings Development Project  
Rationale, General Description and High Level  
Appraisal  
Document short title An Alternative Port Concept Design (Option 'D')  
Status **Draft for Discussion Purposes (Revision 1)**  
Date February 2015  
Project name Port of Hastings Development Project  
Project number 8A030019  
Client Port of Hastings Development Authority  
Reference HAS-CEP0-HY-REP-0017-1

Drafted by Greg Britton  
Checked by Greg Britton  
Date/initials check 9/01/17   
Approved by Greg Britton  
Date/initials approval 2/02/17 

This report has been prepared by Haskoning Australia Pty Ltd solely for its client in accordance with the terms of appointment, the methodology, qualifications, assumptions and constraints as set out in the report and may not be relied upon by any other party for any use whatsoever without prior written consent from Haskoning Australia Pty Ltd.

## CONTENTS

	Page
1 INTRODUCTION	1
2 RATIONALE FOR OPTION 'D'	2
3 GENERAL DESCRIPTION OF OPTION 'D'	5
3.1 Overview of Option 'D' and General Comparison with a Land Backed Option	5
3.2 Features of Option 'D'	7
3.2.1 General Spatial Considerations	7
3.2.2 Training Wall	8
3.2.3 Dredging, Reclamation and Excavation Volumes	8
4 HIGH LEVEL APPRAISAL OF OPTION 'D' – CHECK FOR 'FATAL FLAWS'	13
4.1 General	13
4.2 Ramsar Site	13
4.3 Geotechnical Factors	13
4.4 Hydrodynamics	14
4.5 Navigation	14
4.6 Road and Rail Interface	14
4.7 Aboriginal Cultural and Historical Heritage, Groundwater and Surface Water, Land Use and Topography, and Terrestrial Ecology	14
4.8 Services	15
4.9 Disposal Task for Dredged and Excavated Materials	16
4.10 Construction Risk	16
4.11 Approvals Risk	17
4.12 Conclusion	17
5 SUGGESTED FURTHER STUDIES	18

## APPENDIX A – MEMO FROM GHD-AECOM JV TO ROHAN HENRY DATED 20 NOVEMBER 2014

## **1.1 Introduction**

The purpose of this report is to provide a rationale, general description, and high level appraisal, of an alternative port concept design, Option D, developed for the Port of Hastings Development Project by Haskoning Australia (a company of Royal HaskoningDHV).

The report is set out in the following way:

- Section 2 provides the rationale for development of the alternative Option 'D';
- Section 3 provides a general description of Option 'D';
- Section 4 provides a high level appraisal of Option 'D', in particular a check for any 'fatal flaws';
- Section 5 provides some suggested further investigations and studies to take Option 'D' forward.

The report has been written assuming the reader has a reasonably good understanding of the Project and the site.



## 2 RATIONALE FOR OPTION 'D'

The idea for developing an alternative port concept design option (Option 'D') grew from an understanding of several key site constraints and opportunities.

The several key site constraints and opportunities are:

- **Ground Model (sediment and soil conditions):**  
The marine geotechnical investigation program has established that the materials to be dredged are primarily silty/clayey textured materials, there is little clean sand. While the materials can be readily dredged, beneficial reuse of the dredged material for reclamation purposes poses a number of technical challenges which affect cost and construction risk (refer **Figure 1**).



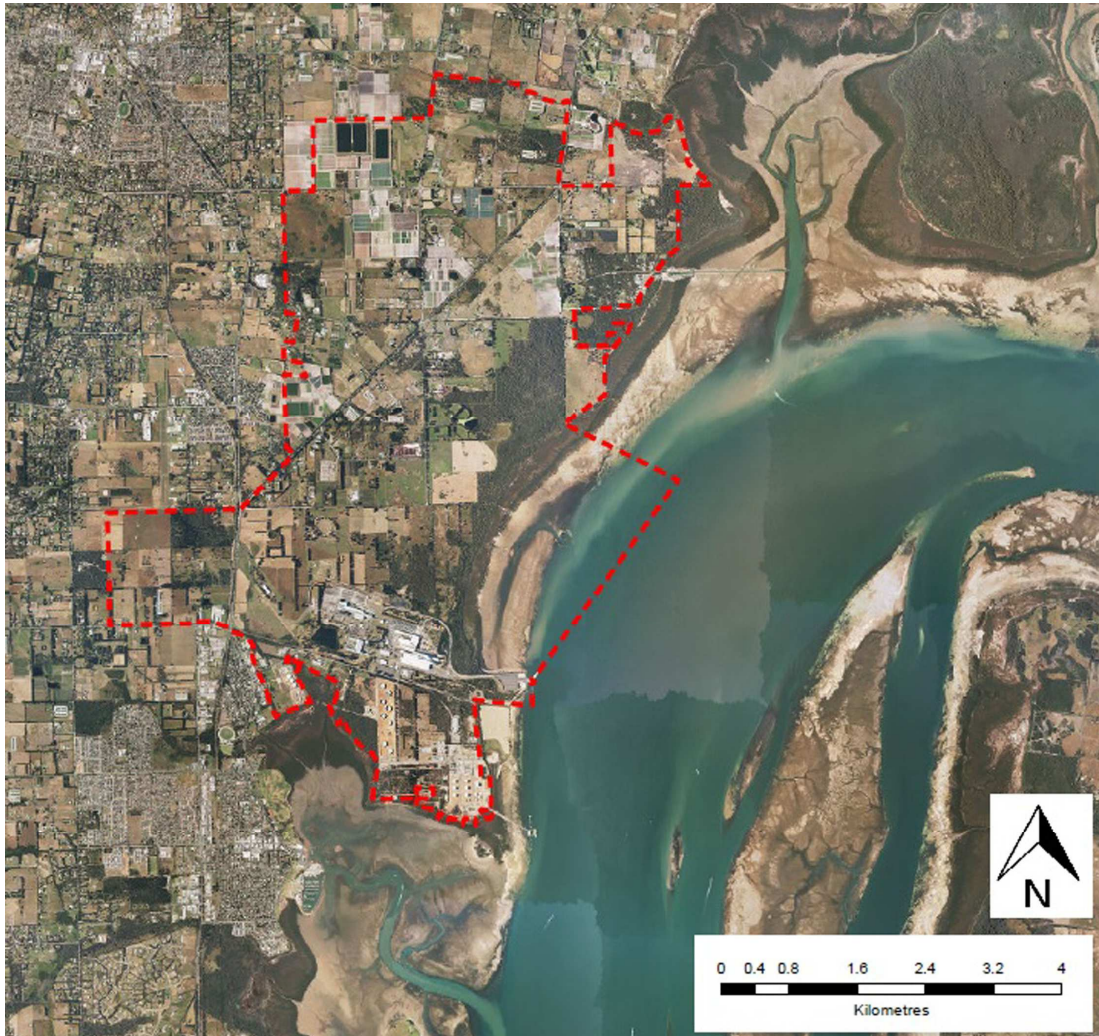
**Figure 1** Settling test underway for a mixture of clay from the port dredging area to inform potential performance in reclamation areas

- **Ramsar Wetland:**  
The proposed Port of Hastings Development Project is situated largely within the Western Port Ramsar Site (those components of the development situated along the foreshore and within the waterway).



**Figure 2** View of a section of the Western Port Ramsar Site, looking south-west from Warneet

- Available Land Area:  
More than 3,000 hectares (ha) of land has been zoned since the late 1970s as Special Use Zone – Schedule 1 (Port related Purposes) (SUZ1) for development and expansion of the Port (refer **Figure 3**). This land area is more than that required to accommodate the land based infrastructure for the Port expansion and is also generally outside the Ramsar Site. Accordingly, the SUZ1 presents an opportunity for provision of not only land based port infrastructure, but also water based infrastructure through excavation.



**Figure 3**    **Extent of the SUZ1 north of Hastings (red dashed line)**

Based on the above, the challenge was to try to identify an alternative port concept design option that would offer the following range of benefits:

- less direct and indirect impact on the Ramsar Site;
- less dredging volume (a measure of real and perceived impact);
- less hydrodynamic impact;
- lower construction risk;
- lower approvals risk.

### 3 GENERAL DESCRIPTION OF OPTION 'D'

#### 3.1 Overview of Option 'D'

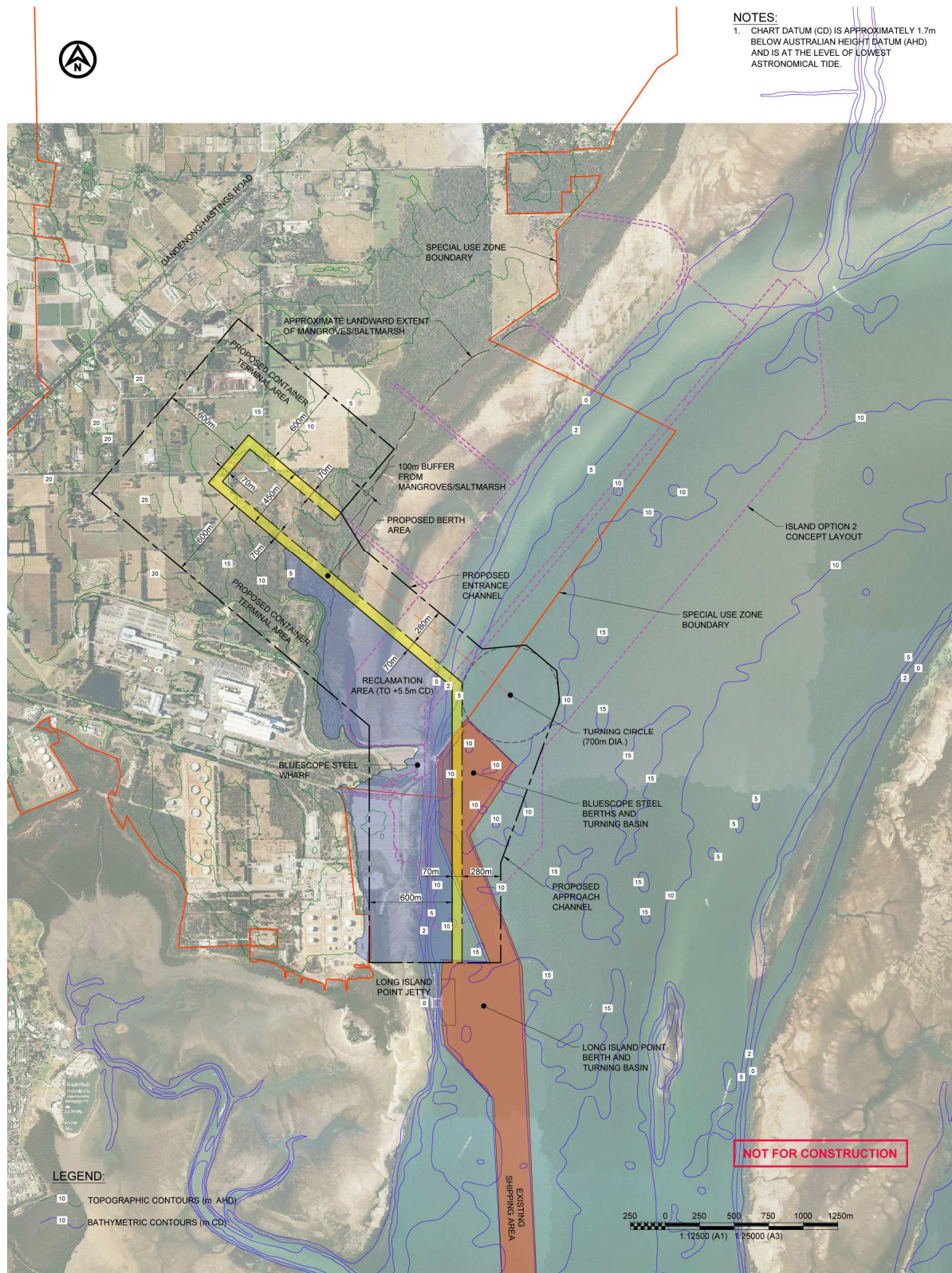
The general arrangement for Option 'D', first developed in September/October 2014, is shown in **Figure 4**<sup>1</sup>. In simple terms:

- the initial stage of the port development would take place in the Long Island Point Jetty to BlueScope Wharf area;
- a swing basin would be created at the northern limit of the first stage;
- further stages of the port development would take place by turning the quay line in a north-westerly direction and cutting into the SUZ1 land (rather than extending in a north-easterly direction along the waterway which is the case with an 'along the waterfront' land backed option).

---

<sup>1</sup> Some refinement of Option 'D' has continued since October 2014. A subsequent version is presented later in this report.





**Figure 4** General arrangement for alternative port concept design Option 'D' (also refer Footnote 1)

## 3.2 Features of Option 'D'

### 3.2.1 General Spatial Considerations

The configuration of Option 'D' has been developed conceptually having regard to a number of factors as set out below, these factors would be revised and refined during further studies:

- minimum 600m 'depth' for a container terminal land area behind the quay line. This has fixed the position of the north-south quay line in the Long Island Point Jetty/BlueScope Wharf area assuming the existing land based infrastructure is retained<sup>2</sup>. It has also determined the minimum distance between the north-west aligned container terminal quay line and north-east corner of BlueScope facilities (the access road to the wharf);
- siting the container terminal generally as far south as practicable, immediately adjacent to the BlueScope facilities, to provide a contiguous industrial land use;
- provision of some northern orientation to the shipping basin to better align with likely prevailing winds<sup>3</sup>;
- a width of 450m for the basin, this equates to the width of basin in the recently constructed Maasvlakte 2 container terminal in Rotterdam, The Netherlands;
- swing basin or turning circle of 700m, based on 2 x LOA (length overall) of a container ship 350m in length<sup>4</sup>;
- truncation of the return basin quay line prior to reaching the mangrove/saltmarsh communities, this is to avoid loss of these communities further north which would otherwise occur if this quay line extended further in a south-easterly direction.

The alignment of the basin generally follows a valley or depression within the SUZ1 which is largely clear of vegetation (refer **Figure 5**). This alignment has some benefit in reducing excavation volume although the reduction is probably relatively small in the context of total excavation volumes, ie. aligning the basin with the depression, while beneficial, is not considered critical. Should Option 'D' be located within the depression, surface water management during construction would be particularly important, but well established techniques exist for such management to mitigate environmental impact and impact on construction activities.

<sup>2</sup> This would give a container terminal quay line somewhat offshore from the existing fender line of Long Island Point Jetty and BlueScope Wharf. In practice the container terminal quay line could be coincident with the existing fender line if the 600m depth was reduced (or if the existing land based infrastructure was modified or removed).

<sup>3</sup> A weather station has been recently (July 2014) established on BlueScope Wharf for the Authority and will provide improved understanding of local wind speed and direction.

<sup>4</sup> In future studies the swing basin may be elongated in the direction of prevailing ebb and flood tide currents and it is possible the container ship size may be revised to a length greater than 350m.





**Figure 5** View looking south-east towards Western Port in the area of the proposed basin in Option 'D'. The tree line in the distance is close to the waterway

### 3.2.2 Training Wall

In practice a training wall would need to be constructed extending in a south-easterly direction from the end of the truncated basin quay line out into the waterway. This structure is not shown on **Figure 4**. The structure would likely be comprised of rock and extend as far into the waterway as a point approximately opposite (in a northerly direction) the turn point in the quay line north of BlueScope Wharf. The final position of the end of training wall would need to be investigated with the assistance of hydrodynamic modelling to ensure a satisfactory outcome for ship manoeuvring and for sedimentation into the channel/swing basin.

### 3.2.3 Dredging, Reclamation and Excavation Volumes

Dredging, reclamation and excavation volumes have been estimated for Option 'D' and for a land backed option by Haskoning Australia in AutoCAD Civil 3D based on shape files supplied by the JV. The JV adopted a number of assumptions:

- a 'big' container ship (20,000 TEU ship);
- all navigable areas to -16.5m CD;
- all container terminal land areas to +5.5m CD.

**Figure 6** shows the adopted concept for a land backed option including an approximate phasing of the terminal development (Phase 1, Phase 2 and balance of remaining phases).

Dredging is assumed to generally match the phasing of the terminal development. The position of the quay line is subject to further design refinement.

**Figure 7** shows the adopted concept for Option 'D', including an approximate phasing of the terminal development (Phase 1, Phase 2 and balance of remaining phases). Again the dredging (or excavation) is assumed to generally match the phasing of the terminal development. The quay line is subject to further design refinement.

It is noted that Phase 1 and Phase 2 of each port concept option are equivalent.

**Table 1** sets out the estimated dredging and fill volume for a land backed option. **Table 2** sets out the estimated dredging, excavation and fill volumes for Option 'D'. Note that the volumes of dredging of the soft muds underlying reclamation areas (expected to be required for stability/settlement reasons) and the subsequent need for additional fill to replace the soft muds are included in **Table 1** and **Table 2**. All volumes are rounded to the nearest 1Mm<sup>3</sup>.

In the case of Option 'D' it has been assumed that the basin would be created by excavation rather than by dredging<sup>5</sup>.

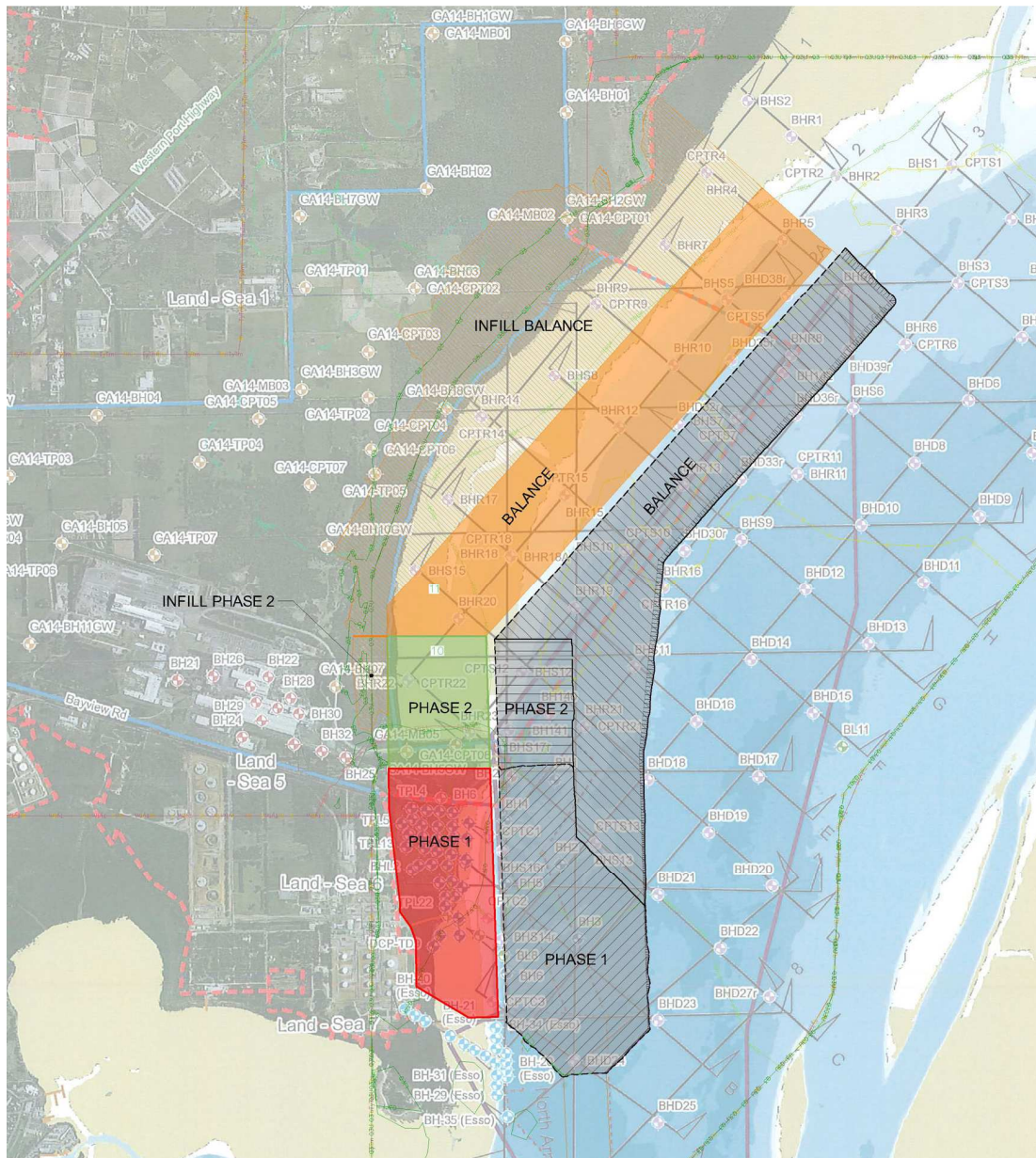
The following comments can be made in relation to the volumes set out in **Table 1** and **Table 2**:

- Option 'D' has somewhat less dredging volume (based on the basin being excavated) than a land backed option when account is taken of the need to remove soft muds underlying reclamation areas;
- Option 'D' has a considerable total excavation volume, approximately 34Mm<sup>3</sup>, of which approximately 20Mm<sup>3</sup> is required to create the basin;
- the total dredging volume in the land backed option of approximately 28Mm<sup>3</sup> exceeds the fill volume of approximately 21Mm<sup>3</sup> required for the terminal area (see Note 2 to **Table 1**). This balance is useful, but a significant proportion of the dredged material in practice will be unsuitable for fill (reclamation), accordingly there will be a shortfall of fill material derived from dredging in this land backed option<sup>6</sup>;

<sup>5</sup> For example by dewatering and excavating, or by using land-based equipment excavating below the water table. Generally speaking, excavation 'in the dry' allows better control, avoids large bulking factors (particularly if the alternative is hydraulic dredging), and can be less costly. Option 'D' presents the opportunity for use of excavation techniques while other options do not. The feasibility of use of excavation techniques is significantly influenced by a knowledge of groundwater conditions and behavior.

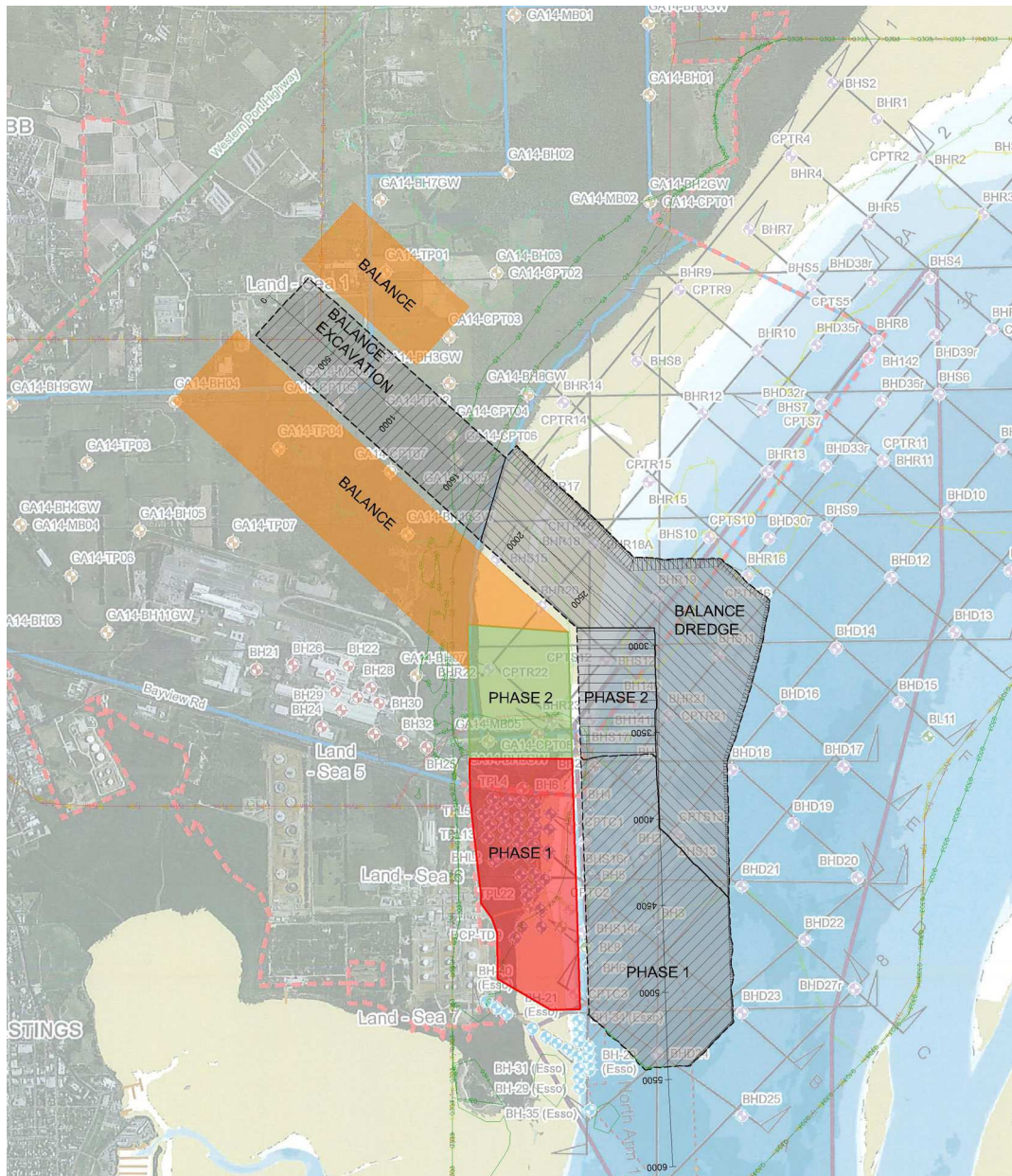
<sup>6</sup> A proportion of the (mostly) silty/clayey textured material to be dredged will form a mud slurry when dredged hydraulically and cannot be reasonably accommodated within a reclamation proposed for a container terminal (this will be further discussed in the dredging and reclamation strategy reporting, it is not proposed to present details here).





**Figure 6** Land backed option showing navigation areas (black outline), terminal areas (coloured) and approximate phasing





**Figure 7** Option 'D' showing navigation areas (black outline), terminal areas (coloured) and approximate phasing

- for Option 'D' the total of the dredging and excavation volumes is well in excess of the required fill volume. Should the dredged material be unsuitable for reclamation, there would be substantial quantities of excavated (in the dry) material available for use as fill, although major excavation may not occur until later in the project. Excavation of land areas could be bought forward if required to accommodate fill requirements in the early phases<sup>7</sup>.

**Table 1 Dredging and Fill Volumes for a Land Backed Option**

Phase	Dredging volume (Mm <sup>3</sup> )	Fill volume (Mm <sup>3</sup> )
1	5	3
2	3	2
Balance	20	24
<b>Ultimate</b>	<b>28</b>	<b>29</b>

Notes:

1. All volumes are insitu (dredging) or in place (fill), ie. no account of bulking or the like.
2. The estimated total fill volume of 29Mm<sup>3</sup> is made up of 21Mm<sup>3</sup> within the terminal area and 8Mm<sup>3</sup> landward of the terminal area.

**Table 2 Dredging, Excavation and Fill Volumes for Option 'D'**

Phase	Dredging volume (Mm <sup>3</sup> )	Excavation volume (Mm <sup>3</sup> )	Fill volume (Mm <sup>3</sup> )
1	5	-	3
2	3	-	2
Balance	16	34	2
<b>Ultimate</b>	<b>24</b>	<b>34</b>	<b>7</b>

Notes:

1. All volumes are insitu (dredging and excavation) or in place (fill), ie. no account of bulking or the like.
2. The estimated total excavation volume of 34Mm<sup>3</sup> is comprised of 20Mm<sup>3</sup> within the basin and 14Mm<sup>3</sup> in the terminal area.

<sup>7</sup> Ideally, those land areas containing suitable fill materials (eg. sand) and located in areas of future excavation would be targeted.

## **4 HIGH LEVEL APPRAISAL OF OPTION 'D' – CHECK FOR 'FATAL FLAWS'**

### **4.1 General**

This section sets out a high level appraisal of Option 'D' under a number of main headings (not necessarily in any order) with a view to checking for the existence of any 'fatal flaws'. It is noted that a meeting was held in the Port of Hastings Authority's (the Authority) office on 12 November 2014 to discuss Option 'D' and identify potential 'fatal flaws'. This meeting was attended by representatives of the Authority and most Work Streams<sup>8</sup>. The following discussion draws on the matters raised at the meeting but the views expressed are principally those of Haskoning Australia unless otherwise noted.

A site walkover also took place on 30 October 2014. Participants comprised Christian Taylor, Sam Williams, Richard Clarke, Richard Hill, Hadyn Pike and Greg Britton.

Certain issues would be common to Option 'D' and other port concept design options due to the fact that Phase 1 of all options would be very similar (refer **Figure 6** and **Figure 7**). Such issues are not discussed here. An example of such an issue would be the safety zones required around the Esso shore facilities at Long Island Point.

### **4.2 Ramsar Site**

Option 'D' has a smaller dredging footprint and smaller reclamation footprint within the Ramsar Site compared to other port concept design options, and would be expected to have less direct (and indirect) impact on the Ramsar Site.

*Outcome: No fatal flaw*

### **4.3 Geotechnical Factors**

Option 'D' would involve less reliance on dredged materials for creation of the container terminal area. Accordingly, geotechnical issues associated with the reuse of problematic dredged materials would be reduced for Option 'D'. Put another way, Option 'D' provides the opportunity to construct a large proportion of the container terminal area on existing geotechnically competent ground, ie. within the SUZ1.

Option 'D' would involve excavation (or dredging) on land within the SUZ1 to create the basin. Available geotechnical information indicates that rock would not be encountered within the proposed basin depth, eg. -16.5m CD, as rock is typically deeper than -40m CD.

*Outcome: No fatal flaw expected<sup>9</sup>*

<sup>8</sup> Authority representatives: Eric Shegog, Emma Connell, Udhaya Arambawela, Christian Taylor, Rohan Henry, Kieran O'Neill, Joseph Thom, Matt Primner, Michael Dillon, Sam Williams, Lal Edirisinghe, Sally Law.

Legal: Bev Kennedy, Rosie Syme

Environment & Social: David May, Mathew Peel,

Design & Engineering: Richard Clarke, Richard Hill

Hydrodynamics & DMM: Greg Britton, Nick Lewis

<sup>9</sup> Additional geotechnical investigation is recommended to provide further data, as noted in **Section 5**.

#### 4.4 Hydrodynamics

Option 'D' would be expected to have less impact on hydrodynamics compared to other options due to the lesser dredging footprint and reclamation footprint within the waterway. Construction of the basin would create some additional tidal prism but this volume would be negligible in the context of Western Port. The impact of the training wall associated with Option 'D' on local hydrodynamics would need to be investigated.

*Outcome: No fatal flaw expected, but additional studies required*

#### 4.5 Navigation

Phase 1 of the port development is similar for Option 'D' and a land backed option. In later phases, Option 'D' would involve the requirement to swing incoming ships in the area north of BlueScope Wharf and 'drag back' the ships into the basin. On departure, ships would need to turn to starboard in the swing basin area. There is likely to be some additional requirement for manoeuvring across the tidal stream in Option 'D' compared to a land backed option, which needs further examination.

*Outcome: No fatal flaw expected but further navigation simulation studies needed for confirmation*

#### 4.6 Road and Rail Interface

Option 'D' would present some additional challenges for interfacing with road and rail transport due to the indented basin which would constrain certain transport alignments. While challenges exist, Michael Dillon (Authority Project Manager for Road, Rail and Port Precinct Planning) noted that there was no fatal flaw.

*Outcome: No fatal flaw, but additional studies required*

#### 4.7 Aboriginal Cultural and Historical Heritage, Groundwater and Surface Water, Land Use and Topography, and Terrestrial Ecology

It is useful to consider these matters collectively for the purposes of this report as they have been considered collectively in a recent Memo (20/11/14), from the Environment and Social Work Stream to Rohan Henry of the Authority, following an initial desk top study. A copy of this Memo is included in **Appendix A**.

Based on this Memo and discussions with member of the Environment and Social Work Stream, no fatal flaws are expected for any of the matters outlined. It is of interest to note several matters:

- two manmade landforms have been identified on SUZ1 which are believed to be historic landfills. One of these is located immediately north of the BlueScope operational area, within the footprint of the container terminal for Option 'D'. Investigation of this landform would be required;



- Option 'D' has the potential to alter the existing groundwater regime in a number of ways, including groundwater flow direction, groundwater levels (drawdown) and groundwater quality (introduction of saline water). Groundwater is also an important factor in assessing the work methods to construct the basin in Option 'D', eg. potential for construction in the dry, construction risk. etc. Groundwater level monitoring undertaken on the BlueScope Steel site to date suggests a relatively shallow groundwater level which becomes increasingly shallow as you move towards Western Port (refer **Figure 8**);
- Option 'D' is more remote from sensitive aquifers including the Koo Wee Rup Groundwater Management Unit (GMU).

*Outcome: No fatal flaw expected, but additional studies required*



**Figure 8** Shallow groundwater 'daylighting' on the BlueScope Steel site in the vicinity of the proposed basin in Option 'D' landward of the wooded vegetation fringing Western Port

## 4.8 Services

There are a number of services located within the SUZ1 that would be affected by implementation of Option 'D', these include product pipelines from the Esso facility at Long Island Point. The services would be impacted in any case by site regrading required for development of land based infrastructure for other port concept design options.

Generally, the impact on services from the construction of the basin in Option 'D' would not be expected for some considerable time in the future as it is in a proposed latter phase of the development. This situation could change if the Authority decided to revise the phasing

strategy or if excavation of soils on the footprint of the basin or adjacent container terminal areas took place early in the project (in services locations) as a means of sourcing good quality engineering fill.

*Outcome: No fatal flaw*

#### 4.9 Disposal Task for Dredged and Excavated Materials

Option 'D' and a land based option would involve disposal of broadly similar quantities of dredged material (based on the basin in Option 'D' being excavated rather than dredged and taking into account the relative quantities of soft muds underlying respective reclamation areas). The options available for disposal of dredged material in the case of Option 'D' would be reduced in the sense that significant reclamation of land is not a requirement for Option 'D' (setting aside that such reclamation raises a number of geotechnical and construction issues due to the problematic nature of the dredged materials).

Option 'D' would involve the need for disposal of a significant additional total quantity of material compared to a land backed option, ie. when the dredged and excavated materials are considered in combination, eg. Option 'D' would involve a combined total of approximately 58Mm<sup>3</sup> of dredged and excavated material compared to approximately 28Mm<sup>3</sup> for a land backed option (dredged material only in this case), all measured insitu (refer **Table 1** and **Table 2**).

It will be a considerable challenge to dispose of the additional total quantity of material in Option 'D'. There is some benefit in that the additional material would be excavated rather than dredged (depending on the method of construction of the basin) thus reducing bulking factors (depending on the method of dredging). It is also relevant that excavation on land within the SUZ1 will be required for site regrading irrespective of the port concept selected thus the over and above additional excavated volume for Option 'D' would in practice not be as great as that suggested by the direct comparison of numbers in **Table 1** and **Table 2**.

Alternative means of disposal of dredged and excavated material, including that associated with Option 'D', is under investigation as part of the Dredged Material Management (DMM) scope of work.

*Outcome: No fatal flaw expected, but this issue is a considerable challenge, additional studies required*

#### 4.10 Construction Risk

Lower construction risk would be expected with Option 'D' compared to other options for several reasons:

- less reliance on problematic dredged material for creation of a container terminal by reclamation;
- ability to construct a significant proportion of the container terminal on existing geotechnically competent ground;

- ability to potentially construct significant elements of the project 'in the dry' or using land-based equipment;
- ability to potentially de-link dredging activities from fill activities (with fill material won from excavation activities).

*Outcome: No fatal flaw*

#### **4.11 Approvals Risk**

Lower approvals risk would be expected for Option 'D' compared to other options, for several reasons:

- less direct (and indirect) impact on the Ramsar Site;
- excavation generally seen by Regulators as posing less environmental risk than dredging - in addition the excavation activity could be undertaken 'off channel' not connected to the waterway thereby lowering the environmental risk;
- the dredging activity could be fully completed in the early phases of the project (or even Phase 1 only) which would address the risk from the Authority's perspective around gaining future approvals ie. improve certainty, and would ease the issue for Regulators in contemplating approval of a future, potentially controversial, activity.

*Outcome: No fatal flaw*

#### **4.12 Conclusion**

The high level appraisal suggests there are no apparent 'fatal flaws' associated with Option 'D'. This was also the collective view of participants at the meeting on 12 November 2014. There are, however, a number of issues that are considered to require more detailed study. These are noted in **Section 5**.



## 5 SUGGESTED FURTHER STUDIES

A large number of studies are ongoing associated with the Port of Hastings Development Project and are not materially affected by the emergence of Option 'D', ie. Option 'D' could be considered as a matter of course within these existing studies. An example is the DMM study, although it is fair to say Option 'D' introduces additional challenges for the DMM scope of work due to the volumes involved.

Option 'D' does, however, elevate the need for particular additional studies of certain issues or to bring some studies forward. These are listed below, followed by some explanatory notes and some closing remarks regarding priorities.

- geotechnical studies;
- training wall / hydrodynamics;
- navigation;
- road and rail interface;
- groundwater.

### Geotechnical Studies

The land based geotechnical investigation completed to date did not contemplate Option 'D'. In addition, the marine geotechnical investigation was, understandably, conducted over a broad area and based on a regular grid. Accordingly, the following activities are suggested in response to Option 'D':

- superimpose the outline of Option 'D' on a base plan which shows the location of all land and marine geotechnical investigation sites, for illustration of the extent of geotechnical information available in the areas of interest;
- determine the volume of different material types (main geological units) involved in the dredging and excavation for Option 'D', using the existing ground model;
- assess the suitability of onshore excavated materials for use as fill;
- assess the influence of geotechnical conditions on structural alternatives for the container terminal quay line in the basin;
- assess the need for additional geotechnical investigations to support further design development and assessment of Option 'D'.

### Training Wall / Hydrodynamics

The training wall that is required extending from the truncated container terminal quay line on the north side of the basin out into the waterway is an important structure for stability of the entrance channel leading to the basin. It will also locally influence tidal hydrodynamics. Preliminary hydrodynamic modelling for Option 'D' has been undertaken based on a very simplified schematisation of the training wall comprising an impermeable vertical 'glass' wall extending above highest water level.

It suggested that a conceptual design of the training wall be prepared and more detailed modelling be undertaken to assess localised hydrodynamic impacts. This work would also feed into the further navigation simulation studies (see below).

## **Navigation**

The ability to safely manoeuvre vessels is one of the potentially more significant issues for Option 'D', in particular, it is understood, on vessel departure from the basin. There is a strong case for bringing forward navigation simulation studies to inform this issue. The training wall concept design and hydrodynamic modelling referred to above are integral to the navigation simulation studies.

## **Road and Rail Interface**

Option 'D' represents quite a departure from what may have been anticipated in terms of a container terminal arrangement to interface with road and rail. For this reason it is important to gain an early understanding of implications of Option 'D' on the road and rail interface. It is understood these studies have been initiated.

## **Groundwater**

A knowledge of groundwater conditions within the SUZ1 in the area of the proposed basin and adjacent container terminal areas is critical as it is relevant for construction (influencing work methods and costs) and for post construction impacts such as effects on groundwater level, groundwater flow direction and groundwater quality. It is also likely to be a factor for sustainability of the foreshore ecology north of the basin in Option 'D'.

The expectation would be that additional groundwater investigations/studies would be required involving:

- detailed review of existing groundwater information in the context of Option 'D';
- installation of additional groundwater monitoring bores;
- investigation of groundwater quality;
- development of a regional groundwater model;
- assessment of the influence of groundwater on alternative work methods for construction of the basin;
- concept design and costing of dewatering strategies;
- assessment of the impact of groundwater on foreshore ecology.

## **Closing Remarks**

Of the above studies, the two priority areas are considered to be the groundwater studies (due to their critical influence on construction methods/costs for Option 'D' and relatively long lead time) and the navigation simulation studies (due to their bearing on proving the feasibility of Option 'D'). The navigation simulation studies in turn drive the need for concept design of the training wall and more detailed hydrodynamic modelling. The DMM studies should continue as a matter of course.

**Appendix A – Memo from GHD-AECOM JV to Rohan Henry dated 20 November 2014**

Draft for Discussion Purposes

## Memorandum

To	Rohan Henry		
CC	David Hyett and David May		
Subject	BlueScope Steel preliminary environmental conditions		
From	Mathew Peel		
File/Ref No.	AGH-CEPO-EV-MEM7	Date	20-Nov-14
<i>Draft for discussion purposes</i>			

### 1.0 Purpose

To present the findings of preliminary environmental investigations for BlueScope Steel to inform design development for the port landside development.

### 2.0 Key findings

The key findings are presented in four sections:

- Aboriginal cultural and historical heritage
- groundwater and surface water
- land use and topography
- ecology.

#### 2.1 Aboriginal cultural and historical heritage

Modelled areas of Aboriginal cultural heritage sensitivity (Andrew Long & Associates 2014), and statutory and potential historical heritage places (Lovel Chen 2014) are presented in Figure 1.

Areas identified as most likely to have Aboriginal cultural heritage include:

- land within 200 m of waterways including Olivers Creek and McKirdys Drain
- coastal land and land within 200 m of the Western Port Ramsar Site
- land within 50 m of registered cultural heritage places
- landforms which have:
  - elevated sandy dune deposits and Cranbourne Sands geology
  - upper slopes and tops of sandy rises and dunes
  - elevated ground inland from the coast located in proximity to wetlands, water sources swamps
  - alluvial fans and outwash fans associated with creeks

- areas with potential based on stakeholder concern – only limited consultation with Aboriginal stakeholder groups has taken place to this point.

There are no National Heritage List or Commonwealth Heritage List sites in the SUZ1. There are also no Victorian Heritage Register or Victorian Heritage Inventory sites in the SUZ1, however on nearby land there is a listed object H0094 (Former Commonwealth Aircraft Corporation Hangar) and listed places H7921-0043 (Maintop Farm) and H7921-0064 (Warringine House Site and Orchard).

Statutory and potential heritage places in the SUZ1 include:

- Heritage Overlays:
  - associated with townships of Tyabb, Hastings, Pearcedale
  - scattered farming properties: 75 Bungower Rd, Somerville (HO268), 83 Bungower Rd, Somerville (HO269) and 48 O'Neills Road, Somerville (HO311)
  - Tyabb Public Cemetery (HO270) which is located just outside SUZ1
- Victorian War Inventory including Hastings Drill Hall (The Parade, Hastings), Hastings Primary School Memorial Gates (Hodgins Road, Hastings), Tyabb Military Site and Tyabb Soldiers Memorial (Frankston-Flinders Road, Tyabb)
- sites with potential heritage value:
  - Orchid Landscape Precinct
  - Hastings and Lysaght Australia steel works
  - places identified for further assessment in the Hastings District Heritage Study including buildings and trees in Somerville, Houses and Conifer Row in Tyabb and BHP Steel Wharves in Hastings.

## 2.2 Groundwater and surface water

Waterways and identified areas of land subject to inundation, along with existing groundwater monitoring points (Golder Associates 2014) are present in Figure 2.

The most prominent waterways are Olivers Creek and McKirdys Drain. The catchment has been modified over time as a result of agricultural activities and drainage works. These works have realigned the streams and removed much of the riparian vegetation (Morning Peninsula Shire Council 2000).

Areas within Tyabb regularly flood and there have been previous works to minimise the flood risk (Morning Peninsula Shire Council 2000). Outside of Tyabb, Olivers Creek passes through a predominantly rural catchment and because of this, the potential residential impact of flooding is significantly reduced, which is reflected in the limited identified areas of land subject to inundation.

The site falls within the Western Port Groundwater Basin, which is widely used for agriculture, industry, and domestic supply; its importance is recognised by the Koo Wee Rup Water Supply Protection Area to the north of SUZ1. SUZ1 is predominantly on the Western Port Group aquifer (Baxter Formation) with flowline generally to the east, moderate salinity (<1,000 mg/l TDS) and low yields (<2.5 l/sec). There are also younger Quaternary unconfined sand aquifers in the northern part of the SUZ1 (Geological Survey of Victoria 1980).

Groundwater level monitoring undertaken on BlueScope Steel to date suggests a relatively shallow groundwater level which becomes increasingly shallow as you move towards the coast. The monitoring undertaken to date has not assessed groundwater quality at BlueScope Steel (Golder Associates 2014).

## 2.3 Land use and topography

Land use and topography are presented in Figure 3 and 4.

BlueScope Steel is the most prominent holding in SUZ1. It includes an operational area, leased agricultural land and recreational facilities. BlueScope Steel land extends into the coastal and marine environment.

South of BlueScope Steel is the Long Island Point oil and gas processing and storage plant. This 158 ha site houses three gas liquids fractionation trains, 19 pressurized Liquefied Petroleum Gas (LPG – propane and

butane) storage vessels, seven refrigerated atmospheric pressure LPG storage tanks, eight crude oil storage tanks, an LPG truck loading terminal and a jetty for loading LPG and crude oil onto ships. There is also a laboratory, warehouse, workshop and administration building.

Infrastructure associated with these key land uses includes road and rail network, water pipelines, transmission lines, and oil and gas pipelines. Of particular importance is the Western Port – Altona– Geelong (WAG) Pipeline which transports liquids brought to Western Port terminal from Longford (from BHP and Esso's Bass Strait and the Gippsland Basin) to refineries in Altona and Geelong.

This area is bounded by the townships of Hastings (south), Tyabb (west) and Pearcedale (north).

Crown land is confined to the coastal areas to the north and south of BlueScope Steel.

Topographically, the area traverses the coastal lowlands west of Western Port, which are characterised by low hills and plains (Andrew Long & Associates 2014). It has a relatively gentle slope seaward to the east.

Two manmade landforms have been identified which are believed to be historic landfills, as follows:

- former landfill associated with the current site of the Tyabb Waste Disposal Centre on McKirdys Road
- on the coastal fringe directly north of the BlueScope Steel operational area.

## 2.4 Ecology

Ecology including modelled native vegetation quality and known Commonwealth and State listed species are presented in Figure 5 (Biosis 2014).

This area contains a range of native vegetation types and fauna habitats dispersed throughout a largely rural landscape. High ecological values are associated with:

- Western Port Ramsar Wetland
- Western Port Biosphere Reserve
- Crown land abutting the coast that supports native coastal vegetation communities, particularly the Commonwealth listed Subtropical and Temperate Coastal Saltmarsh
- the non-operational areas of BlueScope Steel and all areas of native vegetation contiguous with and adjacent to the property (Biosis 2014).

## 3.0 Next steps

As part of the broader program of specialist studies it will be important to:

- Aboriginal cultural heritage – engage with the relevant Aboriginal stakeholder groups about Aboriginal cultural heritage values during preparation of the Cultural Heritage Management Plans (CHMPs). This has commenced as part of the desktop and standard assessments for the BlueScope Steel interim CHMP, which will be broadened to cover the SUZ1
- historical heritage – undertaken targeted stakeholder consultation on local heritage values and field inspection to confirm (or otherwise) the potential historical heritage places identified
- groundwater – review groundwater level monitoring undertaken to inform groundwater specialist study including potential groundwater quality assessment
- surface water – undertake a surface water review including flooding assessment. This may require field inspection
- geology and soils – undertake desktop assessment and field inspections of the two manmade landforms which are believed to be historic landfills, with this informing the land contamination component of the geology and soils specialist investigation
- ecology – undertake field surveys for native vegetation and listed flora, fauna and ecological communities. This has commenced on BlueScope Steel and will be expanded to cover the SUZ1.

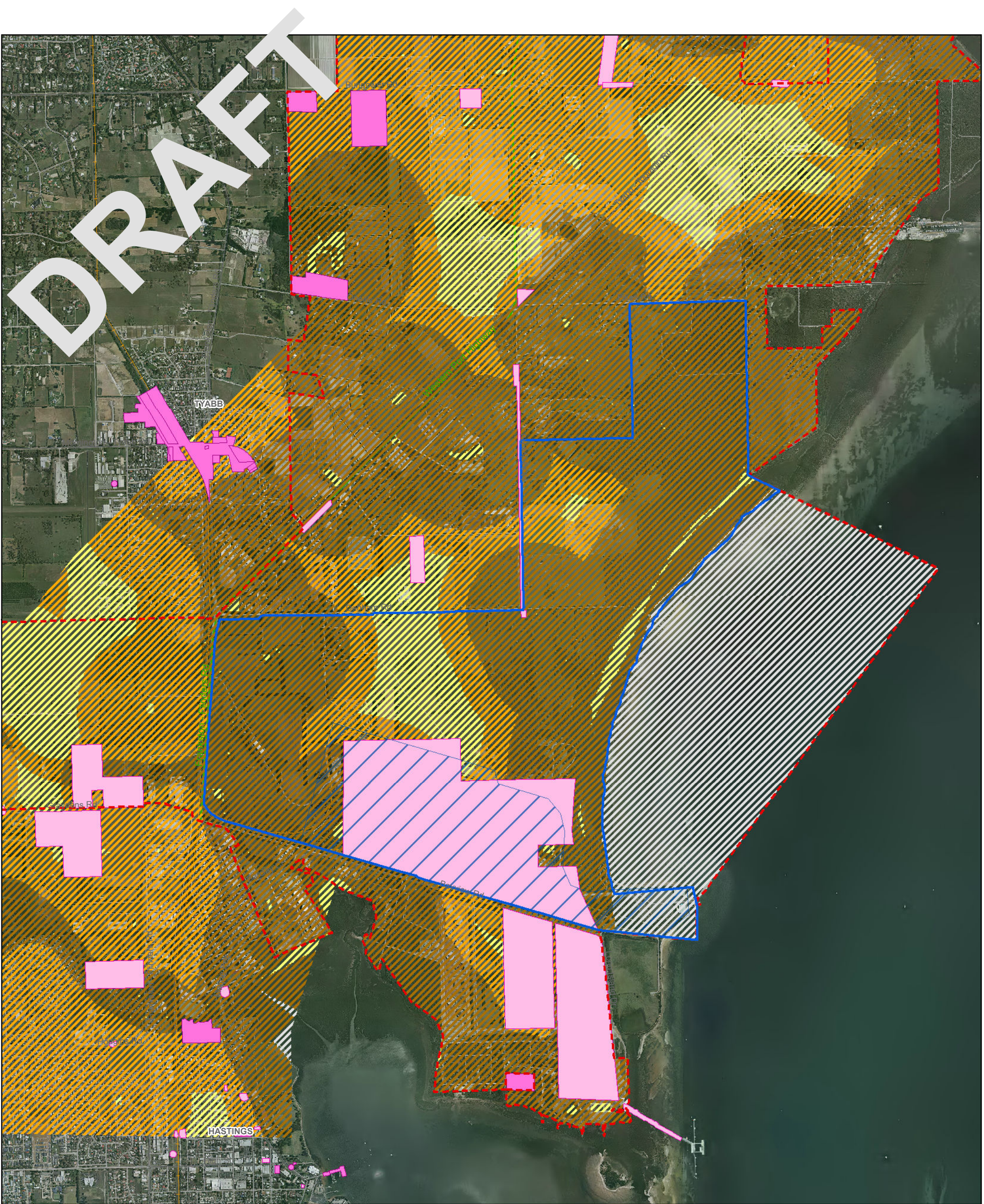


#### 4.0 References

This memorandum on preliminary environmental conditions was informed by:

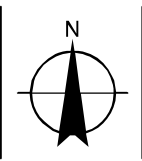
- AECOM (2014) *Port of Hastings Development Project – Land Transport Corridor Land Use Planning Desktop Assessment*
- Andrew Long & Associates (2014) *Port of Hastings Development Project – Aboriginal Cultural Heritage Desktop Assessment*
- Biosis (2014) *Port of Hastings: SUZ1 and Land Transport Corridor Desktop Flora and Fauna Assessment*
- Geological Survey of Victoria (1980) *Hydrogeological Map of Western Port Basin*
- Golder Associates (2014) *Container Expansion Project Terrestrial Geotechnical Investigation Factual Report*
- Lovel Chen (2014) *Port of Hastings Development Project SUZ1 and Land Transport Corridor Historical Heritage Desktop Study*
- Morning Peninsula Shire Council (2000) *Mornington Peninsula Shire Council Storm Water Management Plan Detailed Threats and Values*





- |  |                                |  |  |
|--|--------------------------------|--|--|
|  | Special Use Zone 1- Hastings   |  | Potential Heritage Places (LovellChen)         |
|  | Bluescope Steel                |  | HistoricPlaces (VHR / VHI / VHID / HO)         |
|  | Bluescope Steel Infrastructure | <b>Classified Predictive Model (ALA)</b> |  |
|  |                                |  | Aboriginal cultural heritage most likely       |
|  |                                |  | Aboriginal cultural heritage moderately likely |
|  |                                |  | Aboriginal cultural heritage least likely      |
|  |                                |  | Not modelled                                   |

Paper Size A3  
0 100 200 400 600 800 1,000  
Meters  
Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



PORT OF  
HASTINGS  
DEVELOPMENT AUTHORITY

Port of Hastings Development Authority

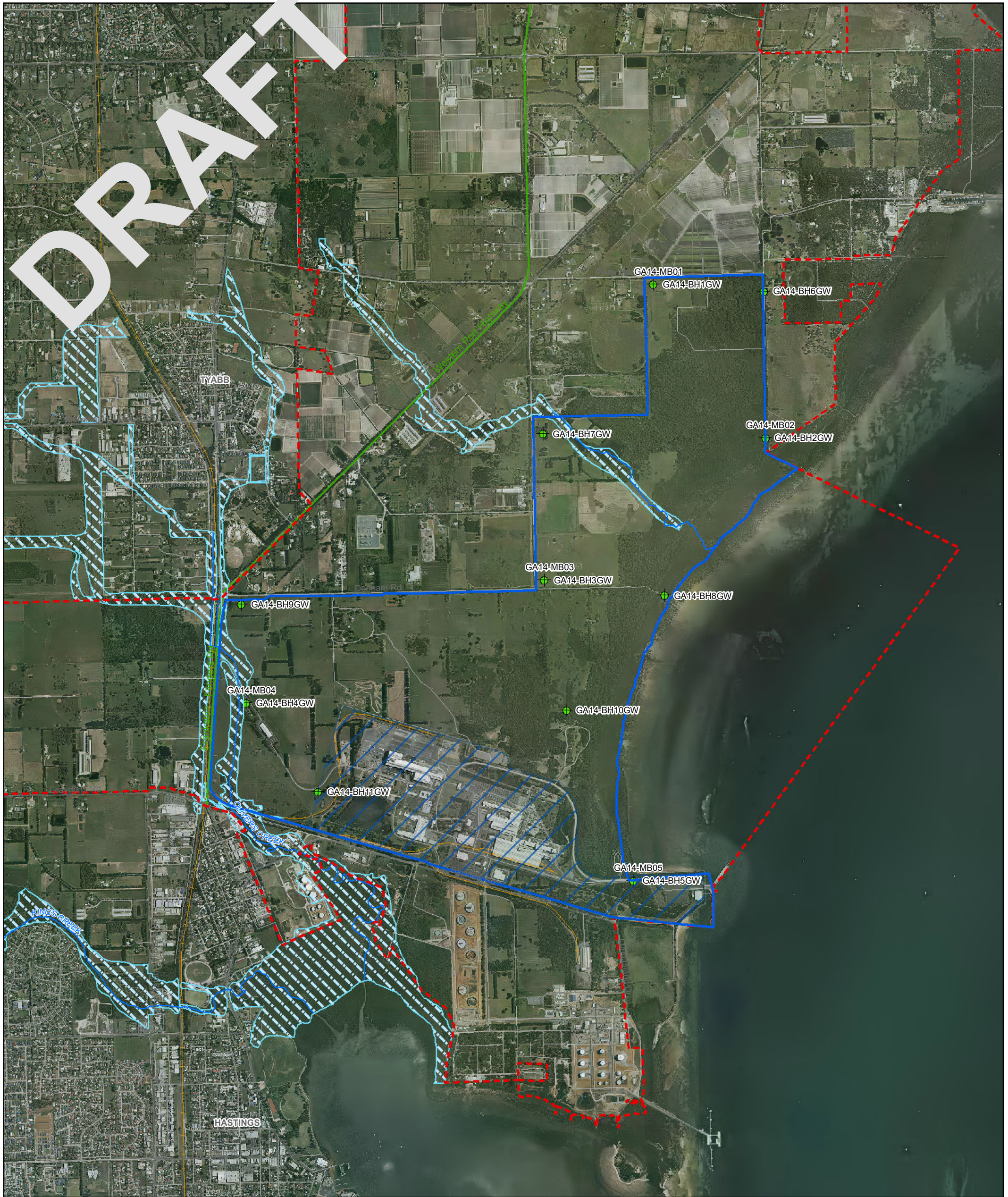
Revision	A
Date	03 Nov 2014

## BlueScope Area - Aboriginal cultural and historical heritage

G:\31\31439\GIS\Maps\Deliverables\ENV\31-31439\_009\_BlueScope\_AboriginalCulturalAndHistoricalHeritage\_A3P.mxd

Hazelwood Drive (cnr Lignite Court) Morwell VIC 3840 Australia T 61 3 5136 5800 F 61 3 5136 5888 E mw@mail@ghd.com W www.ghd.com  
© 2014. Whilst every care has been taken to prepare this map, Port of Hastings Development Authority, GHD (and DEPI) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data source: VicMap (DEPI, Jan 2014), Port of Hastings Development Authority, Created by alovell

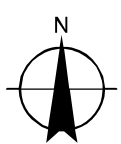




- Special Use Zone 1- Hastings
- Bluescope Steel
- Bluescope Steel Infrastructure
- Named Waterways
- Indicative Groundwater Borehole Locations
- Planning Overlays - Flooding
- Floodway
- Land Subject to Inundation

Paper Size A3  
0 100 200 400 600 800 1,000  
Meters

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



PORT OF  
HASTINGS  
DEVELOPMENT AUTHORITY

Port of Hastings Development Authority

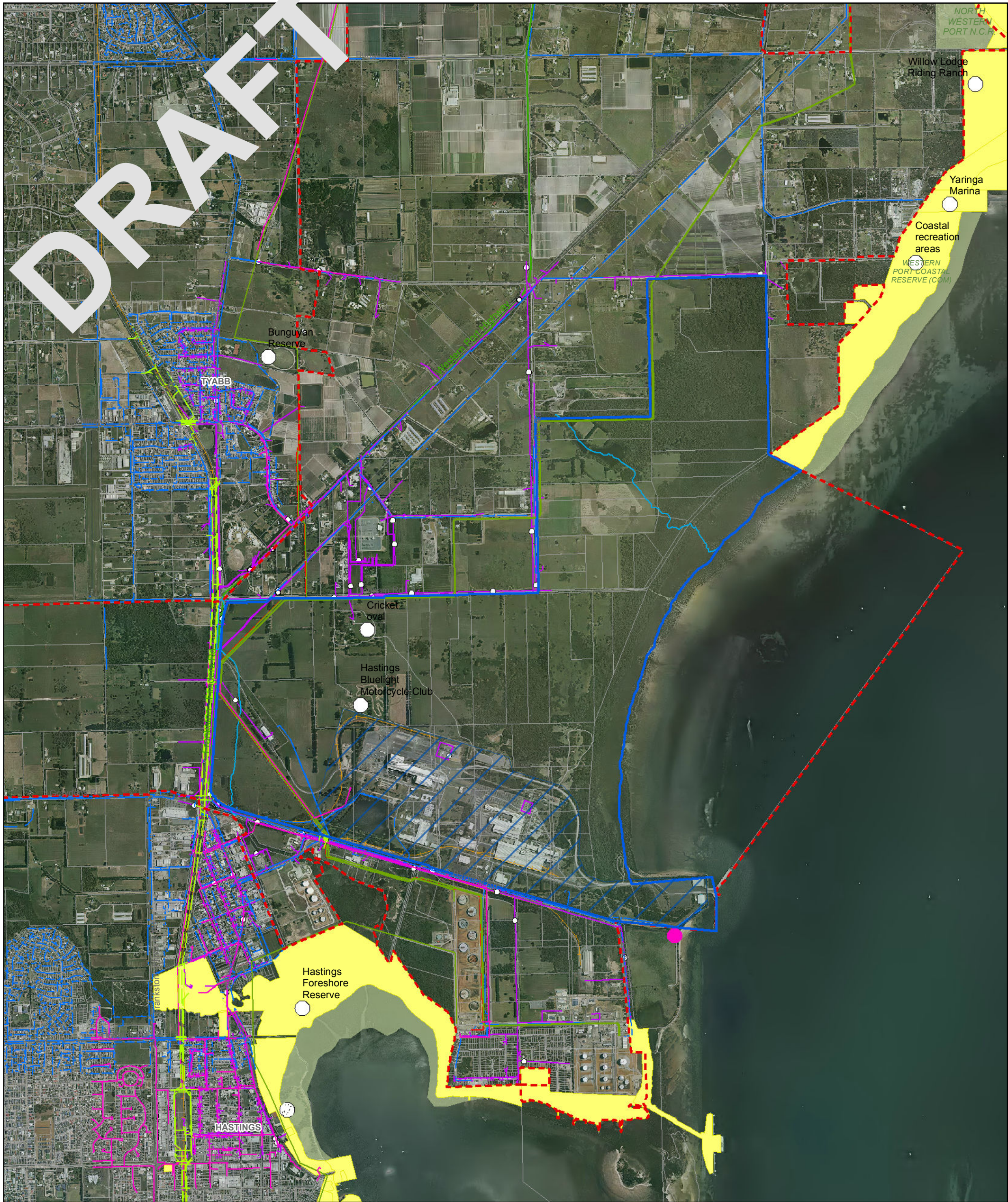
Revision | A  
Date | 11 Nov 2014

## BlueScope Area - Groundwater and Surface water

G:\31\31439\GIS\Maps\Deliverables\ENV\31-31439\_009\_BlueScope\_GroundwaterAndSurfaceWater\_A3P.mxd

Hazelwood Drive (cnr Lignite Court) Morwell VIC 3840 Australia T 61 3 5136 5800 F 61 3 5136 5888 E mw@mail@ghd.com W www.ghd.com  
© 2014. Whilst every care has been taken to prepare this map, Port of Hastings Development Authority, GHD (and DEPI) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data source: VicMap (DEPI, Jan 2014), Port of Hastings Development Authority, Created by:alovell

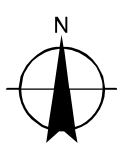




- |                                |                                   |                  |
|--------------------------------|-----------------------------------|------------------|
| Special Use Zone 1- Hastings   | Parks                             | VicTrack         |
| Bluescope Steel                | Reserve                           | APA              |
| Bluescope Steel Infrastructure | National Park                     | ExxonMobil       |
| Parcel                         | Marine National Park or Sanctuary | Melbourne Water  |
| Crown Land                     | Coastal Reserve                   | Shell            |
|                                | Recreational Facilities           | South East Water |
|                                | Fishing Locations                 | United Energy    |

Paper Size A3  
0 100 200 400 600 800 1,000  
Meters

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



PORT OF  
HASTINGS  
DEVELOPMENT AUTHORITY

Port of Hastings Development Authority

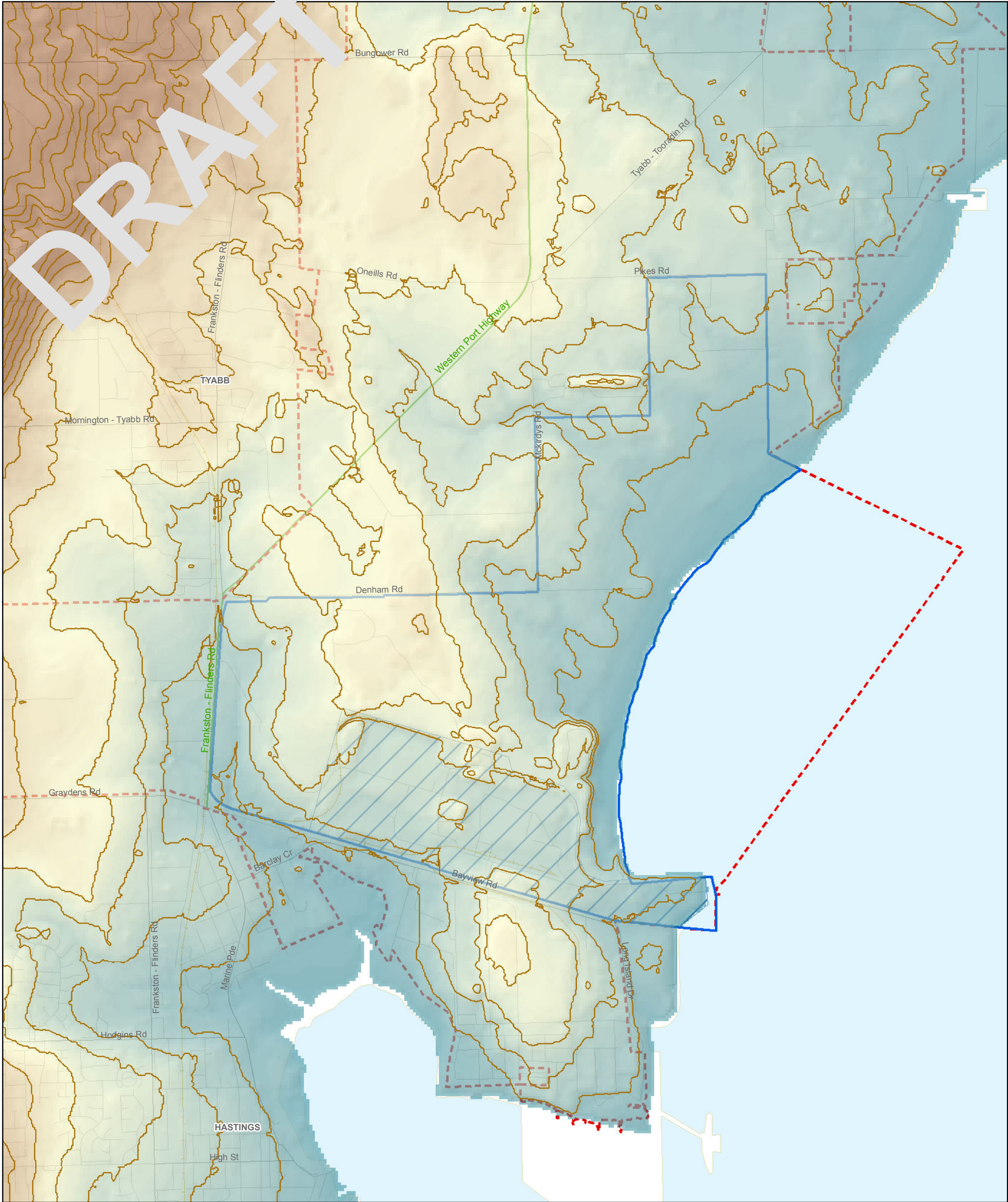
Revision A  
Date 03 Nov 2014

## BlueScope Area - LandUse

G:\31\31439\GIS\Maps\Deliverables\ENV\31-31439\_009\_BlueScope\_LandUse\_A3P.mxd

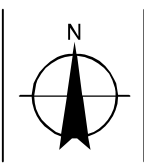
Hazelwood Drive (cnr Lignite Court) Morwell VIC 3840 Australia T 61 3 5136 5800 F 61 3 5136 5888 E mw@mail@ghd.com W www.ghd.com  
© 2014. Whilst every care has been taken to prepare this map, Port of Hastings Development Authority, GHD (and DEPI) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data source: VicMap (DEPI, Jan 2014), Port of Hastings Development Authority, Created by:alovell





- Special Use Zone 1- Hastings
- Bluescope Steel
- Bluescope Steel Infrastructure
- Elevation Contour (5 m)

Paper Size A3  
0 100 200 400 600 800 1,000  
Meters  
Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



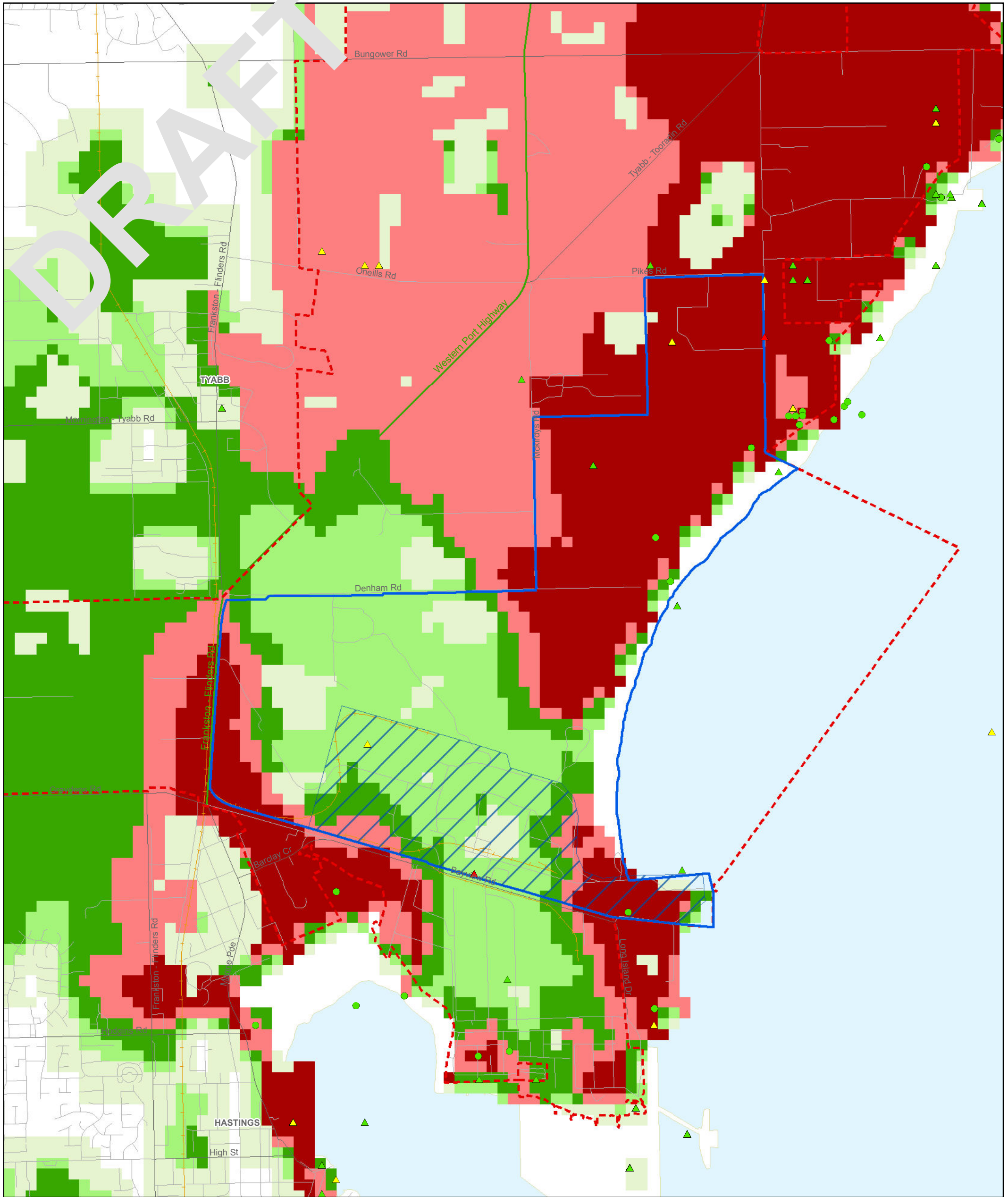
**PORT OF  
HASTINGS**  
DEVELOPMENT AUTHORITY

Port of Hastings Development Authority

Revision | A  
Date | 03 Nov 2014

## BlueScope Area - Topography

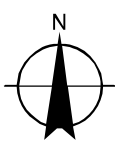




	Special Use Zone 1- Hastings	<b>VBA Fauna</b>		Vic Advisory Listed		Vic Advisory Listed	<b>NVR2013_SBS_v3</b>
	Bluescope Steel		FFG Listed		FFG Listed		sb score
	Bluescope Steel Infrastructure		EPBC Listed		EPBC Listed		0.81 - 1.00
							0.61 - 0.80
							0.41 - 0.60
							0.21 - 0.40
							0.01 - 0.20

Paper Size A3  
0 100 200 400 600 800 1,000  
Meters

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



PORT OF  
HASTINGS  
DEVELOPMENT AUTHORITY

Port of Hastings Development Authority

Revision | A  
Date | 11 Nov 2014

## BlueScope Area - Environment

G:\31\31439\GIS\Maps\Deliverables\ENV\31-31439\_009\_BlueScope\_Environment\_A3P.mxd

Hazelwood Drive (cnr Lignite Court) Morwell VIC 3840 Australia T 61 3 5136 5800 F 61 3 5136 5888 E mw@mail@ghd.com W www.ghd.com  
© 2014. Whilst every care has been taken to prepare this map, Port of Hastings Development Authority, GHD (and DEPI) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data source: VicMap (DEPI, Jan 2014), Port of Hastings Development Authority, Created by:alovell