COASTAL COMPARTMENTS OF WESTERN AUSTRALIA

A Physical Framework for Marine & Coastal Planning

Damara WA Pty Ltd,

Geological Survey of Western Australia

and

Department of Environment & Conservation

Report to the Departments of Environment & Conservation, Planning and Transport

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Cover Photograph

View west from Point Malcolm, near Israelite Bay, South Coast of Western Australia. From the foreground, the photograph shows a granite headland backed by a long sandy beach and dune barrier seaward of a hypersaline coastal lagoon. (Photographer: C. Nutt 2009)

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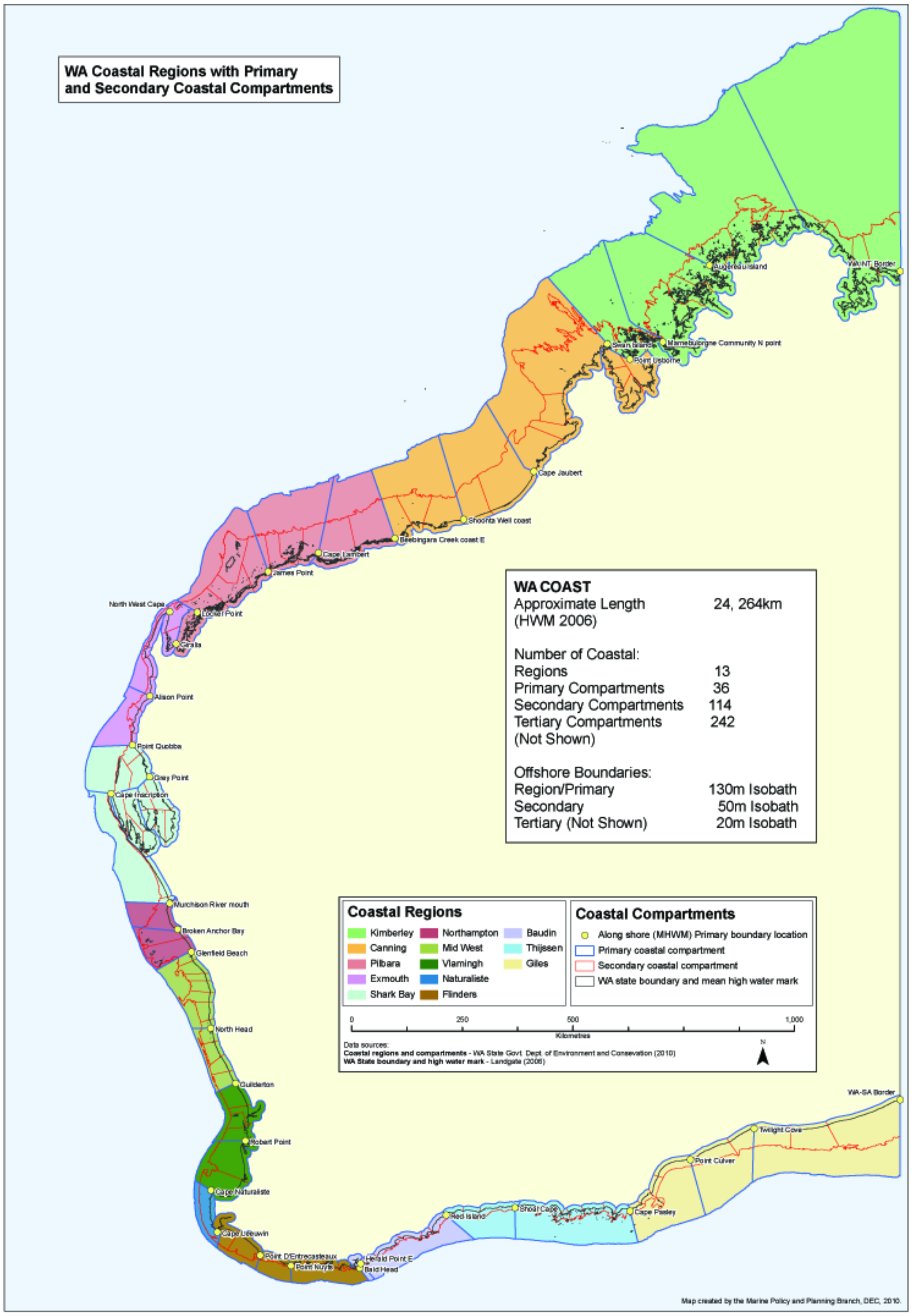
Executive Summary

Western Australia boasts a truly enviable diversity of coastal landforms along approximately 24,000 km of coastline, estimated along the mainland Mean High Water line and discounting the shores of its numerous islands. The diversity is a daunting prospect for planning and management. It encompasses a wide variety of geology and coastal landforms subject to a very wide range of weather and ocean conditions. The coast includes areas of outstanding beauty such as the World Heritage Area at Shark Bay, the low lying areas in the Pilbara, the estuaries of the south-west coast, the spectacular Zuytdorp cliffs and the Kimberley coast. The values of the coast and its inherent sensitivity to change have been acknowledged through formulation and adoption of the State Coastal Planning Policy SPP2.6 (Western Australian Planning Commission: WAPC 2003) and the Coastal Protection Policy (Department for Planning and Infrastructure: DPI 2008). At a broad level the policies are designed to encourage consideration and use of building codes, zoning laws and local government policies that encourage best use of the land and nearshore waters. Essentially they apply principles of natural systems management to land use. However, questions of how they are to be applied in an equitable way from place to place remain. This report provides a framework to help assess such questions.

Available descriptions of geologic features and landforms comprising the coast have been used to identify compartments around Western Australia at strategic, regional and local scales currently used for coastal planning and management. The hierarchy of 36 primary, 114 secondary and 242 tertiary compartments (Summary Figure 1) provides a network of nested planning units. In principle, the network provides a systematic approach to State planning in the coastal environment, including natural resource management and marine conservation planning. It is a multi-scalar framework that facilitates comparison and analyses of environmental data across and within each compartment level as well as between different levels within the hierarchy. In the first instance, the hierarchical framework of coastal compartments enables comparative assessment of information available and planning for future research/surveys of marine and coastal resources. It is a first step in coastal risk analysis and has wider relevance due to the diversity of coastal landforms around the State and the need to assign resources to address issues of resource sustainability.



Summary Figure 1: Coastal Regions, Primary and Secondary Compartments
Tertiary compartments are not shown at the map scale.

Several steps were used to identify the three interrelated levels of compartments. First, major changes rock type along the coast were identified from the 1:500,000 Geological Map. Second, the boundaries of the primary compartments were then adjusted to accommodate apparent changes in the orientation of the coast as well as to incorporate complete landforms of regional significance. This was done with reference to the 1:250,000 Geological Map, the 1:100,000 Topographical Map Series and satellite imagery available on Google Earth 2008 ®. Third, once boundaries for the primary (strategic planning) compartments were determined, each compartment was further subdivided into secondary (regional planning) compartments based predominantly on landform associations such as extensive tracts of coast with continuous beach or dune field formations. Fourth, the secondary compartments were then subdivided into a suite of tertiary (local planning) compartments based on the individual coastal landforms present. The seaward and landward boundaries integrate marine and terrestrial components of the coast as well as the meteorological and oceanographic processes affecting them at each scale. Boundaries of the primary compartments describe the long-term development of the coast. They are based on sea level approximately 18,000 years ago, at the start of the rise in sea level to its present position, as well as the landward extent of sediment accumulation over the past 6,000 years, from when sea level has been relatively stable. In contrast to the boundaries of the primary compartments, tertiary compartment boundaries define the nearshore to backshore zones, the marine and terrestrial areas close to shore where coastal processes are highly active.

The hierarchy of coastal compartments is intended to have applications consistent with those of the land system hierarchy used agricultural planning and management. Similar frameworks have been used in the United Kingdom and the USA as well as in New South Wales and South Australia. Several potential uses for the Western Australian coastal compartments have been briefly outlined in the report. These include planning for marine natural resource and conservation planning; protection of essential life habitats; ecosystem based fisheries management; terrestrial coastal planning and management; and assessment of coastal vulnerability to projected rise in sea level and change in climate. At present the compartments are being used as a framework to assess the vulnerability of coastal landforms to changing weather and ocean conditions, particularly rise in sea level. Whether any of the others are implemented is the business of the relevant State and Local Government agencies, catchment management councils and community interest groups. Full use of the framework is a challenge for the future.

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Available descriptions of geologic features and landforms comprising the coast have been used to identify compartments around Western Australia at strategic, regional and local scales currently used for coastal planning and management. The hierarchy of 36 primary, 114 secondary and 242 tertiary compartments provides a network of nested planning units. An example of the primary, secondary and tertiary compartments is shown in Figure 1 while primary and secondary compartments for the State are illustrated in Figure 2. In principle, the network provides a systematic approach to State planning in the coastal environment, including natural resource management and marine conservation planning. It is a multi-scalar framework that facilitates comparison and analyses of environmental data across and within each compartment level as well as between different levels within the hierarchy. In the first instance, the hierarchical framework of coastal compartments enables comparative assessment of information available and planning for future research/surveys of marine and coastal resources. It is a first step in coastal risk analysis and has wider relevance due to the diversity of coastal landforms around the State and the need to assign resources to address issues of resource sustainability.

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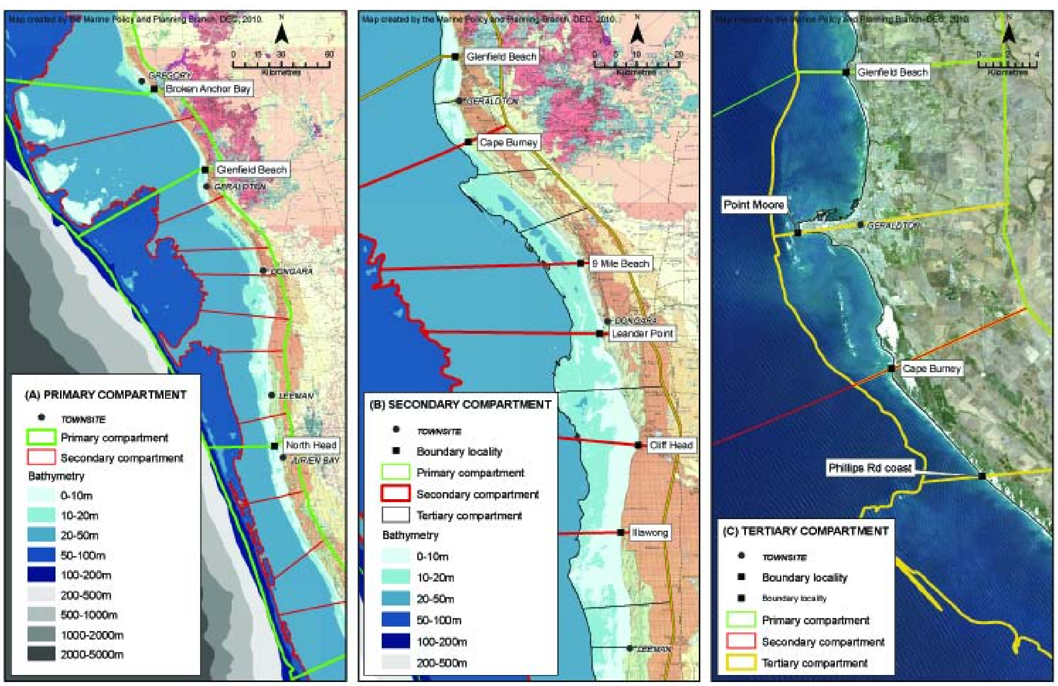
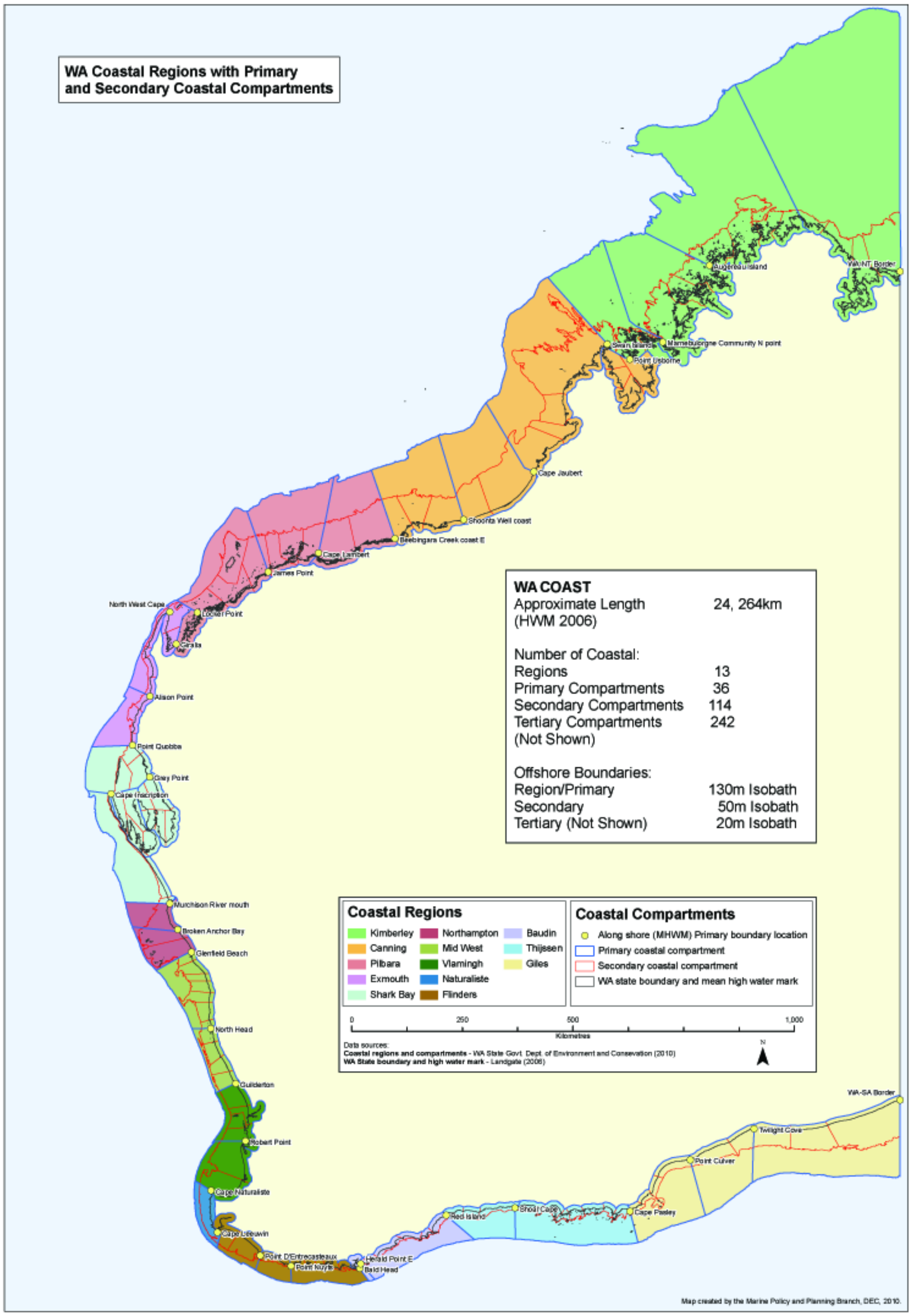


Web Summary Figure 1: Primary, secondary and Tertiary Coastal Compartments in the vicinity of Greenough and Point Moore



Web Summary Figure 2: Coastal Regions with Primary and Secondary Compartments
The Tertiary Compartments are not shown at the map scale

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1. INTRODUCTION

Western Australia includes approximately 24,000 km of coastline, estimated along the mainland Mean High Water line (DEC 2006). This is a daunting prospect for planning and management. It encompasses a wide variety of geology and coastal landforms set in a very wide range of meteorological and oceanographic (metocean) conditions. For example, the type of major storm systems impacting the coast vary from mid-latitude depressions on the south coast, through extra-tropical depressions in the mid-west to tropical cyclones in the north west (Gentilli 1971; Laughlin 1997); tidal conditions vary from micro-tidal environments with a spring tidal range of less than 1.0m on the south west coast to macro-tidal ranges of up to 11.0m in the Kimberley (Easton 1970; Department of Defence 2009); and landforms range from extremely sheltered sandy beaches on the south west coast to long reaches of exposed cliffs in the north west, west and south east. This variation presents challenges for planning and management. The challenges include:

- Provision of a framework for management that ensures natural marine resources of the State are sustained;
- Development of policy guidelines applicable and equitable in all regions;
- Assessment of risks likely to affect people living or seeking to live in close proximity to the coast; and
- Adoption of new approaches sufficiently flexible to incorporate improved technology and information as it becomes available.

These are some of the issues faced in the current revision of the State Coastal Planning Policy - SPP 2.6 (WAPC 2003) and which provide an immediate context for identification of coastal planning units around the coast of Western Australia.

Similar problems have been faced in planning for marine conservation reserves, ecosystem based fisheries management practices and the assessment of coastal vulnerability to projected environmental change throughout the developed world since the early 1970's (Cincin-Sain & Belfiore 2005). Globally, approaches to ecosystem based management and Integrated Coastal Zone Management have been convergent (Cincin-Sain & Belfiore 2005; Forst 2009). The convergence provides the rationale for identification of geological and geomorphological compartments of the shoreface and coast around Western Australia as a basis for integrated planning and management.

Understanding the three-dimensional geologic framework, as well as the meteorologic and oceanographic (metocean) processes governing the character of the shoreface (the nearshore area in which wave energy is expended) is vital to determining coastal behaviour; particularly coastal responses to changes in metocean conditions. It is an especially important consideration in the coastal hazard and risk assessment on soft coasts. Cleary *et al.* (1996) and others (Pilkey *et al.* 1993; Cooper & Pilkey 2004), including Bruun (Bruun 1983,1988) have argued the presence of a complex geologic framework negates application of the Bruun Rule (Bruun 1962; Schwartz 1967), which has been widely applied in the calculation of setback to development on mixed sandy and rocky coast in Western Australia (WAPC 2003). The point was originally raised by Bruun (1983) in his review of conditions for uses of the Bruun Rule of erosion (Slott 2003).

Given a more complete appreciation of the geologic framework structuring the coast it is appropriate to consider how coastal vulnerability to changing meteorologic and oceanographic (metocean) conditions might be linked to different land systems and landforms at different time-space scales. Intuitively, different landform systems and the landforms they contain are subject to varying degrees of susceptibility to change. For example, rocky coast is less susceptible to environmental change than sandy coast. Additionally, similar landforms sharing the same degree of susceptibility to change but in different locations may be more or less unstable, where instability is recognised as the present mobility of the landforms and their components. Similar types of barrier systems with nested blowout dunes that are fully vegetated on one and substantially unvegetated on the other provide an example of relatively stable and unstable conditions. Hence identification of coastal compartments together with the land systems and landforms they contain provides a means of systematically assessing vulnerability at an indicative level. In so doing it also offers scope for determination of an appropriate development setback based on hazard assessment models forecasting potential environmental change for each landform type.

1.1. Project Aim & Objectives

The aim of this project is to identify a hierarchy of planning units based on natural coastal systems similar to the approaches used to identify river catchments and the land system hierarchy used in soils description (Schoknecht *et al.* 2003 and van Gool *et al.* 2005) which accord with mapping scales commonly used for the preparation of statutory plans. The procedure broadly parallels that used for integrated coastal management in the United Kingdom which is based on the geomorphological behaviour of the coastal system as a whole and links between its component parts, although it demonstrably has potential for a wider range of applications (eg. Roff *et al.* 2003; Hemer 2006). The British approach has been reviewed by Cooper & Pontee (2006) and recently updated. See reports by Walkden & Rossington (2009) and Whitehouse *et al.* (2009). The objectives of the project in Western Australia are to:

1. Define the geologic framework controlling the structure of the coast at spatial scales currently used in coastal planning and management by State and Local Government authorities;
2. Identify marine and coastal landform units within each compartment according to the existing OZRA (AMSA 2006), Smartline (Sharples 2007; Sharples *et al*. 2009) and WACoast (Gozzard 2010) geomorphologic classifications;
3. Review the conceptual models describing the morphology and dynamics of each landform type; and
4. Outline the potential use of the marine and coastal landform units in (a) natural resource conservation and management under the CALM Act (1984); (b) development of guidelines for implementation of the State Coastal Planning Policy - SPP2.6 (WAPC 2006); and (c) comparative assessment of coastal vulnerability to climate change and rise in sea level potentially affecting coastal protection measures.

1.2. Context

A scalar hierarchy is commonly used by land use planners and currently adopted by the Western Australian Planning Commission (WAPC 2003) is illustrated in Figure 1. The approximate limiting scales at each level are linked to the detail of information required for the type of planning to be undertaken rather than the size of landform or natural resource units encompassed by the plan. In effect the hierarchy ranges from broad policy setting to preparation of highly detailed local plans. Despite the diversity of application the same procedure is applied to the description of compartment boundaries at all planning scales. However, there are discrepancies in the size of each of the units. In some instances, similar scales may be used to identify coastal regions as well as primary compartments. Similarly, based on the dominant geology and morphology secondary and tertiary level coastal compartments are apparent at each scale but may span reaches of coast that are the same length approximately. Despite the overlap, and in increasing detail, the regions and compartments respectively correspond with policy statements, regional strategies, regional and local plans and detailed local and site plans (Figure 2).

Identification of coastal compartments and sediment cells is a regionalisation process which divides the Earth surface into a hierarchy of geographical units for a designated purpose. For example see Gentilli (1979:3-48) who reviewed the criteria and outcomes of previous determinations of physical regions in Western Australia as well as the assessment of land evaluations standards for land resource mapping by van Gool *et al.* (2005). These are incorporated in the current analysis. *Coastal regions* have been described in detail for the coast of New South Wales (Chapman *et al*. 1982; New South Wales Government 1990). They are large areas sharing similar environmental conditions, particularly with respect to variation in the occurrence of extreme synoptic weather events, tidal regime, geologic framework, land systems (dominant landscapes and/or seascapes), and aspect of the shore in relation to cardinal compass direction. Similarly, compartments and cells identified within each region are increasingly smaller units and therefore share some of the attributes defining the wider region.

Several hierarchical classifications covering different scales and have been used for different purposes in Western Australia; such as those for agriculture (van Gool *et al.* 2005) and geoheritage (Brocx & Semeniuk 2007 & 2010). Classifications covering coastal and marine environments include the landform classifications of Richardson (2005), AMSA (2006), Sharples (2007) and Sharples *et al.* (2009) as well as the habitat classifications of Semeniuk (1986), Bancroft & Sheridan (2000), Lyne *et al.*(2002), Bancroft (2003), Department of Environment and Heritage (2005) and Ryan *et al.* (2007). In Western Australia, partners in NWSJEMS (Lyne 2002) developed a hierarchical classification system for nearshore marine ecosystems of the North West Shelf, including terrestrial environments principally subject to tidal inundation. The approach we have used is to focus specifically on description of the framework provided by the geology and geomorphology of the coast. It is anticipated the hierarchical framework could subsequently be used in conjunction with other specific classifications of seascape and coastal land systems as a basis for a wide range of applications linked to use of coastal and marine environments.

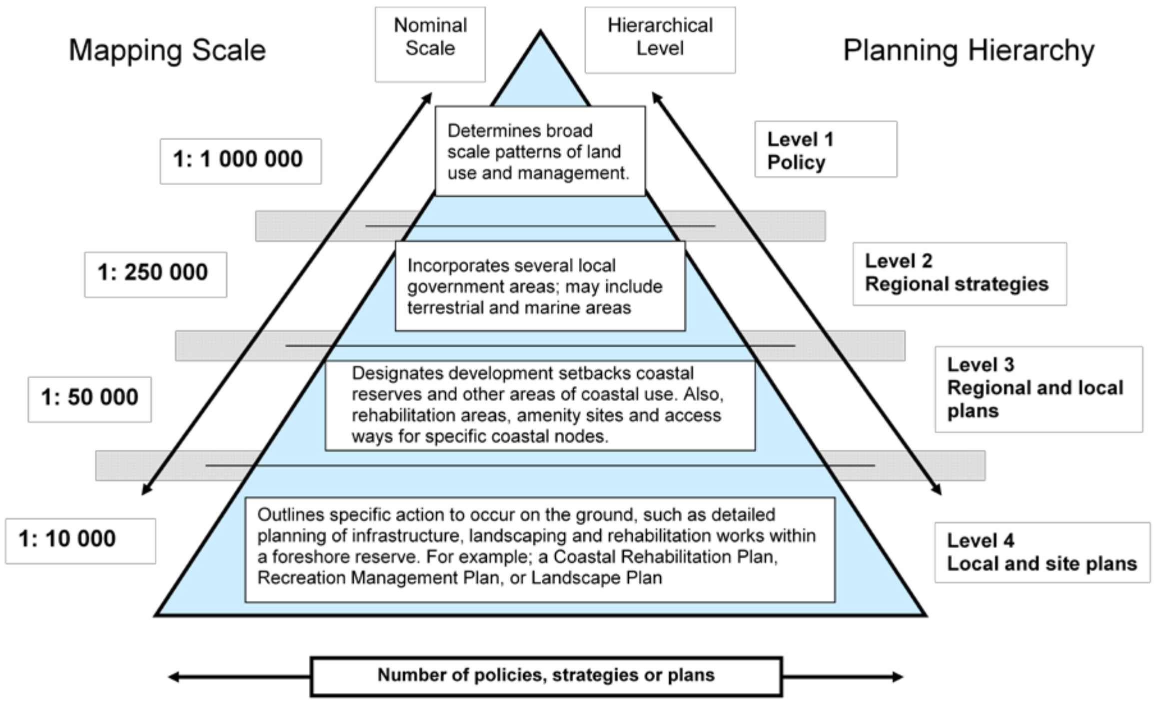

Figure 1: The planning hierarchy and content of plans for coastal areas (Based on WAPC 2006)

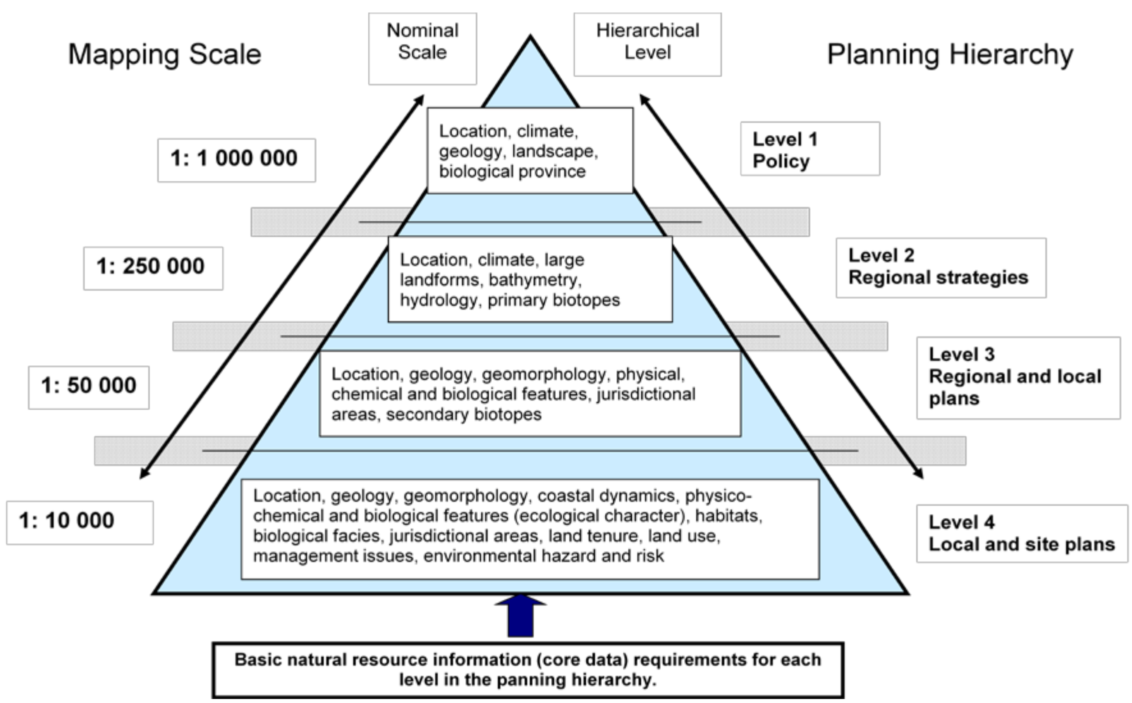

Figure 2: Planning hierarchy, indicative mapping scales and natural resource related content

The shape of the hierarchy indicates the increased number of plans required at more detailed scales for a single region, with more at a site than a policy level**.**

Coastal compartments are structural features. For the purposes of this report they are distinguished from sediment cells, which are functional units describing the movement of material along the coast. Sediment cells and sediment budgets are not discussed in any detail although they are of fundamental importance for detailed local coastal planning and management. Herein *coastal compartments* primarily relate to the regional geologic framework of the coast which exerts structural control on the plan form of the coastline. The compartments are secondarily dependent on coastal aspect and land systems, large coastal landforms such as deltas and cuspate forelands visible at a scale of 1:250,000.

A coastal compartment is a natural management unit for development of plans for sustainable use of natural marine resources, conservation of essential life habitats and sedimentary processes, and mitigation of environmental risks. Coastal compartments have been used as a coastal planning and management framework in the United Kingdom (Mc Innes *et al.* 1998; Cooper *et al.* 2001; M^c^Glashan & Duck 2002; Hansom *et al.* 2004; Cooper & Pontee 2006) and proposed as a model for marine conservation and ecologically based fisheries management in the UK and USA (AAG 2008; Wright & Heyman 2009). An example of coastal compartments identified in the UK is shown in Figure 3. The approach potentially enables a focus on management of change by facilitating recognition of geomorphologic components within each compartment that are subject to different levels of susceptibility to change and hence provides scope for proactive adaptation to changing environmental conditions. The key attribute of the approach is that it leads to consideration of coastal evolution and change rather than the more static, quasi-equilibrium approach currently in use.

In an evolutionary approach the geologic framework structuring the coast also has ramifications for marine hazard and risk assessment. Cleary *et al*. (1996) and Riggs *et al*. (1995, 1996) pointed out that limited data exists on the interrelationships between the underlying geological framework and the morphology, sediments and evolution of coastal systems fundamental to hazard and risk assessment. Nevertheless these variables are important through the effects they have on the wave and current dynamics of the shoreface that determine how the adjacent shoreline and beach will respond to storms, and ultimately to the effects of rising sea level. Since then McNinch & Drake (2001) have described the influences of underlying geology on nearshore and shoreline processes in the United States. Their observations have been supported by List *et al.* (2002) through evaluation of the persistence of hotspots

In contrast to compartments, *sediment cells* commonly are smaller three-dimensional units (Figure 4). They are functionally defined by the likely movement of unconsolidated sediments between source areas and sinks via transport pathways within geologic and geomorphic boundaries identifiable at scales of 1:50,000 or larger to a detailed local level. In part the distinction between compartments and cells is based also on the potential ease of determining a *sediment budget* from available information. Each of these concepts – sediment cells and budgets – has been described by Komar (1996), van Rijn (1998), Short (1999), and Whitehouse *et al*. (2009).

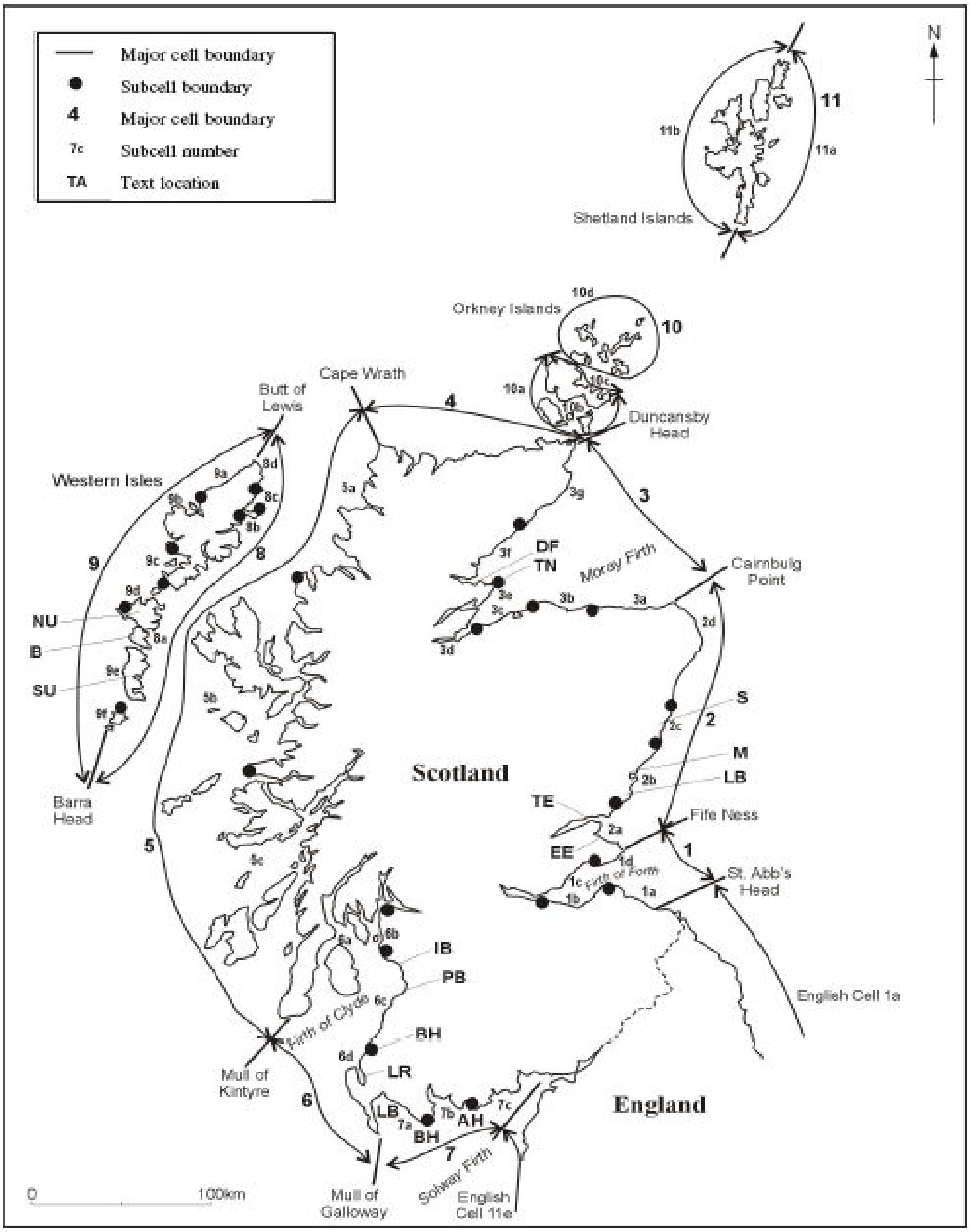

Figure 3: Coastal cells in Scotland (From Hansom *et al.* 2004)
Definition of a cell in this context is equivalent to a compartment on the WA Coast

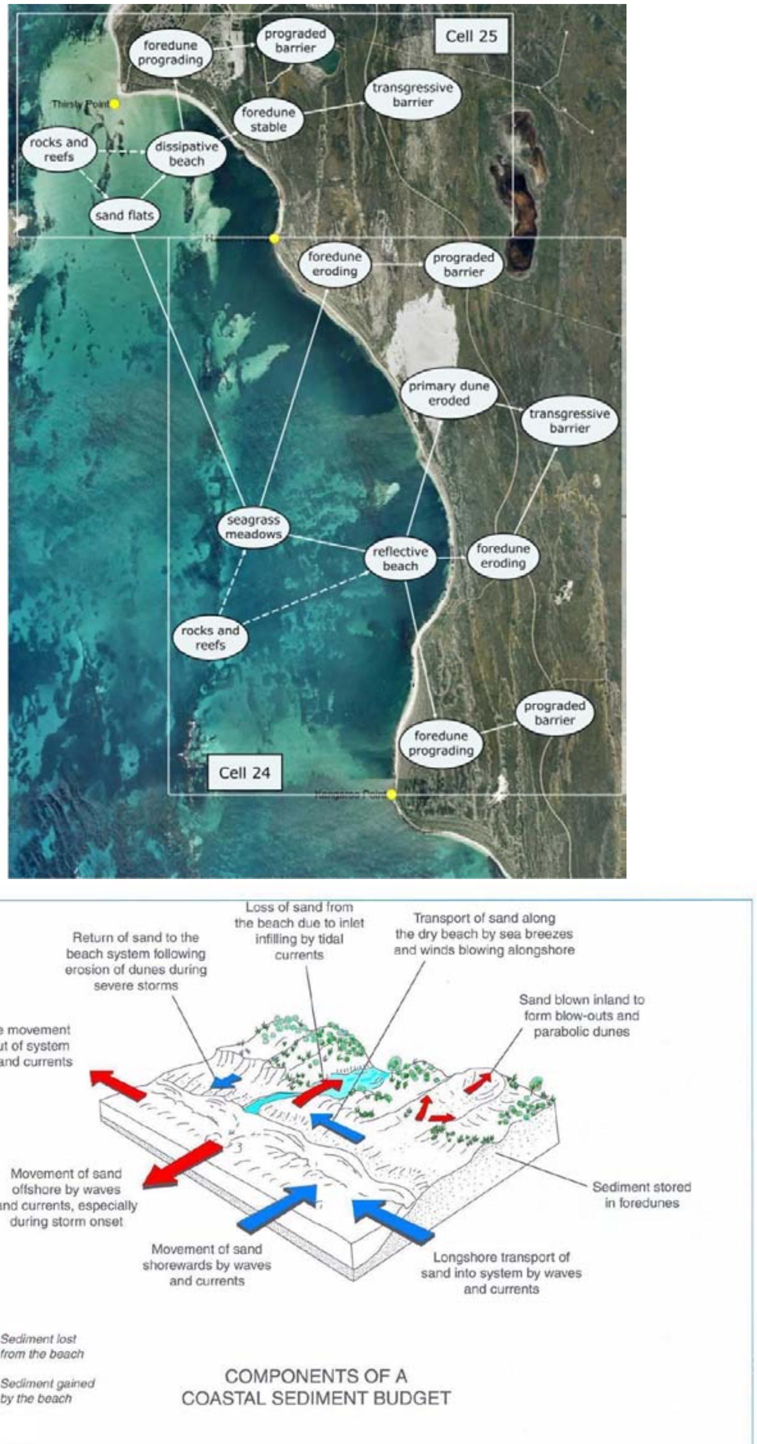

Figure 4: Sediment Budget Components (After WAPC 2003)

(A) Components of a Sediment Cell; and

(B) A Conceptual Sediment Cell in which the Components of the Sediment Budget Have Been Identified

2. METHODOLOGY

The procedure followed involved:

1. Selection of coastal information sources (Metadata) covering Western Australia;
2. Determination of compartment boundaries at three scales; and
3. Identification of the principal landforms within each compartment at a primary and secondary compartment scale.

Together, compartments and the landforms they contain comprise discrete *planning units* appropriate to planning at each of the three scales. Identification of landforms in the tertiary compartments is ongoing and based on the OSRA (AMSA 2006) and Smartline (Sharples 2007, Sharples *et al.* 2009) databases.

2.1. Metadata

Twelve data sets were used for identification of the boundaries of the compartments and the landforms each compartment contained:

1. Australian Government, 1993. *Topographic Series*, *1:100 000 Map Sheets for Western Australia.*, AUSLIG, Canberra.
2. Australian Government, (2006a). *Oil Spills Response Atlas.* Australian Maritime Safety Authority: AMSA, Canberra. (http://www.amsa.gov.au)
3. Geological Survey of Western Australia: GSWA, 2007. *Atlas of 1:250 000 Geological Series Map Images, Western Australia, April 2007 update*. GSWA, Perth.
4. Google Earth 2008. Images for Western Australia. (http://www.googleearth.com)
5. Sharples C, (2007). *Smartline* maps, compiled for the *Inventory of Potentially Unstable Coastal Landform Types for the National Shoreline Geomorphic and Stability Mapping Project*. University of Tasmania, Hobart.
6. Geonoma dataset from: Geographic Names database 2005, Landgate, Government of Western Australia (http://www.landgate.wa.gov.au/corporate.nsf/web/Geographic+Names+Frequently+Asked+Questions)
7. Australian Government (2006). State coastal waters from: Australian Maritime Boundaries Geoscience Australia, Canberra (http://www.ga.gov.au/nmd/products/thematic/ambis.jsp)
8. Coastline dataset developed by DEC, coastline data originally from Landgate 2006, Government of Western Australia (http://www.landgate.wa.gov.au/corporate.nsf/web/Coastline+Data)

9. Department of Industry and Resources: DOIR, (2008). *1:500,000 Tectonic units of Western Australia – Preliminary Version. ANZLIC Core Metadata Elements _ Directory Item Report.* Department of Industry and Resources, Perth Western Australia.

10. Department of Industry and Resources: DOIR, (2008). *1:500,000 Interpreted bedrock geology of Western Australia, 2008 Update. ANZLIC Core Metadata Elements _ Directory Item Report.* Department of Industry and Resources, Perth Western Australia

11. Australian Government, (2006b). *A guide to the Integrated Marine and Coastal Regionalisation of Australia* Version 4.0. Department of Environment and Heritage, Canberra, Australia.

12. NASA Shuttle Radar Topographic Mission (SRTM) 90m digital elevation model. Available http://srtm.csi.cgiar.org/.

2.2. Identification of Planning Units

Several steps were used to identify coastal compartments at three interrelated levels (primary, secondary and tertiary) approximating strategic, regional and local levels in the planning hierarchy. First, major changes in lithology along the coast were identified from the 1:500,000 Geological Map. These provided the first approximation of boundaries for identification of the primary (strategic planning) compartments around the coast of Western Australia from the border of the Northern Territory to that with South Australia. The boundaries of the compartments were identified according to Table 1. Examples of boundaries are provided in Figure 5.

Table 1: Features used to establish the boundaries of each coastal compartment

Priority	Feature	Examples
1	Changes in geology	Metamorphic to sedimentary rocks; lithified to unconsolidated sediments
2	Rock structures (topography)	Rocky capes, peninsulas, termination of extensive cliffs
3	Geomorphic features (morphology)	Large cuspate forelands and tombolos; extensive sandy beaches
4	Change in aspect of the shore	Bald Head at the entrance to King George Sound; changes in aspect along Eighty Mile Beach

Second, the boundaries of the primary compartments were then adjusted with reference to the 1:250,000 Geological Map, the 1:100,000 Topographical Map Series and satellite imagery available on Google Earth 2008 ®. The adjustment was made to accommodate apparent changes in the orientation of the coast as well as to incorporate complete landforms of regional significance. This selection of landforms broadly accords with the scheme proposed by van Gool *et al.* (2005) and landform descriptions by Semeniuk (1986). For example the delta of the De Grey River is a landform of regional significance and considered to be a primary (strategic planning) compartment. In turn the delta is comprised of smaller scale landforms and landform elements apparent at sub-regional, local and site scales.

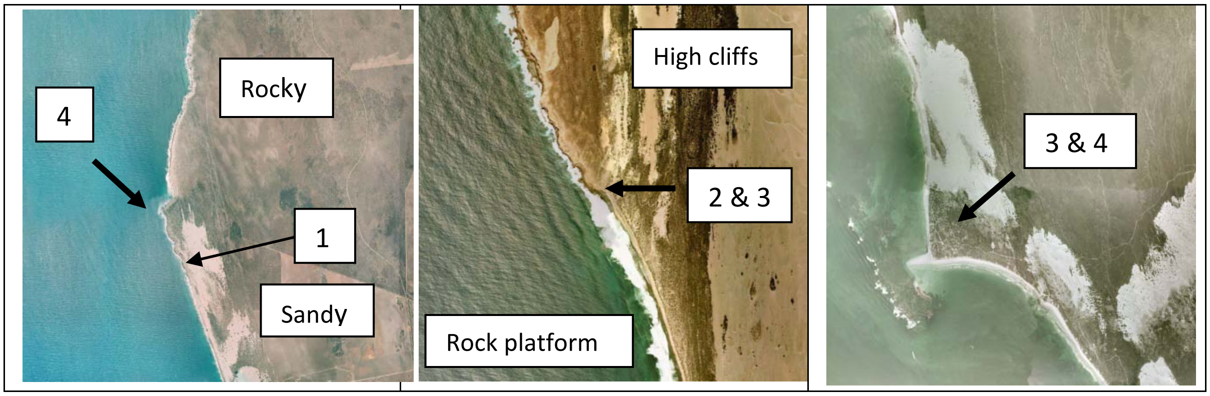

Figure 5: Examples of compartment boundaries

1 = change in geology; 2 = rock structure; 3 = geomorphic feature; and 4 = change in aspect

= Primary boundary = Secondary boundary

Third, once boundaries for the primary (strategic planning) compartments were determined each compartment was further subdivided to identify large-scale landforms of sub-regional significance. These secondary (regional planning) compartments have been based predominantly on landforms such as extensive tracts of coast with continuous beach or barrier dune formations. The landforms were identified with reference to the 1:100,000 Topographical Map Series and satellite imagery available on Google Earth 2008 ®.

Fourth, the secondary (regional planning) compartments were then subdivided into a suite of tertiary (local planning) compartments based on the coastal landforms present. For example, with down-drift distance along the shores of compartments on the South Coast of Western Australia, cliffed dunes give way to wider beaches with developed foredunes, and ultimately to broad beaches fronting active parabolic dunes and large mobile sand sheets. The four categories of boundary described in Table 1 and Figure 5 were used for all levels of the hierarchy, although with appropriate changes of scale.

Alongshore boundaries identified at each level specifically refer to natural features on the coastline. The onshore and offshore boundaries are presently under consideration: In this analysis these boundaries are more arbitrary than indicative of natural system boundaries. For consistency, they need to be commensurate with the scale of the compartments at each level of the hierarchy and with identifiable geological or geomorphological features. Currently, the terrestrial boundary is a 10km buffer landward of the High Water Mark. The regions and primary compartments (strategic planning units) are bounded to seaward by the 130m isobath. This depth contour was selected because it is the approximate position of the last glacial peak shoreline approximately 20,000 years ago and provides an indication of the continental shelf area inundated by the rise in sea level during Holocene, particularly over the past 8,000 to 3,000 years when the modern coast developed. The seaward boundary of the secondary compartments (regional planning units) has been set at the 50m isobath to ensure incorporation of the area of shoreface and sediment movement active during moderate storm events. Closer to shore, the outermost, continuous 20m isobath was chosen as the offshore boundary for the tertiary compartments (local and site planning units) to include areas of coast subject to variability in response to short-term changes in metocean processes. An example of the three compartment levels is provided in Figure 6.

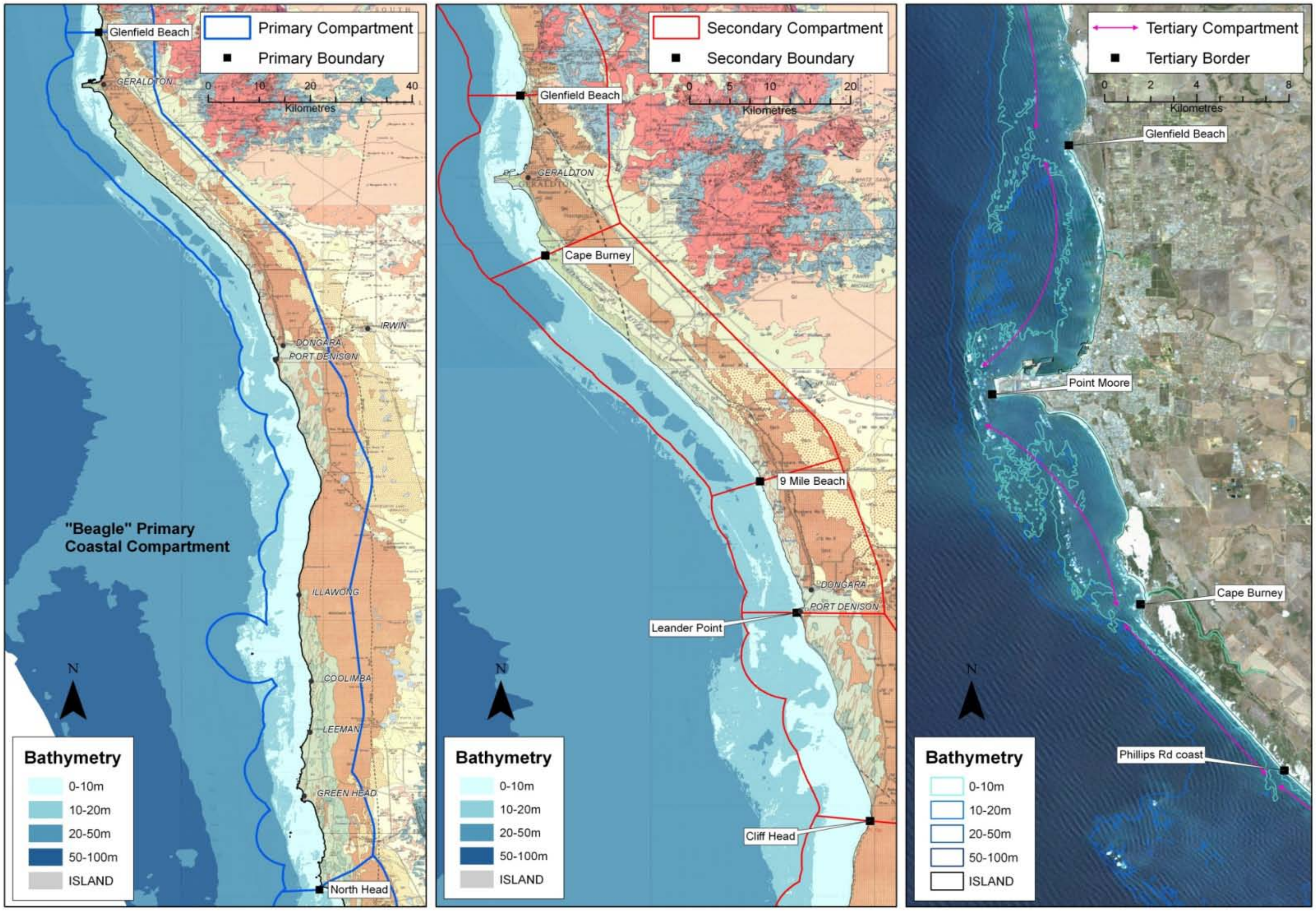

Figure 6: Primary, secondary and tertiary compartments including Point Moore

3. USE OF COMPARTMENTS AS MARINE AND COASTAL PLANNING UNITS

Based on the geologic framework, major landscapes and seascapes, and the aspect of the shore, Western Australia is comprised of 13 broad coastal regions containing a total 36 primary, 113 secondary and 242 tertiary compartments (Figure 7). The regions are a composite of those identified by Gentilli (1979), Woods et al. (1985) and Short and Woodroffe (2006). Boundaries of the regions and compartments are listed in Appendix A. Primary and secondary compartments are illustrated in Figure 7, whilst the three sets of compartments are illustrated for each region in (Appendix B).

Comparatively, the regions and the compartments they encompass are subject to large geographic and temporal variation in meteorologic and oceanographic (metocean) conditions due to the extent of the State and its position as the eastern boundary of the Indian Ocean. From a management perspective the metocean conditions of particular interest are the primary factors driving coastal change: for example those identified by NCCOE (2004) and listed in Table 2. Over a planning horizon of 100 years, the period which coastal strategies and plans are required to address in Western Australia (WAPC 2003), the primary processes affect the structure and evolution of major landforms as well as the plan form of the coast. These processes and their modification of coastal landforms directly affect the distribution of marine biota as well as human infrastructure in coastal waters. Hence they are relevant to development of natural resource planning and coastal management approaches based on coastal change and ecosystem variability rather than concepts of an unchanging, static equilibrium resource base.

Table 2: Primary and Secondary Metocean Variables (From NCCOE 2004)

<table>
<tr><th>Primary Variables</th><th colspan="2">Secondary Variables</th></tr>
<tr><td>K1 – Mean Sea Level</td><td>S1 – Local Sea Level</td><td>S8 – Beach Response</td></tr>
<tr><td rowspan="2">K2 – Ocean Currents / Temperatures</td><td>S2 – Local Currents</td><td>S9 – Foreshore Stability</td></tr>
<tr><td>S3 – Local Winds</td><td>S10 – Sediment Transport</td></tr>
<tr><td>K3 – Wind Climate</td><td>S4 – Local Waves</td><td>S11 – Hydraulics of Estuaries</td></tr>
<tr><td>K4 – Wave Climate</td><td>S5 – Effects on Structures</td><td rowspan="2">S12 – Quality of Coastal Waters</td></tr>
<tr><td>K5 – Rainfall / Runoff</td><td>S6 – Groundwater</td></tr>
<tr><td>K6 – Air Temperature</td><td>S7 – Coastal Flooding</td><td>S13 – Ecology</td></tr>
</table>

The same processes operate as secondary variables at sub-regional and local scales where the occurrence of extreme weather events, tidal regime, geologic framework, dominant landscapes and aspect determine the stability of the shore. Interactions between geologic structure, landform and coastal processes potentially facilitate a risk-based approach to marine and coastal management. The approach builds on concepts of the inherent susceptibility of geologic/geomorphic structures to change and the present day instability of coastal landforms. Susceptibility is associated with the Holocene structure of the coast; the landform system that developed over the past 10,000 years. Stability refers to the surface condition or state of landforms comprising the structure. Hence, susceptibility and stability are related concepts. If a geologic structure or landform system is *susceptible* to change it is highly likely that it is comprised or consists of, or supports unstable, mobile landforms. For example a barrier system may be comprised of stable or unstable sand dunes where the current state of *instability* is evidenced by the proportion of the land surface under vegetation cover. Conversely, destabilisation of a barrier system on a stable coast may occur when barriers change from progradational to erosional forms as a result of prolonged loss of sediment from the coast (Roy *et al.* 1994; Cowell *et al*. 1995, 2000; Hesp & Short 1999; Masetti *et al.* 2008). Together, susceptibility and stability determine the vulnerability of a land system to changes in the metocean (meteorologic and oceanographic) process affecting the coast.

In the dynamic approach adopted, the planning units consist of the coastal compartments together with geomorphologic features (landforms) and coastal processes shaping them. Landforms and the percentage of coastline occupied by each landform type were determined for each compartment at the primary and secondary level in the hierarchy. Examples of the information collated are provided in Appendix C. Although the alongshore boundaries of the tertiary compartments have been identified (Appendix A) the landforms contained within the tertiary compartments remain to be determined. It is anticipated this will be done on a project by project basis by overlaying the compartment boundaries on information from databases, such as OSRA (AMSA 2006), Smartline (Sharples 2007; Sharples *et al.* 2009) and NWJEMS (Lyne *et al*. 2006) for the reach of coast being examined and for which more detailed descriptions of the planning units are required. Most significantly for the Coast between Cape Naturaliste and Kalbarri, the boundaries can be linked to the environmental geology CoastWest data base, currently being compiled by the Geological Survey of Western Australia (Gozzard 2010). In this respect it is envisaged the more detailed descriptions of marine and coastal landforms will be linked to identification of sediment cells and determination of the coastal sediment budget

3.1. Marine Planning Units

Marine planning units are defined by onshore and offshore boundaries as well as the geologic framework of the compartments. The onshore boundary is commonly defined as High Water Mark (HWM) but may otherwise be determined by biotic considerations, such as areas of mudflats and mangroves, or historical land tenure agreements. The offshore boundaries are the 130m, 50m and 20m isobaths respectively for the primary, secondary and tertiary compartments. As indicated in Section 2.2 they were selected because of their geological and topographic implications and have no jurisdictional basis. However, they provide a detailed subdivision of the Western Australian Fisheries Regions (WA Department for Fisheries 2009). The hierarchy of compartments also adds detail to the IMCRA v4 (Australian Government 2006) classification because IMCRA v4 uses marine geomorphology as one criterion for regional subdivision of marine habitats. It systematically shifts focus for the broad Western Australian Fisheries and Australian Government classifications of the marine environment from the inner continental shelf, across offshore reefs of the State Waters and to nearshore waters close to shore. Shoreface and inshore detail is commonly lost in broad classifications based on the IMCRA v4 regions, e.g. Richardson *et al*. (2005).

3.2. Terrestrial Coastal Planning Units

An understanding of terrestrial coastal responses to environmental change is required for coastal planning and management. This necessarily requires consideration of the attributes of the marine planning units, including topographic and metocean factors that affect the susceptibility of geologic and geomorphic structures to change as well as the stability of individual landforms comprising those structures. The understanding is significant because it enables identification of coastal hazards and assessment of risks to land use and infrastructure associated with the inherent vulnerability of the natural structures on which they have been constructed. Hence the physical units used for terrestrial planning should extend to the offshore boundaries to ensure integration of marine and terrestrial planning and management. The relevance of the offshore boundaries to terrestrial planning is indicated in Table 3. The landward boundary of the coastal planning units is the same at all scales. It incorporates landforms developed over the past 10,000 years, during the Holocene period, and extends to the landward limit of tidal influence on inland waters.

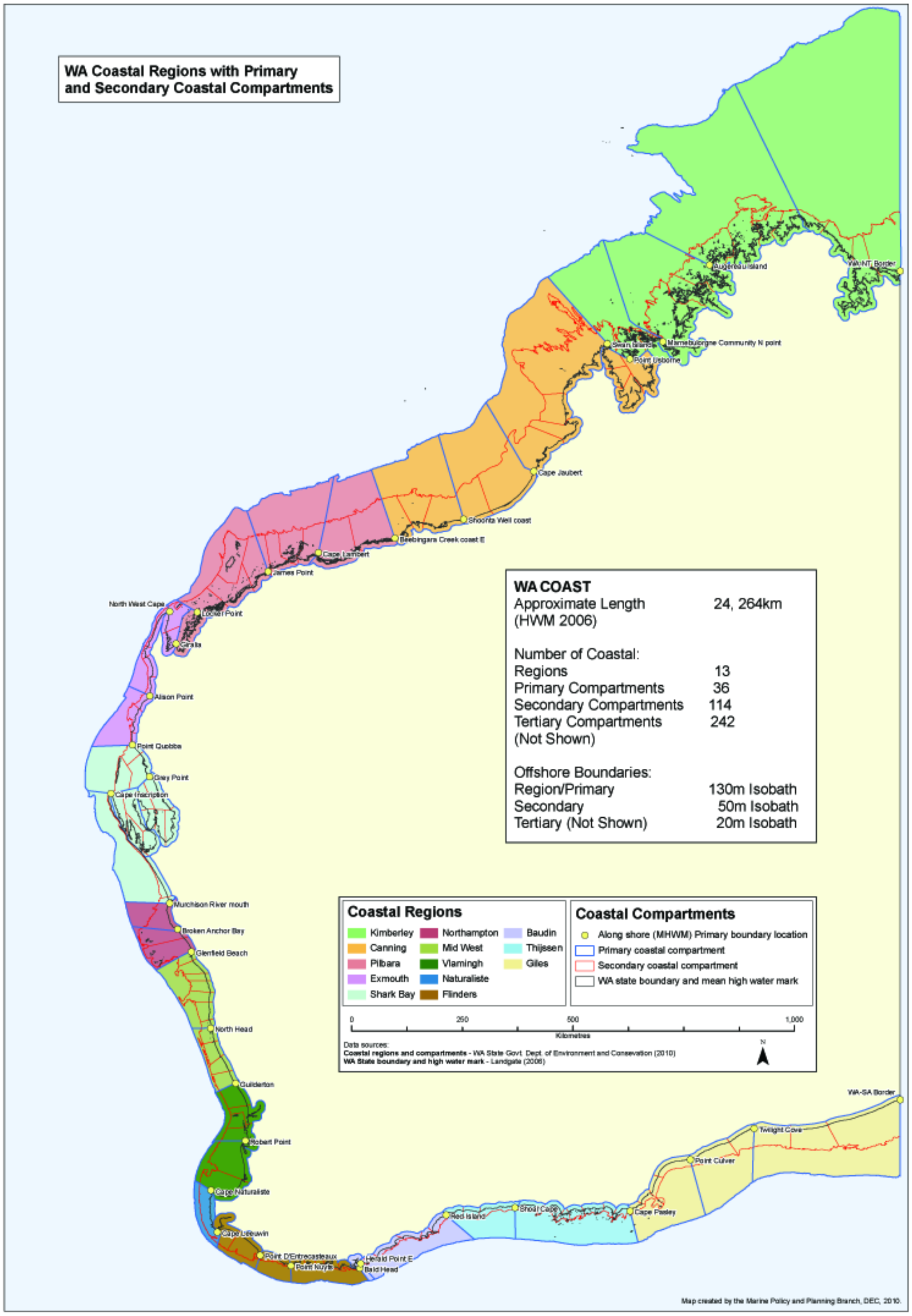

Figure 7: Western Australian regions and primary compartments

Table 3: Offshore boundaries and their interpretation in terrestrial coastal planning

Boundary (Isobath)	Landform Scale	Planning Application
130 metres	Mega-scale landforms eg. Barriers, river deltas, zeta-form beaches Geological development of the coastal plan form occurs at this scale. Marine processes affecting this part of the continental shelf establish the geologic setting of coastal land and its broad susceptibility to erosive forces.	The inner continental shelf area is significant for marine resource planning and management because it supports a high proportion of aquatic biota fished for commercial and recreational purposes, and which demand land based infrastructure for their exploitation. This is an area of substantial overlap between Commonwealth and State interests. Waters beyond the State Water boundary at 6nm are jointly managed through an intergovernmental agreement.
50 metres	Meso- to Macro-scale landforms eg. Cuspate forelands ,tombolos and dune sequences Holocene, including present day, development of the coastal plan form occurs at this scale. The topographic structure of the Inner continental shelf affects wave patterns and nearshore water circulation.	Closer to shore, this is the area of most intense use of the marine environment for commercial and recreational purposes, including recreation and tourism. Meso-scale landforms are apparent as components of coastal sediment cells and sediment budgets at this scale. They identify areas of relative coastal stability as well as susceptibility to change, and hence indicate potential coastal problems for planning and management. In this context they determine areas where there is a requirement for detailed studies at a local scale.
20 metres	Micro- to Meso-scale landforms eg. Beaches, foredunes, and blowouts Inshore topography landward of the 20m isobath determines the nearshore wave regime and current patterns that drive the coastal sediment budget and have a direct effect on coastal stability.	The inshore waters and coastal lands are critical for provision and maintenance of marine based infrastructure (harbours & marinas). The area comprises a substantial proportion of State Waters and is highly significant for coastal recreation as well as its commercial use. Conservation planning and fisheries management overlap in this area and have been sources of Government inter-departmental conflict in the immediate past. The conflict is an issue that may be resolved through adoption of a common geographic framework for planning and management.

4. POTENTIAL APPLICATIONS

The hierarchy of coastal compartments potentially provides a State-wide framework of coastal and nearshore marine management units based on natural system boundaries (Table 4). At each level of the hierarchy, compartments may be used in several planning contexts; marine and coastal planning and management, habitat description; and for hazard and risk assessment (Figure 8). In turn, habitat classifications, which commonly use marine geomorphology as a surrogate for habitat (Roff *et al.* 2003; AAG 2008; Wright & Heyman 2009), have applications for marine conservation planning and ecologically based fisheries management (Wright & Heyman 2009).

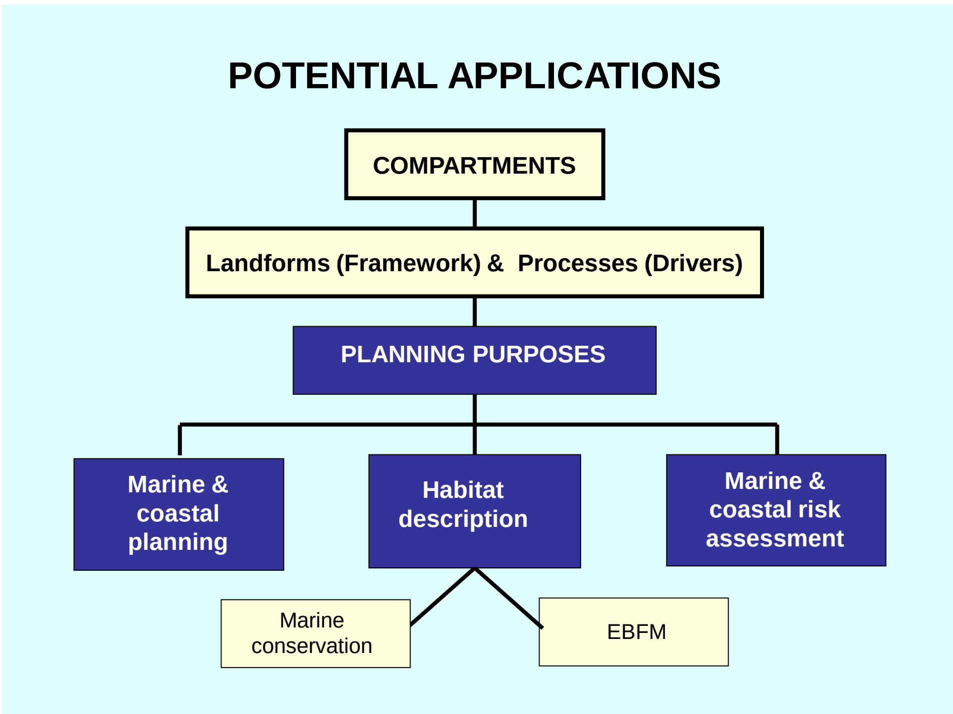

Figure 8: Potential marine and coastal applications of the planning units

A brief description of some potential applications is presented below. The descriptions are indicative only. They are not intended to provide a comprehensive coverage of potential use because use of the hierarchy or individual compartments is necessarily agency specific and likely to vary with jurisdictional responsibilities. However, they are intended to provide examples of how the framework might be used by the lead agencies for coastal and marine planning and management.

Table 4: Conceptual application of coastal compartments and sediment cells at planning scales

COMPARTMENT APPLICATION		DESCRIPTORS IN APPLICATION			
PLAN (Compartment)	**OFFSHORE LIMIT (Depth Contour)**	**GEOLOGY & GEOMORPHOLOGY**	**Meteorologic**	**KEY PROCESSES Oceanographic**	**Landform Change**
POLICY (State or Region)	Exclusive Economic Zone (EEZ) Continental shelf boundary (250m isobath)	Broad scale geological structures & coastal landform systems	Climate zone & global weather scales such as the Walker Circulation & Southern Oscillation	Broad-scale tidal environment; Deepwater wave environment; Geographic variation in major ocean currents	Main structural features & landscapes Broad-scale (geologic) evolution of the coast
STRATEGIC PLAN (Primary)	Glacial low sea level (130m isobath)	Shoreface geological structures & coastal landform systems (eg. Episodic transgressive sand barrier)	Distribution of major weather systems affecting the region; including those associated with extreme events	Broad-scale tidal regime Inter-annual and long-term variation in mean sea level Deepwater wave environment; Outer shelf current regime	Geological development of major landforms apparent at a regional scale eg. barrier type
REGIONAL PLAN (Secondary)	Present day shoreface (50m isobath)	Sub-regional geologic framework &. coastal landform patterns; (eg. Nested blowouts overlying long-walled parabolic dunes) Large geomorphic responses to metocean processes.	Major weather systems & assessment of regional scale risks associated with their onset & passage	Water level characteristics & range (tide & surge) Seasonal and inter-annual fluctuation in mean sea level Inner-shelf wave & current regime.	Landforms; eg organization of dune types on a barrier. Broad changes occurring to coastal landforms at a range of time scales; eg. Seasonal, inter-annual and inter-decadal.
LOCAL or SITE PLAN (Tertiary)	Inshore sediment movement (Offshore 20m isobath)	Local geologic framework, landforms & individual landform elements (eg. Mobile sand sheet and active parabolic dune)	Regional & local weather systems together with local or site scale assessment of risks associated with their onset & passage	Water level regime at site level Seasonal and inter-annual fluctuation in mean sea level Nearshore wave & current regimes	Landform elements; eg. slip face of dune Description of shoreline movement and landform change at sub-decadal intervals Local dynamics in response to metocean processes
LOCAL or SITE PLAN (Sediment Cell)	Depends on the size of the cell and location of offshore sediment sinks, hence overlap with planning scales	Local geologic framework & landform elements. Areas of sediment movement: sources, transport paths & sinks identified at local and site scales	Identification of local and site scale weather systems driving processes at a sediment cell scale	Water level regime at site level Seasonal and inter-annual fluctuation in sea level Nearshore wave & current patterns	Inter-annual resolution of the coastal sediment budget for cells at the planning scale

4.1. Marine Natural Resource and Conservation Planning

The State Western Australia and the Australian Government respectively share a responsibility to manage the coastal and marine environment in an equitable, sustainable and ecologically sound manner on behalf of the wider community. The marine environment of WA is among Earth's oldest in terms of its supporting geological structure, and most pristine with respect to intensity of use and biological diversity. As such it holds significant biological value at national and international levels, as well as being highly valued by Western Australians. Government commitments to conserve and where necessary restore the environment are recognised in the ratification of various international and national agreements and treaties such as the *Convention on Biological Diversity* (UNEP 1994) and the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). However the level of diversity accompanied by the scale of the area involved, arguably pose the biggest challenge for agencies involved in the planning and management of the coastal and marine environment or its resources. This is well illustrated in conflicting arguments emergent when plans to set aside sanctuary areas for conservation are announced and the local press fuels disputation by commenting that the areas are equivalent to a substantive proportion of another Australian state. A more apt comparison would indicate the proportion of the local bioregion or sub-bioregion to be incorporated in the conservation estate. A significant part of the challenge is to develop frameworks providing consistency in the capacity to down-scale decision making from a national or state policy level and up-scale it to policy formulation from the detail of on-ground management at a local site scale.

Scale and diversity are key components of the Integrated Marine and Coastal Regionalisation of Australia (IMCRA). IMCRA v4, the most recent regionalisation (Australian Government 2006) specifically refers to the Australian Exclusive Economic Zone (EEZ) although arguably it spans the area between the coast and the EEZ boundary approximately 200 nm seaward from the territorial sea baseline. In IMCRA v4 the Australian Government (2006b) defined two bioregionalisations based on benthic and pelagic criteria and respectively including descriptions of geophysical and oceanographic factors. These provide broad scale classifications for national policy formulation. The meso-scale classification of IMCRA v4, which is a sub-regional description of the benthic and pelagic regions, is a close fit with the primary compartments around Western Australia (Figure 7). The correspondence provides scope for integration of the Australian Government and State approaches to marine management by linking the broad scales of the IMCRA classifications to the increasing detail of the compartmental hierarchy and ultimately to local sediment cell scales.

Linkage is appropriate because geomorphology is used as a surrogate for habitats at a wide range of scales. These vary from the broad bioregional scales used by the Australian Government and the Western Australian Department of Fisheries (Australian Government 2006; WA Department for Fisheries 2009), through sub-regional assessments used in marine conservation planning by the Department of Environment and Conservation (Bancroft 1999, 2003, Bancroft & Sheridan 2000) to local habitat identification (Bancroft & Sheridan 2000; Ryan *et al.* 2006). A combination the hierarchy of coastal compartments and habitat maps at appropriate scales could be used to identify the distribution and location of essential life habitats at each level, an approach that would enhance State Government initiatives in sustainable management of coastal and marine natural resources.

4.1.1. Essential Life Habitats

Essential life habitats are features and/or areas of specific ecological importance from biologic and/or economic perspectives. Many essential life habitats are recognised under the Australian Government EPBC Act (1999) and the EPA (2004) Guidance Statement for *Benthic Primary Producer Habitat Protection.* The EPBC Act is the central piece of environmental legislation of the Australian Government. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. Under a Heads of Agreement between the Australian and State Governments made in 1997, the Australian EPBC Act provides a national scheme of environment and heritage protection and biodiversity conservation. The agreement focuses Australian Government interests on the protection of matters of national environmental significance, with the State having responsibility for matters of state and local significance separately through the actions of the Department of Environment and Conservation and the Department of Fisheries.

4.1.2. Management Responsibilities

Two State Government agencies play lead roles in management of the marine environment, the Department of Environment and Conservation (DEC) and the Department of Fisheries (DoF). Through the CALM Act (1984) the Department of Environment and Conservation has a lead role in the conservation and restoration of biodiversity in Western Australian Waters which extend to the 3 nm (5.6 km) limit. The DEC prepares habitat maps to inform policy and assist compilation of plans. This is done as part of the departmental remit to establish a comprehensive, adequate and representative (CAR) system for the declaration of marine parks and reserves. The Department of Fisheries has responsibility for the management of aquatic organisms, particularly fish stocks, through the Fish Resources Management Act 1994 (FRMA). Its area of jurisdiction extends to the seaward limit of the EEZ under the Offshore Constitutional Settlement (1980) agreement with the Australian Government (Australian Government 1980) and to a boundary ratified by UNCLOS through the Commission on the Limits of the Continental Shelf (Symonds *et al*. 2009). Under section 115 of the *Fish Resources Management Act 1994* (FRMA) the DoF may undertake habitat mapping for the establishment of a Fish Habitat Protection Area. Such areas are declared for the conservation and protection of fish, fish breeding areas, fish fossils or the aquatic eco-system; culture and propagation of fish and experimental purposes related to that culture and propagation; or the management of fish and activities relating to the appreciation or observation of fish. Under both jurisdictions the focus of the State agencies is on identification of discrete sections of coast as conservation sanctuary zones or fish habitat protection areas. The identification is limited by the availability of resources to undertake full habitat identification despite the breadth of habitat areas mapped by the DEC.

It is unlikely that a complete understanding of biodiversity can be obtained for the marine environment given its extent, but quantitative analysis has shown that habitat diversity can be used as a surrogate for species biodiversity (Ward *et al*. 1999; Kenny *et al*. 2003: Roff *et al*. 2003). Others have shown that nearshore marine habitats are strongly influenced by geology, geomorphology and sedimentary processes (Bancroft 2003; Ryan *et al.* 2006; CSIRO 2007; AAG 2008; Heap *et al*. 2008; Wright & Heyman 2009). Additionally, through the identification of broad-scale marine natural regions for the entire Canadian coast and seascapes on the Scotial Shelf of Atlantic Canada, Roff *et al*. (2003) described how GIS techniques based on readily available data can lead to identification of representative habitat types over broad geographic regions. The overall approach was reviewed in a workshop reported by the Association of American Geographers (2008) and subsequently by Wright & Heyman (2009). It involves recognition of benthic habitats and geomorphological surrogates at a range of scales.

Primarily, the hierarchy of coastal compartments describes the underpinning structural control that geology exerts on all facets of the coastal environment. Logically, a spatial framework of planning units based on the geologic and geomorphic make-up of the coast potentially provides the basis for a systematic approach to State planning in the coastal environment, including natural resource management and marine conservation planning. In the first instance, the hierarchy of coastal compartments provides a framework to comparatively assess information availability and plan future research/surveys of marine and coastal resources. The multi-scalar framework facilitates comparison and analyses of environmental data across and within each compartment level as well as between different levels within the hierarchy. Further state-wide frameworks enable such analyses to be executed in a consistent and systematic manner. For example, a planning exercise may aim to define features or areas of specific ecological importance, such as primary production, and for these features to be recognised and contextualised for the different levels of the hierarchy. Further, State-wide frameworks enable such analyses to be executed in a consistent and systematic manner. For example a planning exercise may aim to define features and/or areas of specific ecological importance, such as primary production, and for these features to be recognised and contextualised for the different levels of the hierarchy.

4.1.3. Marine Conservation Planning

Establishment of an effectively managed system of marine protected areas (MPAs) is a tool that has gained national and international credibility in marine conservation (Kenchington *et al*. 2003; New Zealand Ministry for Environment 2004). Arguably the most effective system should be designed to accommodate the principles of comprehensiveness, adequacy and representativeness, collectively referred to as CAR principles. These principles require detailed scientific knowledge of the coastal and marine areas to be managed, such as that acquired for the South-west Marine Bioregional Planning process of the Australian Government (Department of the Environment and Water Resources, 2007)) and the Securing WA's Marine Futures project (University of Western Australia 2010). Comprehensiveness and adequacy are understood and applied to the broader scales of biodiversity: bioregion; ecosystem; and habitat, whereas representativeness applies to the finer scales of biodiversity: communities/populations; and species/individuals. For a comprehensive explanation see ANZECC (1998 & 1999). The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) was developed to provide a spatial framework to inform the national process of designing a representative network of marine protected areas, specifically at a national level. However it is less applicable at smaller scales for which the Marine Futures data applies. Habitat information is generally available for unusual or unique areas. It rarely coves a complete IMCRA bioregion. Additionally, the purpose and methods of data collection applied have varied greatly over space and time. In this context the hierarchy of coastal compartments introduces a state wide data set to establish an intermediary step between the broad IMCRA 4 meso-scale and site-specific benthic habitat data. It also offers a framework for critical assessment of information currently being used in conservation and management.

Site selection and design for marine reserves in Western Australia are currently based on a 'values /risks assessment matrix', the Wilson Report, the IMCRA 4 meso-scale bioregionalisation, available habitat data, social criteria and opportunism. The coastal compartments hierarchy could facilitate a more systematic approach with primary, secondary and tertiary coastal compartments providing a geomorphic basis for sub-regionalisation of the existing national-scale IMCRA bioregions, as suggested in IMCRA v3.3 and v4 (Figure 9). The distribution of Marine Conservation Reserves and the reserve system proposed by Wilson *et al*. (1994) are mapped against the primary and secondary compartments for the State's coastal regions in Figure 10. In conjunction with knowledge of hydrography, bathymetry, and oceanography of areas, and of key species' distributions, coastal compartments may be used for planning of MPA's, ensuring CAR planning of no-take areas that capture community-level habitats across the sub-meso scale biogeographic zonation. They have already proved useful for the sub-regionalisation of an IMCRA bioregion in preparation of the draft South Coast Regional Marine Plan (DEC 2010) in ensuring CAR planning of no-take areas that capture community-level habitats. Use of the hierarchy of primary, secondary and tertiary compartments is determined by the planning objectives and directives, where primary and secondary compartments approximately correspond to micro-scale bioregions and the tertiary compartments with pica-scale bioregions. The potential applications are illustrated in Figure 11, in which the compartments have been applied to habitat mapping described by D'Adamo & Monty (1997) and the MPRA (2000) for the Jurien Bay Marine Park.

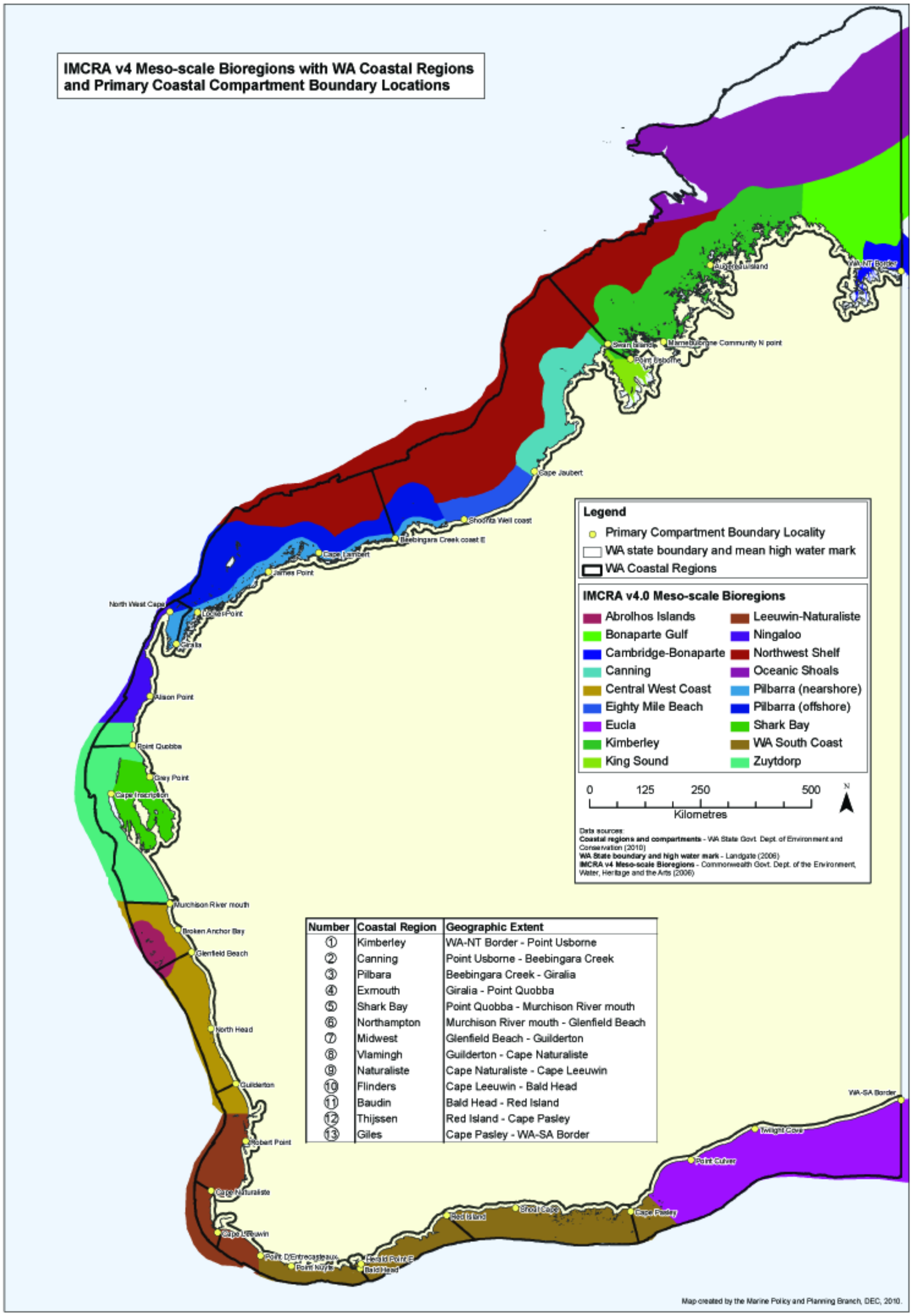

Figure 9: IMCRA Meso-scale Bioregions with WA Coastal Regions & Primary Compartments

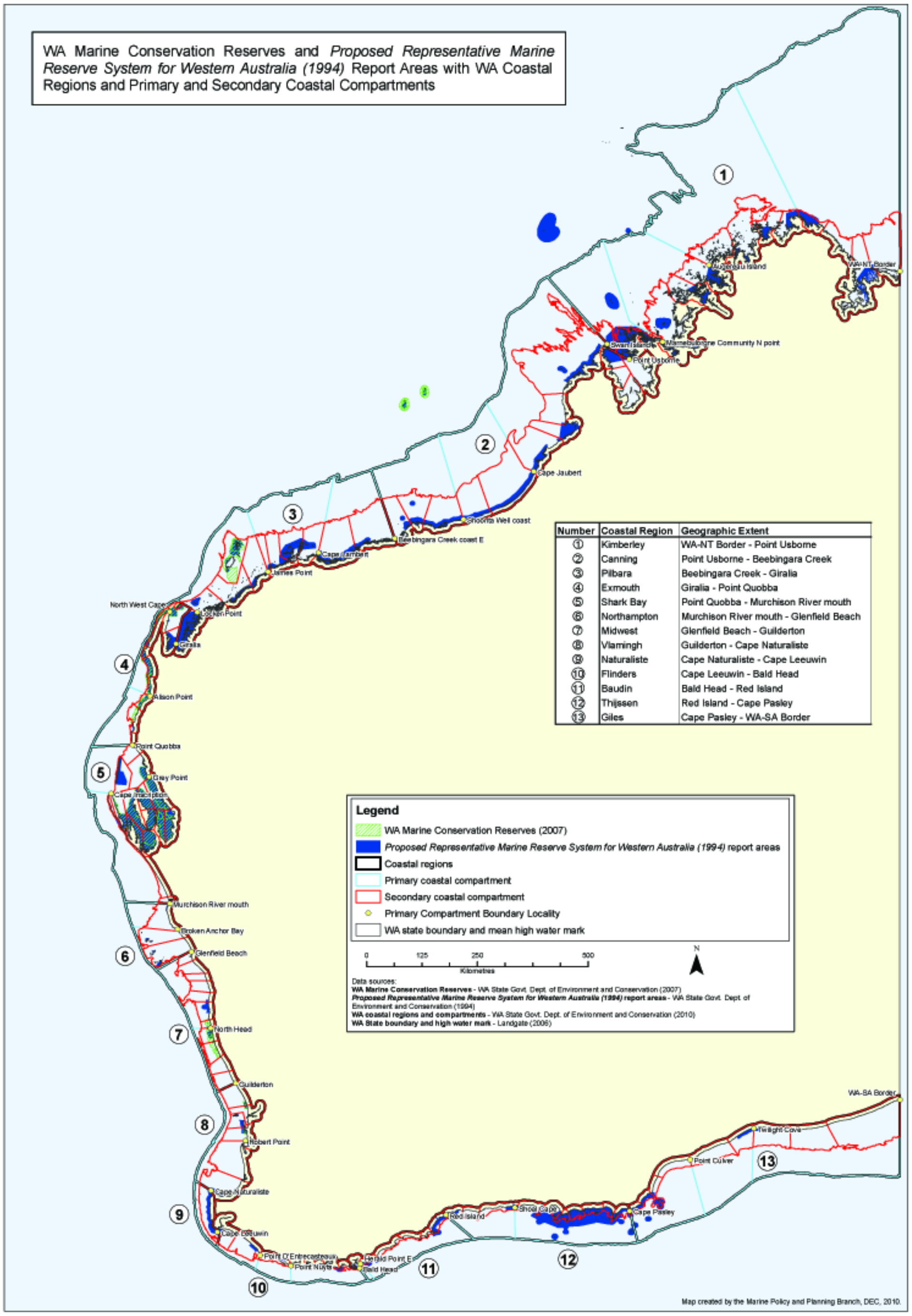

Figure 10: Marine Conservation Areas (Present & Proposed) with WA Coastal Compartments

The figure shows the *Proposed Representative Marine Reserve System for Western Australia (Wilson 1994)* Report areas with WA Regions and Primary and Secondary Coastal Compartments

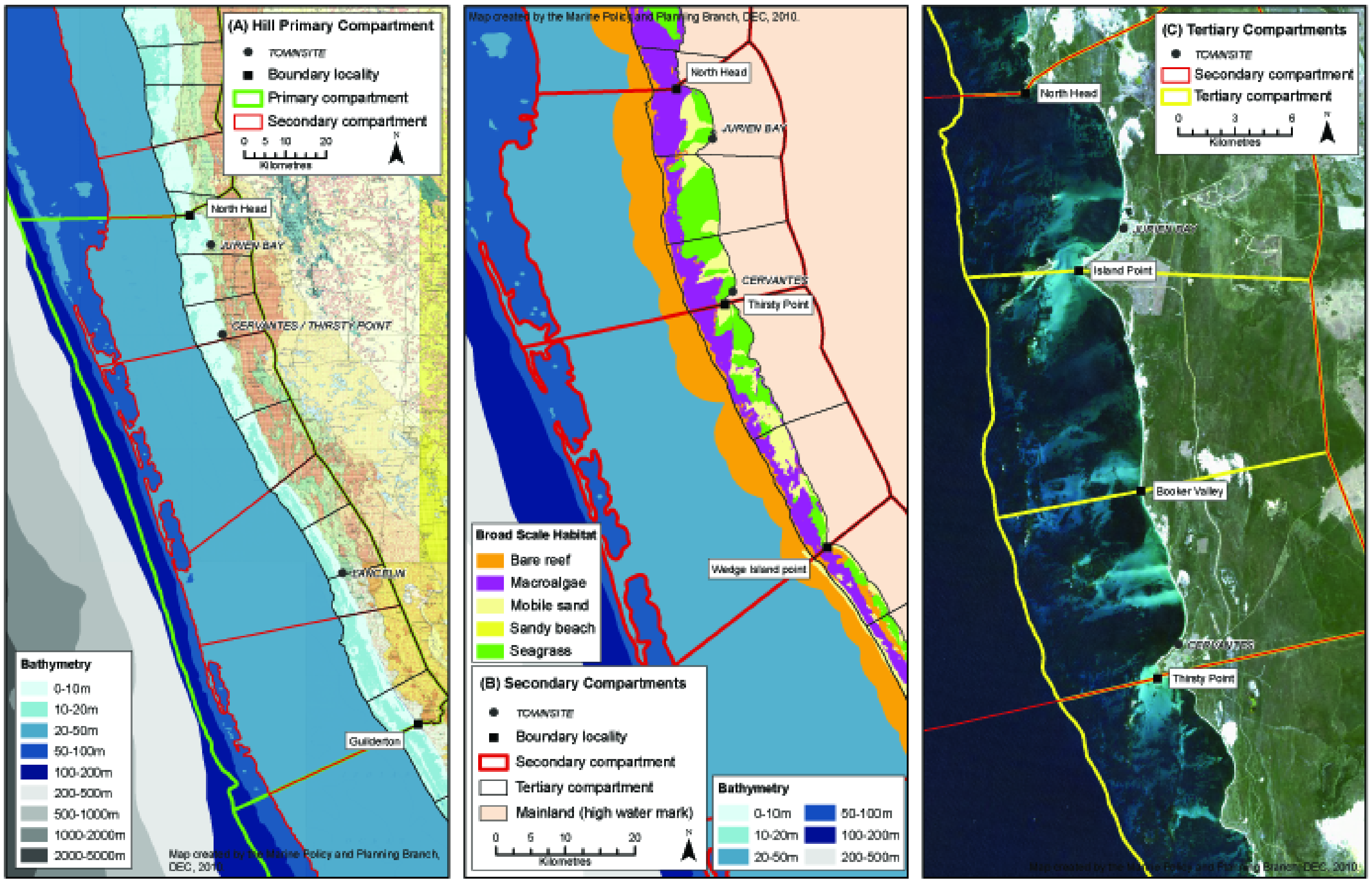

Figure 11: Mid-west coastal and marine planning and resource management Related at Primary, Secondary and Tertiary Scales

4.1.4. Ecosystem Based Fisheries Management

Ecosystem based fisheries management (EBFM) is part of an environmental management system which has ecologically sustainable development as its goal (WA Department of Fisheries 2010). EBFM '*deals with the aggregate management of all fisheries related activities within an ecosystem or bioregion*' under the Fish Resources Management Act 1994 (WA Department of Fisheries 2010). This creates a separation between what can and can't be managed: respectively the fisheries which are managed through a variety of strategies (Metcalf *et al*. 2009) and the physical environment in which the fisheries operate. The issue is further complicated by the bioregional scale at which fisheries are reportedly managed. It is a separation recognised by the Western Australian Department of Fisheries (DoF 2010) in a paper outlining the scope, rationale and framework for a new Aquatic Resources Management Act to replace the existing *Fish Resources Management Act* (1994).

A coastal ecosystem is an area of a variable size where the metocean conditions, plants, animals and the landscape (or seascape) that supports them all interact. The stress in this definition is on the interaction between all its parts. Alteration of one element of the system will have consequences for all other elements. However, the system response to disruptive change depends on the degree of alteration to the driving component s and the direction of feedback between it and the other components parts. The fastest response is driven by the greatest disruption. Although it may be obscure in current fisheries legislation, the structure of ecosystems is implicit in identification of essential life habitats through the Australian Government EPBC Act (1999), State EP Act (1986) and State EPA (2004) guidance statements and underpins the sustainability of natural marine resources. In this context, linking fisheries and habitat management is a challenge for sustainability of the resources being managed.

Although it may involve a new level of complexity, there is scope for management of separate fisheries to be considered at different biophysical scales. This is already being done through the use of quasi-compartments for the declaration of Fish Habitat Protection Areas, such as those at Miaboola Beach, Carnarvon and Shark Bay (Figure 12).The wider application of a broader management approach based on coastal compartments has potential to strengthen integration of fisheries and habitats in the management process. It may also lead to a change in the way in which decisions regarding the allocation and use of marine biological resources and result in a more sustainable use of the marine environment. The relative proportion of the type of fishery likely to be most significant at each scale is illustrated qualitatively in Figure 13.

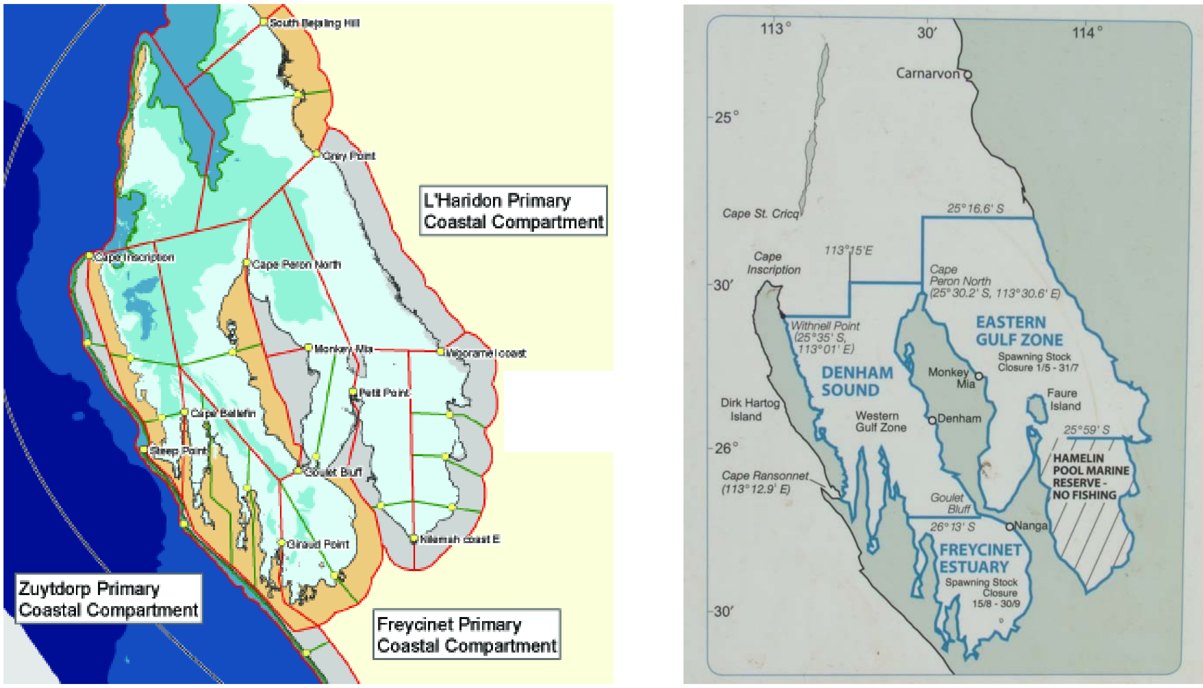

Figure 12: Compartments and Fisheries management areas in Shark Bay as shown on signs

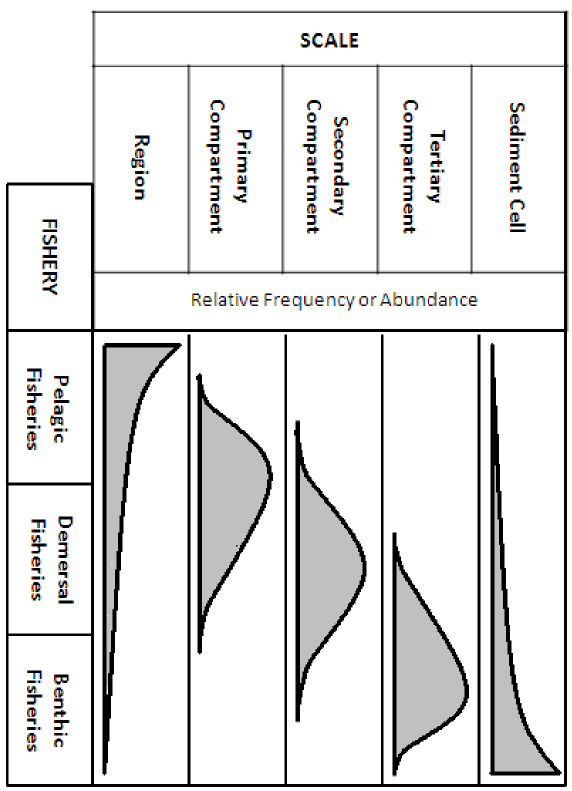

Figure 13: Proportion of fishery likely to be most significant at each scale

4.2. Coastal Planning

Direction for coastal planning and management by the State and Local Government is provided in the Coastal Zone Management Policy for Western Australia (WAPC 2001). The policy supports strategic objectives for environmental, community, economic, infrastructure and regional development interests; particularly through the recognition of natural hazards and minimisation of risk to people and property. Application of coastal zone management is mainly directed through the State Coastal Planning Policy SPP No. 2.6 (WAPC 2003) and the Coastal Protection Policy (DPI 2008). These policies contain specific reference to incorporation of coastal landforms and marine processes in coastal planning and management. The reference provides a direct link to the hierarchy of coastal compartments and, through them to coastal planning at all levels.

The State Coastal Planning Policy (SPP 2.6) promotes the establishment of coastal setbacks and foreshore reserves to achieve strategic objectives, with focus on the following:

- *Recognition of the dynamic nature of coastal environments and the consequences for coastal development and use.*
- *Avoidance or mitigation of the impacts of natural hazards through intelligent siting and design of infrastructure, based on ongoing scientific research.*

Through the State Coastal Planning Policy SPP 2.6 (WAPC 2003) and the Coastal Protection Policy (DPI 2008) it is recognised that land developments may be adversely affected by a range of physical processes occurring at the coast, with three of the most common being:

- Coastal erosion or accretion;
- Coastal flooding; and
- Coastal landform instability.

In the State Coastal Planning Policy SPP 2.6 (WAPC 2003) coastal flooding refers to the submergence of coastal lowland by marine incursion as well as flooding by rivers and streams. The two processes are not differentiated.

A general method for calculating a horizontal setback allowance for coastal erosion is outlined in SPP 2.6. The principles of recognising coastal dynamics and avoiding adverse impacts are incorporated in the policy. They are relevant for assessment of flooding and landform instability. Their applications are site specific, but loosely entrain consideration of the susceptibility of each site to potential change and its current state of stability. Typically applications of SPP 2.6 include identification of minimum development levels, or minimum reserve widths to cater for shoreline movement and changes in sand dune formations.

Where use of wide setbacks is not practical or subsequent shoreline change has significantly reduced a setback allowance the Coastal Protection Policy (DPI 2008) allows for development of protective structures. However, clear justification for protective works is required, and unacceptable adverse environmental, social or financial impacts to neighbouring areas must be avoided. Within this context, the effects of sand impoundment by a protective structure must be considered:

- "*The natural supply of littoral sand is a resource shared by all West Australians. Accordingly, those benefiting from future works or developments that change the natural supply of sand along the coast shall compensate for the change to that supply...*"

These points are significant in two respects. First, coastal development should not be proposed in areas where there is a high probability of adverse environmental and other impacts occurring that would require installation of protective works in the projected 'life' of the proposed development, especially on 'green field' sites. Second, the requirement to consider the impact of proposed development on sand impoundment necessitates determination of the coastal sediment budget at a scale commensurate with the scale of the proposed development.

The hierarchy of coastal compartments and sediment cells is intended to provide a natural framework with potential for a variety of applications in coastal planning and management. Under the policy and guidelines provided by the State Government, possible applications depend on the information linked with the compartments and cells as overlays or tables for comparative and other purposes. Potentially, applications range from structured audits of coastal population associated with individual landform systems, infrastructure, beach use and tourism activities to comparative assessment of different parts of the coast to geographically different hazards and risks. Compartments and cells may be populated with information at the user's discretion and at appropriate scales. Hence the examples below which focus on coastal planning policy and coastal vulnerability should be regarded as indicative only. For example Table 6 identifies the relative vulnerability of different barrier systems to change in metocean conditions. Barriers are accumulations of sand deposited at the shoreface over a discrete period of geological time and comprising characteristic assemblages of landforms such as parabolic dunes and blowouts. Their vulnerability is a combination of structural susceptibility to environmental change and the condition, the relative stability of the landforms they support. Vulnerability is defined in more detail below.

Table 5: Susceptibility of barrier systems on a rocky and sandy coast to environmental change & indicators of the present instability of landforms comprising the barriers

LANDFORM SYSTEM	SUSCEPTIBILITY (Potential future change of structure)			INSTABILITY (Present changes to landforms and surface of structure)		
Barrier [1]	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Episodic Transgressive	High (>20m), Wide (>1km) barrier. Mainland barrier overlying continuous bedrock surface	Moderate Height (10m to <20m). Width 0.5 to 1.0km. n discontinuous bedrock surface	Low (<10m) Narrow (<0.5km) Mainland barrier on unconsolidated sediments	Higher than 80% vegetation cover on dune sequence	20 to 80% vegetation cover on dune sequence	Less than 20% vegetation cover on dune sequence Mobile sand sheets are present
Prograded	High (>5m) & Wide (>1km) Mainland barrier overlying continuous bedrock surface	Moderate height (2 to 5m) & width (0.5 to 1km) Mainland barrier on discontinuous bedrock surface	Low (<2m) and Narrow (<0.5) land system Mainland barrier on unconsolidated sediments	Higher than 80% vegetation cover on dune sequence	20 to 80% vegetation cove on dune sequence. Frontal ridge includes active blowouts s	Less than 20% vegetation cover on dune sequence mainly comprised of small hummocky dunes
Stationary	High (>10m) & Wide (>1km) Mainland barrier overlying continuous bedrock surface	Moderate height (5 to 10m) & width (0.5 to 1km) on discontinuous bedrock surface.	Low (<5m) and Narrow (<0.5) Lagoonal sediments outcrop along the beach	Higher than 80% vegetation cover on dune sequence	20 to 80% vegetation cove on dune sequence That includes active blowouts s	Less than 20% vegetation cover on of small nested blowout dunes
Eroded	Not applicable	Low (<5m) and Narrow (<0.5) Overlies discontinuous bedrock surface outcropping along the beach.	Low (<5m) and Narrow (<0.5) Mainland barrier with lagoonal sediments outcropping at beach	Vegetated frontal dunes on bedrock outcropping as a continuous , >2m high pavement or platform along the beach	Mobile blowouts over discontinuous outcrops of lagoonal sediments, beachrock, or <1m high rock platform along the beach	Numerous mobile blowouts over discontinuous outcrops of weakly cemented lagoonal sediments or beachrock.
Subtidal sand sheet	Not applicable	Not applicable	Mobile sand sheet in nearshore zone	Not applicable	Patch reef with mobile sand sheets	Mobile sand sheet in the inshore zone

4.2.1. *Specification of Landforms in the State Coastal Planning Policy SPP 2.6*

In a landuse planning context the hierarchy of coastal compartments provides a spatially and regionally consistent framework for interpretation of the SPP 2.6 Guidelines, although the specific geologic and geomorphologic settings vary around the coast. Physical features and coastal types are common to both the policy and compartmental framework. The compartmental hierarchy could be developed as an annotated atlas based solely on topography and landforms described at several spatial scales, each of which accords with the hierarchical planning scales described by the WAPC (2006) and is directly relevant to marine and coastal planning and management. In the State Coastal Planning Policy (SPP 2.6) guidelines the advised setback to development is *determined with regard to physical or biological features of the different coastal types*. Four types of landforms (sandy shoreline, mobile dune systems, rock coast and cyclonic storm inundation areas), and one vegetation community (mangroves) are listed in the SPP 2.6 Guidelines (Table 6).

Table 6: Existing Schedule 1, Section C of State Coastal Planning Policy SPP 2.6 (WAPC 2003)

SCHEDULE 1, SECTION C – SETBACK DELINEATION
C1 Sandy Shorelines / Mobile Dunal Systems
HSD = The line indicating the landward limit of annual beach change
C2 Rock Shorelines
HSD = case-by-case assessment based on the normalised alignment of the landward limit of sea action
C3 Low Energy Mangrove Shorelines
HSD = normalised landward extent of annual inundation by ocean tides, marine mangrove species and areas of salt marsh based on historical data
C4 Cyclonic Storm Inundation Areas
HSD = Determined by a storm surge evaluation as discussed in Section F.4 of this Schedule

This mixture of physical process, morphology and biology is not altogether clear although some clarification is provided in notes forming part of the guidelines. The two aspects of the marine and coastal environment, metocean processes and biota, entrained in the policy mix require consideration for planning and management for different reasons and have application to all types of coast, including some not currently listed in SPP 2.6. Hence the metocean processes and biotic factors should be treated separately and applied to a more complete list of coastal landforms. The guidelines also could be improved by incorporation of interpretive notes and policy statements as attachments to guidelines that can be updated as required by a responsible agency.

Under Schedule 1, Section C of the Policy Guidelines a horizontal setback allowance between the vegetation line and proposed development is determined with regard to the physical features of different coastal types (WAPC 2006). In this respect, the guidelines specify key landform systems for consideration under the policy. The distribution of those landform systems and the landforms comprising them characterise the coastal compartments around the State and identify particular planning and management approaches applicable in each region. Although potential use of a compartment framework for coastal planning and management in Western Australia is compatible with the existing approach, some rewording of the guidelines is recommended. Further, there is a need to clarify the nomenclature applied and establish descriptions of landforms that are pertinent and specific to each level in the hierarchy.

4.2.2. Recommended Modification of the State Coastal Planning Policy SPP 2.6

At present Schedule 1, Section C of the State Coastal Planning Policy (SPP 2.6) recognises two coastal landform systems, sandy shores and rocky shores, as well as several coastal processes. Although it is a mixture of landform, biology and process the policy is in essence precautionary in principle and based on a limited range of potential coastal hazards. To broaden the policy and account for other coastal systems not currently covered by the policy it is recommended the planning guidelines relate specifically to landform units. Further, it is recommended the planning guidelines are interpreted in relation to environmental guidelines provided by other agencies, particularly the Department of Transport and the Department of Environment and Conservation.

The recommended SPP 2.6 Guidelines would then read as indicated in Table 8 below:

Table 7: Recommended modifications to Schedule 1, Section C of SPP 2.6
The modifications are proposed to facilitate close focus on coastal landforms and the processes affecting them

SCHEDULE 1, SECTION C – SETBACK DELINEATION
C1 Sandy Beaches and Dunes Landform Units: Barrier systems; coastal plan form; beach type Setback depends on coastal plan form, barrier type & susceptibility to change, beach& dune stability
C2 Rocky Coast Landform Units: Coastal plan form; cliffs & bluffs for different rock types Setback depends on geotechnical information and modelling of changes in coastal plan form
C3 Mixed Sand and Rock Coast Landform Units: Coastal plan form (tombolos, cuspate forelands & salients); perched beaches Setback depends on geotechnical information and models adjusted to describe 3D beach change
C4 Coastal Lowlands Landform Units: Coastal plan form; river deltas and outwash plains, sand flats, mudflats & saltflats Setback based on projected changes to coastal plan form, storm surge inundation & flooding
C5 Estuaries Landform units: Landforms (C1 to C4) associated with the tidal reaches of rivers, rias & estuaries Setback based on guidelines provided by relevant management authorities (DoW).
C6 Islands Landform units: Landforms (C1 to C5) associated with the tidal reaches of rivers & estuaries Setback based on C1 to C4 guidelines or provided by relevant management authorities (DEC and DoF).

Within the Policy, guidelines for HSD may be based on specific landforms contained within the compartments. These would need representation in tables to direct the application. Some examples follow. Examples which may be applied to sandy and rocky coast are provided in Tables 9 and 10.

Table 8: Sandy Beaches and Dunes

State Planning Policy Section C1
Refer to Guidelines related to Sea Level Change & Coastal Response as well as those required for description of Extreme Storm Events and Protection of Sea Grass Meadows (EPA Guideline 29)

COMPARTMENT	LANDFORM	HSD
Primary (Regional strategies)	Unconsolidated sandy coast	Not relevant at this scale
Secondary (Sub-regional plans)	Barrier type & dune formations	Indicates long-term trend
Tertiary (Local & site plans)	Geomorphic features (eg. tombolos & salients) & beach type (exposed and fetch restricted)	Based on the type of beach, the line indicating the landward limit of annual beach change
Sediment Cells (Local & site plans)	Beach type on exposed and fetch restricted shore.	As above but based on position in the sediment cell (Source, transport or sink areas) and demonstrated change in the shoreline position

Table 9: Rocky Coast

State Planning Policy Section C2
Refer to Guidelines interpreting Coastal Geology as well as those required for description of Extreme Storm Events and Protection of Mangrove Vegetation (EPA Guideline 29)

COMPARTMENT	LANDFORM	HSD
Primary (Regional strategies)	Unspecified rocky coast	Not relevant at this scale
Secondary (Sub-regional plans)	Rock type	Indicates long-term trend
Tertiary (Local & site plans)	Landforms comprising the geologic framework (eg headlands and promontories, inshore reefs and outcrops)	Calculated from the line indicating the landward limit of apparent erosion on soft coast. The shoreline is the HSD on hard rock coast (eg. granite)
Sediment Cells (Local & site plans)	Features on soft sedimentary rocks (eg cliffs, colluvial slopes & fractures)	As above but additionally depends on geotechnical information and modelling of changes in coastal plan shape

4.2.3. Recommended Additions to Policy Guidelines

One objective in the approach outlined above is to provide direction to relevant guidelines for coastal development and management at the time planning for a 'green field' site is initiated. The approach provides a checklist as much as instruction on calculation of setback. Guidelines linked to the current State Planning Policy (SPP2.6) include guidelines for the protection of benthic primary producer habitats published by the Environmental Protection Authority (2004). Similarly, the Department of Transport, previously part of the Department for Planning and Infrastructure, provided an overview of its roles and responsibilities in coastal management (DPI 2008). A more comprehensive listing of ancillary guidelines and their subject matters is beyond the ambit of this report. However such a list would include guidelines such as those of the Environmental Protection Authority (EPA 2001). Their addition would enhance application of the coastal planning policy, particularly to green field sites. The relevance of each set of advice to a particular section of coast could be incorporated in the framework where appropriate and the guidelines reviewed and updated regularly by the responsible agency.

4.3. Coastal Vulnerability Assessment

An arbitrary classification of landform vulnerability may be based on comparison of coastal and marine landform systems and their component landforms represented in the compartments. Identification of the land systems follows a procedure similar to that originally described for terrestrial environments by Stewart & Christian (1953) and more recently by McDonald *et al*. (1990) and van Gool *et al*. (2005). The approach and effects of map scale on land resource mappingin Western Australia have been reviewed by van Gool *et al*. (2005). They identified a hierarchy of soil-landscape mapping units for land resource surveys in the agricultural south-west that has been adopted by the Department of Agriculture in order to maintain a consistent approach with the different mapping scales and varying levels of complexity in both landscape and soil patterns. The coastal regions, primary, secondary and tertiary coastal compartments described in this report approximate the provinces, zones, systems and subsystems described by van Gool *et al*. (2005) in that they identify areas respectively characterised by regional scale geology, geologic and geomorphologic structures, landform patterns, individual landforms and landform components.

Together the State Coastal Planning Policy SPP 2.6 (WAPC 2003) and the Coastal Protection Policy (DPI 2008) provide rationale for a multi-scalar approach based on identification of coastal landforms at each scale and the processes affecting them. The hierarchical structure described above presents an up and down scaling framework to which a consistent methodology may be applied at all scales. The land systems approach is applicable to examination of environmental risk associated with the vulnerability of geologic and geomorphic structures to possible future change as well as description of the current stability of the individual landforms they support. Herein this is referred to as *indicative vulnerability*. Potential use of the hierarchy of compartments for vulnerability assessment advisedly requires the actions and requirements indicated in Table 11, some of which remain to be formally agreed by Government and non-government organisations.

At a primary level sections of rocky coast are less susceptible to change than sandy reaches along the shore and hence the distinction between sandy and rocky coast in SPP 2.6. However, the relationship between the geologic framework and overlying sandy landforms is often complex, as it is for most of the Western Australian coast. The diversity of possible coastal responses to changes in the metocean regime warrants consideration of the susceptibility of geologic and geomorphologic structures to long-term changes in environmental conditions, as well as identification of short –term change in the condition landforms which are inherently unstable. The distinction is between the large-scale structural changes occurring over decades and longer and more detailed changes taking place to landforms on the surface of the larger structures. Together these comprise the overall stability of different coastal compartments at all scales and define their vulnerability.

Herein, *susceptibility* identifies *potential* land system or large-scale landform change over a planning horizon of 100 years. It is expressed as the *likelihood* of future change at a broad structural scale. In contrast to this the stability of individual landforms essentially describes the present condition of the land surface. It describes landform change that is *currently* taking place and might be mitigated through management action. In the example above, landward migration of the dunes in response to destabilising processes may or may not alter the overall structure of the landform on which they have formed. The risk of a landform structurally altering in response to changes in metocean conditions, its vulnerability, is considered to be the sum of its susceptibility to change and its current state of stability. For example, the elevation of a rock surface in relation to sea level is a critical factor in determining the effects of natural fluctuations in sea level on overlying sand deposits 'perched' above the rock. In some circumstances coincidence of periods of higher than average sea level with storm surge and high waves may erode frontal dunes and trigger their instability. In such circumstances susceptibility to change and the instability of the sand deposit are clearly related

At any time scale, variations in weather conditions, sea level and the wave regime all impact on the coast in different ways that determine whether the coast tends to an accretionary or erosional state, or is relatively stable. Coastal change on unconsolidated sedimentary shores is a function of interaction between morphology, sediments and oceanographic processes, with alteration of any single factor impacting on the other two (Wright & Thom 1977). Hence shorelines of mobile sediment are almost constantly in a state of change, with the movement of waves and currents causing transport of sediment under all but the most quiescent conditions. This is also true for the mixed sand and rock coast around much of Western Australia rock, including the calcarenite Coastal Limestone, provides a significant framework at all scales. Although it provides a degree of protection, the rocky framework interacts with marine and coastal processes to affect the distribution of unconsolidated sandy sediments and gives rise to distinctive landforms such as shore salients, cuspate forelands, tombolos (Semeniuk *et al.* 1988; Sanderson & Eliot 1996; Brocx & Semeniuk 2010) and perched beaches (Semeniuk & Johnson 1985; Green 2008; da Silva 2010) linked to the interaction. Mixed sand and rock coasts are sufficiently common in Western Australia and may require separate consideration under the State Planning Policy (SPP 2.6).

Any final classification of landforms requires consensual agreement and ratification by the scientific community through structured analysis and description of major landform types. Hence, further refinement of the scheme may be achieved by comparing the different landforms common to each system. For example, a variety of coastal dune barriers have been identified from New South Wales by Roy (1984) and Roy *et al.* (1994). In an evolutionary context the disparate barrier types are indicative of different levels of susceptibility to structural change (Cowell *et al*. 1995; 2000). Although there are significant differences between the barriers of New South Wales and those in Western Australia, in Table 5 each type of barrier has been ranked for its vulnerability to change in metocean processes.

Landform *instability* is the present condition of the land surface, the erosive state of landforms. For example, it is visually apparent as sediment movement where fluctuation in the shoreline position results in widening of the beach as it accretes or destruction of the foredunes and the formation of cliffs when the beach is being eroded. Similarly it is apparent as the unvegetated proportion of a barrier as indicated by mobile blowouts, parabolic dunes and sand sheets. Instability is measureable and is the major factor used in calculation of set-back of development on the coast under SPP 2.6. In the context of this report instability is considered qualitatively to facilitate comparison of the stability of disparate landforms.

Susceptibility and stability are related concepts. If a landform system is susceptible to change then it is highly likely it is comprised of or supports unstable, mobile landforms. For example, an episodic transgressive barrier is comprised of nested blowouts, parabolic dunes and mobile sand sheets. Conversely, destabilisation of a landform system on a stable coast due to activation of dunes by an extreme erosional event, loss of a major source of sediment, or transport of sediment offshore may result in a change of the landform pattern and the structure of the land system. For example, barriers may be geologically short lived systems and undergo a change from progradational to erosional forms. The two concepts are linked through estimation of the vulnerability of a land system or landform to change. This is expressed as broad statement of the likelihood of environmental change. It may be applied as the first step in a risk analysis framework such as the ISO 31000 framework (Standards Australia 2009) following procedures used by Rollason et al. (2009) and Rollason & Haines (2011) to examine the likelihood of shoreline change under different projections of future rise in sea level at Coffs Harbour in NSW.

Erosion and accretion of sandy beaches are components of the coastal *sediment budget*. The changes are measurable and volumes of sediment may be estimated as part of a budgetary analysis of sediment movement through an identifiable *sediment cell.* Less apparent, but still measurable components of instability relate to sediment transport by marine processes, particularly those related to tidal fluctuation, wave action and nearshore current activity. In some parts of the coast the effects of marine processes are manifest as inter-annual, seasonal and higher-frequency change to the plan shape and/or profile of the shoreline.

Table 10: Indicative assessment of environmental vulnerability

Step	Action	Requirements
1	Identify the major marine and coastal landform assemblages at a scale relevant to the investigations;	Landforms appropriate to each scale in the hierarchy of compartments and for each region require expert agreement and incorporation in the guidelines for SPP 2.6.
2	Ascertain the potential susceptibility of the major landform assemblage to projected changes in metocean processes, particularly projected changes in sea level and the wave regime;	Indicative and comparative levels of susceptibility require establishment for the major landform assemblages in each region.
3	Determine the relative stability/instability of landform types (eg dune forms) comprising each of the major landform assemblages (eg barrier type) in each compartment.	Agreement needs to be reached on recognition of the relative stability of landforms for each coastal land system (eg. On episodic transgressive barriers low instability is associated with fully-vegetated dunes and high instability with bare, mobile sand sheets).
4	Prepare a vulnerability matrix based on the sum of susceptibility and instability ratings for each landform component of a coastal land system.	Tabulation of the comparative ratings of susceptibility and instability of structures and landforms within each compartment or sediment cell.
5	Map the total vulnerability for each compartment or cell.	At a stakeholder level agreement needs to be reached on recognition of the relative vulnerability attributed to each coastal land system and the ramifications of the indicative vulnerability to coastal land use and management.

5. SUMMARY AND CONCLUSIONS

A hierarchy of planning units based on natural coastal systems has been prepared from existing information, particularly descriptions of the geology and geomorphology of the Western Australian coast provided by AUSLIG (1993), AMSA (2006), Department of Environment and Heritage (2008), Department of Industry and Resources (2008), Geoscience Australia (2006), Google Earth (2008), Gozzard (2010), GSWA (2007), Landgate (2005), NASA (2010), Sharples (2007) and Sharples *et al*. (2009). The information obtained was used for identification of the boundaries of the compartments at each level in the hierarchy and to identify the landforms each compartment contained. The hierarchy of land systems is similar to that originally described for terrestrial environments by Christian & Stewart (1953) and more recently in Western Australia by van Gool *et al*. (2005). It accords with mapping scales commonly used for the preparation of statutory plans.

Three of the four objectives of the project were considered. These included objectives to:

1. Define the geologic framework controlling the structure of the coast at spatial scales currently used in coastal planning and management by State and Local Government authorities;
2. Identify marine and coastal landform units within each compartment according to existing geomorphologic classifications; and
3. Outline the potential use of the marine and coastal landform units in (a) natural resource management and conservation; (b) development of guidelines for implementation of the State Coastal Planning Policy (SPP2.6); and (c) comparative assessment of coastal vulnerability potentially affecting coastal infrastructure and coast protection measures.

The fourth objective, to indicate conceptual models describing the morphology and dynamics of each coastal land system, has been introduced in discussion of potential applications but requires further development and detail similar to that provided for barrier structures in Table 6. The extension is particularly relevant to further development of hazard and risk assessment to natural resources and coastal infrastructure.

In principle, the hierarchy of coastal compartments describes the underpinning structural control that geology exerts on all facets of the coastal environment. Logically, a spatial framework of planning units based on the geologic and geomorphic make up of the coast potentially provides the basis for a systematic approach to State planning in the coastal environment, including natural resource management and marine conservation planning. In the first instance, the hierarchy of coastal compartments provides a framework to comparatively assess information availability and plan future research/surveys of marine and coastal resources. The multi-scalar framework facilitates comparison and analyses of environmental data across and within each compartment level as well as between different levels within the hierarchy.

Potential uses of the marine and coastal landform units in (a) conservation under the CALM Act (1984) and natural resource management; (b) development of guidelines for implementation of the State Coastal Planning Policy - SPP2.6 (WAPC 2006); and (c) comparative assessment of coastal vulnerability were described. Further development of the project requires identification of the shoreface landforms within the tertiary compartments and a more detailed demonstration of potential applications.

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APPENDIX A BOUNDARIES OF REGIONS AND COMPARTMENTS

PRIMARY	SECONDARY	FROM_	TO	FROM_LONG	FROM_LAT	BOUND_DESC
BONAPARTE	WA-NT Border - East Cape Domett	WA-NT Border	East Cape Domett	129.000	-14.879	Jurisdictional boundary. E limit of tidal creek mangrove system at mouth of Keep River
BONAPARTE	East Cape Domett - Thurburn Bluff	East Cape Domett	Bare Hill	128.417	-14.795	Geomorphic feature: E bank at mouth of Ord River
BONAPARTE	East Cape Domett - Thurburn Bluff	Bare Hill	Thurburn Bluff	128.220	-14.718	Geomorphic feature: W bank at mouth of Ord River
BONAPARTE	Thurburn Bluff - Cape Bernier	Thurburn Bluff	Aunty Islet	128.032	-14.584	Geomorphic feature: Approximate N limit of deposition from Ord River
BONAPARTE	Thurburn Bluff - Cape Bernier	Aunty Islet	Elsie Island N	127.824	-14.397	Geomorphic feature: Approximate S limit of deposition from Berkeley River
BONAPARTE	Thurburn Bluff - Cape Bernier	Elsie Island N	Cape Bernier	127.666	-14.187	Geomorphic feature: Approximate N limit of deposition from Berkeley River
BONAPARTE	Cape Bernier - Cape Londonderry	Cape Bernier	Cape Rulhieres	127.467	-14.000	Geomorphic feature: coral platform & irregular embayments appear along the shore
BONAPARTE	Cape Bernier - Cape Londonderry	Cape Rulhieres	Un-named Head	127.355	-13.906	Geomorphic feature: beginning of irregular, deeply embayed coast with a N aspect
BONAPARTE	Cape Bernier - Cape Londonderry	Un-named Head	Cape Londonderry	127.081	-13.840	Geologic feature: boundary at W extent of irregular, deeply embayed coast
DRYSDALE	Cape Londonderry - Anjo	Cape Londonderry	Cape Talbot	126.961	-13.739	Geologic boundary & major change in aspect NE to NW
DRYSDALE	Cape Londonderry - Anjo	Cape Talbot	Drysdale River	126.743	-13.790	Major change in aspect NNW to WSW
DRYSDALE	Cape Londonderry - Anjo	Drysdale River	Anjo	126.707	-13.973	Geormorphic feature: embayment at S mouth of Drysdale River estuary
DRYSDALE	Anjo - Cape Bougainville	Anjo	Low Island Point	126.539	-13.933	Geologic feature: Peninsula separating Napier-Broome Bay and Vansittart Bay
DRYSDALE	Anjo - Cape Bougainville	Low Island Point	Cape Bougainville	126.297	-14.140	Geologic feature: separating NW from N trending shores in Vansittart Bay
DRYSDALE	Cape Bougainville - Davidsons Point	Cape Bougainville	Crystal Head	126.091	-13.895	Geologic feature: Peninsula separating Vansittart Bay and Admiralty Gulf
DRYSDALE	Cape Bougainville - Davidsons Point	Crystal Head	Davidsons Point	125.852	-14.457	Geologic feature: separating Port Warrender from Walmesley Bay in Admiralty Gulf
DRYSDALE	Davidsons Point - Augereau Island	Davidsons Point	Swift Bay	125.591	-14.244	Geologic feature: Head of peninsula separating Admiralty Gulf and Montague Sound
DRYSDALE	Davidsons Point - Augereau Island	Swift Bay	Combe Hill Point	125.585	-14.526	Geologic feature: separating W from irregularly embayed N facing shore
DRYSDALE	Davidsons Point - Augereau Island	Combe Hill Point	Augereau Island	125.367	-14.505	Geologic feature: Peninsula separating irregularly embayed N facing shore from shore facing NW
BROCKMAN	Augereau Island - Cape Wellington	Augereau Island	Anderdon Islands Point	125.124	-14.755	Geologic feature: Off Cape Pond, a promontory separating NW facing shore from irregularly embayed SW facing shore
BROCKMAN	Augereau Island - Cape Wellington	Anderdon Islands Point	Cape Torrens	125.187	-14.963	Geologic feature: Promontory on a point near SE Anderdon Islands on N shore of Prince Frederick Harbour in York Sound
BROCKMAN	Augereau Island - Cape Wellington	Cape Torrens	Cape Wellington	125.074	-14.976	Geologic feature: Peninsula separating Prince Frederick Harbour from Port Nelson
BROCKMAN	Cape Wellington - Battery Point	Cape Wellington	High Bluff	124.834	-15.158	Geologic feature: Peninsula separating York Sound from Brunswick Bay & the Saint George Basin
BROCKMAN	Cape Wellington - Battery Point	High Bluff	Battery Point	124.680	-15.254	Geologic feature: promontory separating Hanover Bay and Port George IV
BROCKMAN	Battery Point - Marnebulorgne Community N Point	Battery Point	Un-named Promontory	124.446	-15.503	Geologic boundary & major change in aspect from NW to W trending shore
BROCKMAN	Battery Point - Marnebulorgne Community N Point	Un-named Promontory	Raft Point	124.412	-15.877	Geologic feature: Un-named promontory N Lizard island at N entrance to Doubtful Bay
BROCKMAN	Battery Point - Marnebulorgne Community N Point	Raft Point	Shale Island	124.445	-16.065	Geologic feature: Peninsula at S entrance to Doubtful Bay
BROCKMAM	Battery Point - Marnebulorgne Community N Point	Shale Island	Marnebulorgne Community N point	124.340	-16.381	Geologic feature: Central part of promontory separating Walcott Inlet and Secure Bay
YAMPI	Marnebulorgne Community N Point - Nares Point	Marnebulorgne Community N point	Un-named Peninsular	124.180	-16.310	Geologic feature: Promontory on mainland SSE of Helipad Island & changing trend in shore from ENE to NNE facing
YAMPI	Marnebulorgne Community N Point - Nares Point	Un-named Peninsular	Nares Point	123.910	-16.211	Geologic feature: Peninsula at E entrance to Talbot Bay
YAMPI	Nares Point - Point Usborne	Nares Point	Conilurus Island	123.703	-16.129	Geologic feature: Peninsula separating Talbot Bay from Yampi Sound & the Buccaneer Archipelago
YAMPI	Nares Point - Point Usborne	Conilurus Island	Sir Richard Island	123.576	-16.147	Geologic feature: Island, approximate N beginning of deeply indented, NW/SE trending structural embayments
YAMPI	Nares Point - Point Usborne	Sir Richard Island	Point Usborne	123.471	-16.407	Geologic feature: Island, separating northern and southern parts of the Buccaneer Archipelago
KING SOUND	Point Usborne - Point Torment	Point Usborne	Helpman Island	123.502	-16.659	Major change in aspect from NW to SW trending shore with small embayments
KING SOUND	Point Usborne - Point Torment	Helpman Island	Meda River mouth spit SW	123.623	-16.689	Geologic boundary: Change from bedrock to sedimentary coast with extensive sand/mud flats
KING SOUND	Point Usborne - Point Torment	SW	Point Torment	123.796	-17.003	Geomorphic feature: Unconsolidated sedimentary shore facing SW
KING SOUND	Point Torment - Jangerie	Point Torment	Jangerie	123.590	-17.027	Geomorphic feature: Peninsula with aspect change to unconsolidated sedimentary shore facing W; eastern margin of Fitzroy River delta
KING SOUND	Jangerie - Cornambie Point	Jangerie	Malaburra Spring	123.384	-17.242	Geomorphic feature: Salient on unconsolidated sedimentary shore facing NE; western margin of Fitzroy River delta
KING SOUND	Jangerie - Cornambie Point	Malaburra Spring	Cornambie Point	123.278	-17.036	Geomorphic feature: Salient and change of aspect from NNE to NE
KING SOUND	Cornambie Point - Swan Island	Cornambie Point	Swan Island	123.174	-16.855	Geomorphic feature: Tombolo separating irregular (N) and smooth (S) shores

PRIMARY	SECONDARY	FROM_	TO	FROM_LONG	FROM_LAT	BOUND_DESC
PINDAN	Swan Island - Coulomb Point	Swan Island	Packer Island	123.046	-16.351	Major change in aspect from E to W facing coast
PINDAN	Swan Island - Coulomb Point	Packer Island	Chimney Rocks	122.779	-16.579	Geomorphiic feature: Tombolo separating Thomas Bay from Pender Bay
PINDAN	Swan Island - Coulomb Point	Chimney Rocks	Red Bluff	122.578	-16.762	Geologic feature: Promontory at Perpendicular Head separating Pender Bay and Beagle Bay
PINDAN	Swan Island - Coulomb Point	Red Bluff	Coulomb Point	122.318	-17.054	Geologic feature: Salient separating different drainage patterns on NW facing shore
PINDAN	Coulomb Point - Entrance Point	Coulomb Point	Cape Boileau	122.150	-17.356	Geological feature: Rocky salient and major change in aspect from NW to W facing coast
PINDAN	Coulomb Point - Entrance Point	Cape Boileau	Entrance Point	122.185	-17.669	Geomorphic feature: Spit
PINDAN	Entrance Point - Cape Villaret	Entrance Point	Cape Villaret	122.210	-18.009	Geologic feature: Major geologic boundary and change in coastal aspect
PINDAN	Cape Villaret - Cape Jaubert	Cape Villaret	Cape Gourdon	122.148	-18.290	Geologic feature: Major geologic boundary and change from consolidated to unconsolidated sediments
PINDAN	Cape Villaret - Cape Jaubert	Cape Gourdon	Saddle Hill	121.983	-18.404	Geologic feature: Boundary between mud flats and rocky coasts
PINDAN	Cape Villaret - Cape Jaubert	Saddle Hill	False Cape Bossut	121.824	-18.446	Geologic feature: promontory separating rocky embayed coasts from tidal creeks and mudflats
PINDAN	Cape Villaret - Cape Jaubert	False Cape Bossut	Tryon Point	121.729	-18.571	Geologic feature: marking a change in aspect from NW to WNW
PINDAN	Cape Villaret - Cape Jaubert	Tryon Point	Cape Jaubert	121.620	-18.742	Geologic feature: change from rocky coasts to infilled embayments
WALLAL	Cape Jaubert - Eighty Mile Beach Caravan Park NE	Cape Jaubert	Samphire bore coast	121.556	-18.940	Geologic feature and geomorphic boundary: Sandstone promontory and start of Eighty Mile Beach
WALLAL	Cape Jaubert - Eighty Mile Beach Caravan Park NE	Samphire bore coast	Eighty Mile Beach Caravan Park NE	121.170	-19.497	Aspect change from NW to NNW facing coast
WALLAL	Eighty Mile Beach Caravan Park NE - Shoonta Well	Eighty Mile Beach Caravan Park NE	Cooraidegel Well coast	120.675	-19.752	Geologic feature: Geological boundary, Cretaceous red quartz sands close to shore
WALLAL	Eighty Mile Beach Caravan Park NE - Shoonta Well	Cooraidegel Well coast	Shoonta Well	120.366	-19.858	Geomorphic feature: low amplitude salient associated with Cretaceous red quartz sands (Pindan) close to shore
DE GREY	Shoonta Well coast - Condini Landing	Shoonta Well coast	Cape Keraudren	120.133	-19.913	Geomorphic feature: low amplitude salient, western extent of Eighty Mile Beach, eastern extent of N aspect coast at primary level
DE GREY	Shoonta Well coast - Condini Landing	Cape Keraudren	Mulla Mulla Creek	119.770	-19.956	Geologic feature: Coastal carbonate sandstone promontory, separates large emabyment east from smaller embayments between coastal carbonate sandstone outcrops west, mangals west, aspect change from NNW to NW and N facing coasts
DE GREY	Shoonta Well coast - Condini Landing	Mulla Mulla Creek	Condini Landing	119.490	-20.018	Geologic feature: coastal carbonate sandstone outcrop separates larger bay east from smaller bays west; aspect change from N to NNE facing coast
DE GREY	Condini Landing - Yan Well coast	Condini Landing	Yan Well coast	119.316	-19.987	Geologic and geomorphic feature: calcarenite conglomerate outcropping close to shore and spit, defines easterm booundary of active De Grey River delta,
DE GREY	Yan Well coast - Beebingara Creek coast E	Yan Well coast	Wattle Well coast	119.076	-20.008	Geologic feature: calcarenite conglomerate outcropping close to shore defines western boundary of active De Grey River delta
DE GREY	Yan Well coast - Beebingara Creek coast E	Wattle Well coast	Beebingara Creek coast E	118.951	-20.136	Geomorphic boundary: southern margin of spit point foreland; transition from De Grey to tidal creek influence
ROEBURNE	Beebingara Creek coast E - Cape Cossigny	Beebingara Creek coast E	Turner River NE foreland	118.737	-20.298	Geologic feature and geomorphic boundary: calcarenite conglomerate outcropping close to shore separates embayed coast east from coast influenced by river catchments west; aspect changes from NW to N facing coast
ROEBURNE	Beebingara Creek coast E - Cape Cossigny	Turner River NE foreland	Cape Thouin	118.347	-20.327	Geologic feature: calcarentire conglomerate foreland separates two embayments
ROEBURNE	Beebingara Creek coast E - Cape Cossigny	Cape Thouin	Cape Cossigny	118.182	-20.336	Geologic feature and geomorphic boundary: calcarentire conglomerate headland separates river catchment and tidal creek dominated embayment east from sandy coast with beaches and dunes west; aspect change from N to NNW facing coast
ROEBURNE	Cape Cossigny - Cape Lambert	Cape Cossigny	Sherlock coast	117.940	-20.483	Geologic feature: calcarenite conglomerate outcropping close to shore; aspect change from NNW to NW facing coast
ROEBURNE	Cape Cossigny - Cape Lambert	Sherlock Coast	Cape Lambert	117.612	-20.675	Geologic feature: lithified coastal dunes on seaward margin of mud/sand flats and tidal creeks; aspect change from NW to N facing coast

PRIMARY	SECONDARY	FROM_	TO	FROM_LONG	FROM_LAT	BOUND_DESC
DAMPIER	Cape Lambert - Dolphin Island N point	Cape Lambert	Clearville coast	117.185	-20.592	Geologic feature: rocky promontory; aspect change from N to NNW facing coast
DAMPIER	Cape Lambert - Dolphin Island N point	Clearville coast	Karratha Back Beach E	116.977	-20.666	Geologic feature: rocky outcrop at eastern boundary of Nichol Bay; aspect change from NNW to NW facing coast
DAMPIER	Cape Lambert - Dolphin Island N point	Karratha Back Beach coast	Cinders Rd coast	116.884	-20.721	Geomorphic feature: small limestone salient; aspect change from NW to NE facing coast
DAMPIER	Cape Lambert - Dolphin Island N point	Cinders Rd coast	Dolphin Island N point	116.795	-20.649	Geologic boundary: Change from unconsolidated sediment E to rocky shore N an W; change in aspect from NE to ESE
DAMPIER	Dolphin Is N point - West Intercourse Island coast	Dolphin Island N point	West Intercourse Island coast	116.885	-20.423	Geologic feature: Rocky promontory on end of rocky peninsular at eastern limit of Dampier Archipelago coast; change in aspect from ESE to WNW facing coast
DAMPIER	West Intercourse Island coast - Cape Preston	West Intercourse Island coast	Pelican Point	116.581	-20.742	Geologic boundary: Change from rocky coast east to mud/sand flat coast with tidal creeks and river deltas west; aspect change from NW to NNW facing coast
DAMPIER	West Intercourse Island coast - Cape Preston	Pelican Point	Cape Preston	116.397	-20.823	Geologic feature and geomorphic boundary: Small peninsula at western boundary of Regnard Bay and eastern boundary of 40 Mile Beach; aspect change from NNW to N facing coast
BARROW	Cape Preston - Peter Creek coast E	Cape Preston	James Point	116.206	-20.832	Geologic feature: Basaltic promontory, regional geologic boundary between Archaen Pilbra Craton east and Phanerozoic Northern Carnarvon Basin west; aspect change from N to NW facing coast
BARROW	Cape Preston - Peter Creek coast E	James Point	Mount Salt coast W			Geologic feature: regional geologic boundary between Archaen Pilbra Craton east and Phanerozoic Northern Carnarvon Basin west; aspect change from WNW to NNW facing coast
BARROW	Cape Preston - Peter Creek coast E	Mount Salt coast W	Peter Creek coast E	115.915	-21.081	Geomorphic boundary, western point at mouth of tidal creek system, western boundary of lithified chenier and narrow lagoon, eastern boundary of broad mud flats with tidal creeks, aspect change from NW to WNW facing coast
BARROW	Peter Creek coast E - Coolgra Point W	Peter Creek coast E	Weld Island coast S	115.825	-21.242	Geomorphic feature: head of large shallow embayment, separates Fortescue River and Robe River deltas; aspect change from WNW to NNW facing coast
BARROW	Peter Creek coast E - Coolgra Point W	Weld Island coast S	Yardie Landing	115.552	-21.412	Geomorphic boundary: lithified chenier promontory, western boundary of shore parallel lithified cheniers cut by small tidal creeks; aspect change from NNW to NW facing coast
BARROW	Peter Creek coast E - Coolgra Point W	Yardie Landing	Coolgra Point W	115.382	-21.542	Geomorphic feature: north headland at mouth of Cane River, western boundary of extensive mud flats and large tidal creek system; aspect change from NW to NNW facing coast
BARROW	Coolgra Point W - Locker Point	Coolgra Point W	Hooley Creek coast	115.235	-21.566	Geomorphic boundary, chenier promontory at eastern margin of Onslow mud flats, sand barriers and sandy beaches
BARROW	Coolgra Point W - Locker Point	Hooley Creek coast	Baresand Point			Geomorphic feature: low amplitude salient, eastern extent of active Ashburton River delta; aspect change from NW to NNW facing coast
BARROW	Coolgra Point W - Locker Point	Baresand Point	Locker Point			Geomorphic feature: spit at western extent of active Ashburton River delta; aspect change from NNW to NW facing coast
EASTERN GULF	Locker Point - Giralia	Locker Point	Hope Point	114.723	-21.799	Geologic feature: salient separating NNW sandy coast from WNW muddy coast
EASTERN GULF	Locker Point - Giralia	Hope Point	Giralia	114.455	-22.164	Geologic feature: Rocky promontory separating more exposed northern shoreline from more protected southern section
WESTERN GULF	Giralia - Learmonth	Giralia	Point Lefroy	114.293	-22.437	Geologic feature: Major promontory separating east and west facing coasts; geomorphology changes from muddy to mixed sandy and rocky coast
WESTERN GULF	Giralia - Learmonth	Point Lefroy	Learmonth	114.178	-22.305	Geomorphic feature: Promontory at northern entrance to Gails Bay
WESTERN GULF	Learmonth - North West Cape	Learmonth	Shothole Canyon N	114.093	-22.204	Aspect change from NE to ESE facing coast
WESTERN GULF	Learmonth - North West Cape	Shothole Canyon N	Bundegi	114.116	-22.048	Geomorphic feature: Delta of Shothole Creek separates tidal creeks and mangroves from mixed sandy and rocky coast
WESTERN GULF	Learmonth - North West Cape	Bundegi	North West Cape	114.156	-21.855	Geologic boundary marking start of Holocene foreland complex
NINGALOO	North West Cape - Winderabandi Point	North West Cape	Vlamingh Head	114.165	-21.785	Major change of aspect from E to W facing coast
NINGALOO	North West Cape - Winderabandi Point	Vlamingh Head	Low Point	114.109	-21.803	Geologic feature: Boundary marking end of Holocene foreland complex; aspect change NNW to NW facing coast
NINGALOO	North West Cape - Winderabandi Point	Low Point	Osprey Bay	113.937	-21.971	Geomorphic feature: Change in offshore reef morphology and narrowing of lagoon; aspect change NW to WNW facing coast
NINGALOO	North West Cape - Winderabandi Point	Osprey Bay	Winderabandi Point	113.836	-22.241	Geomorphic feature: Change from continuous to discontinuous reef
NINGALOO	Winderabandi Point - Point Cloates	Winderabandi Point	Point Cloates	113.708	-22.495	Geomorphic feature: Tombolo, marks northern end of foreland complex
NINGALOO	Winderabandi Point - Point Maud	Point Cloates	Coast Hill	113.673	-22.720	Geomorphic feature: Tombolo, marks southern end of foreland complex; aspect change from W to WSW facing coast
NINGALOO	Winderabandi Point - Point Maud	Coast Hill	Point Maud	113.818	-22.925	Aspect change from WSW to WNW, marks southern extent of coast subject to parabolic blow outs

PRIMARY	SECONDARY	FROM_	TO	FROM_LONG	FROM_LAT	BOUND_DESC
MACLEOD	Point Maud - Alison Point	Point Maud	Alison Point	113.760	-23.122	Geomorphic feature: Tombolo marking change in aspect from WNW to W; narrowing of coastal lagoon south of Point Maude
MACLEOD	Alison Point - Gnaraloo Bay	Alison Point	Gnarraloo Bay	113.766	-23.494	Change in aspect form W to NW facing coast
MACLEOD	Gnaraloo Bay - Cape Cuvier	Gnarraloo Bay	Red Bluff	113.552	-23.766	Geomorphic feature: Closing of coastal lagoon and end of Ningaloo reef
MACLEOD	Gnaraloo Bay - Cape Cuvier	Red Bluff	Cape Cuvier	113.422	-24.043	Geologic feature: Promontory
MACLEOD	Cape Cuvier - Point Quobba	Cape Cuvier	Point Quobba	113.392	-24.223	Geologic feature: Salient separating southern straight coast from northern embayed coast
GASCOYNE	Point Quobba - South Bejaling Hill	Point Quobba	South Bejaling Hill	113.408	-24.491	Geologic feature: Salient separating W from SW facing coast
GASCOYNE	South Bejaling Hill - Grey Point	South Bejaling Hill	West Side Creek	113.569	-24.678	Geological feature: Boundary at northern extent of the active Gascoyne delta
GASCOYNE	South Bejaling Hill - Grey Point	West Side Creek	Grey Point	113.686	-24.930	Geologic feature: Boundary of remnant delta, southern extent of the active Gascoyne delta
LHARIDON	Grey Point - Worramel coast	Grey Point	Wooramel Coast	113.752	-25.131	Geologic feature: Boundary of remnant delta, northern end of Wooramel Bank
LHARIDON	Worramel coast - Nilemah coast E	Wooramel Coast	Hamelin Pool	114.174	-25.807	Geologic feature: Southern end of Wooramel Bank, northern boundary Faure Sill
LHARIDON	Worramel coast - Nilemah coast E	Hamelin Pool	Yaringa Point	114.207	-26.024	Geologic feature: southern boundary of Faure Sill
LHARIDON	Worramel coast - Nilemah coast E	Yaringa Point	Goat Point	114.191	-26.167	Geologic feature: Salient separating embayments
LHARIDON	Worramel coast - Nilemah coast E	Goat Point	Nilemah coast E	114.214	-26.342	Change in aspect from WSW to NW facing coast
LHARIDON	Nilemah coast E - Peron Point	Nilemah coast E	Booldah well	114.082	-26.446	Geomorphic feature: Head of Hamelin Pool; aspect change from NW to NE facing coast
LHARIDON	Nilemah coast E - Peron Point	Booldah Well	Peron Point	113.972	-26.336	Geomorphic feature: Change from a broad to a narrow shelf; aspect change from NE to E facing coast
LHARIDON	Peron Point - Monkey Mia	Peron Point	Taillefer Spit	113.874	-25.944	Geologic feature: Peninsular separating E and W facing coasts
LHARIDON	Peron Point - Monkey Mia	Taillefer Spit	Monkey Mia	113.750	-26.169	Geomorphic feature: Head of L'Haridon Bight, separating E and W facing coast
LHARIDON	Monkey Mia - Cape Peron North	Monkey Mia	Cape Peron North	113.722	-25.793	Geolomorphic feature: Northern boundary of Faure Sill; aspect change from E to ENE gacing coasts
FREYCINET	Cape Peron North - Goulet Bluff	Cape Peron North	Middle Bluff	113.511	-25.504	Geologic feature: northern end of Peron Peninular separating E and W facing coasts
FREYCINET	Cape Peron North - Goulet Bluff	Middle Bluff	Goulet Bluff	113.464	-25.811	Geomorphic feature: Salient separating broad and narrow subtidal terraces; aspect change from WNW to WSW facing coast
FREYCINET	Goulet Bluff - Giraud Point	Goulet Bluff	Fording Point	113.688	-26.216	Geologic feature: entrance to Henri Freycinet Harbour, geomorphic change from embayed to straight coast
FREYCINET	Goulet Bluff - Giraud Point	Fording Point	Giraud Point	113.811	-26.574	Geomorphic boundary: head of broad embayment change in aspect from W to NE facing embayed coasts, the latter with a markedly indented coast;
FREYCINET	Giraud Point - Cape Bellefin	Giraud Point	Cararang Peninsular N point	113.630	-26.463	Geologic feature: Peninsular separating disappointment Loop from Depuch Loop
FREYCINET	Giraud Point - Cape Bellefin	Cararang Peninsular N point	Cape Heirisson	113.514	-26.275	Geologic feature: Peninsular separating Depuch Loop from Brown Inlet
FREYCINET	Giraud Point - Cape Bellefin	Cape Heirisson	Cape Bellefin	113.362	-26.016	Geologic feature: Peninsular separating Freycinet Reach and Brown Inlet from Useless Inlet
FREYCINET	Cape Bellefin - Cape Inscription	Cape Bellefin	Tumbledown Point	113.299	-26.015	Geologic feature: Peninsular separating Useless Inlet form Blind Straight
FREYCINET	Cape Bellefin - Cape Inscription	Tumbledown Point	Herald Bay N	113.219	-26.035	Geologic feature: Western entrance to Blind Straight
FREYCINET	Cape Bellefin - Cape Inscription	Herald Bay N	Cape Inscription	113.112	-25.830	Geomorphic feature: Boundary at change from embayed coast to straighter coast with small cuspate forelands
ZUYTDORP	Cape Inscription - Steep Point	Cape Inscription	Quoin Head	112.971	-25.480	Geologic feature: Northern tip of Dirk Hartog Island; aspect change from ENE to W facing coast
ZUYTDORP	Cape Inscription - Steep Point	Quoin Head	Steep Point	112.967	-25.778	Geomorphic feature: Salient marking aspect change from W to WSW facing coast
ZUYTDORP	Steep Point - Nunginjay Spring coast N	Steep Point	Zuytdorp Point	113.159	-26.143	Geologic feature: entrance to Blind Straight
ZUYTDORP	Steep Point - Nunginjay Spring coast N	Zuytdorp Point	Kakura Dunes coast	113.296	-26.399	Geologic feature: Northern end of Zuytdorp Cliffs
ZUYTDORP	Steep Point - Nunginjay Spring coast N	Kakura Dunes coast	Nunginjay Spring coast N	113.715	-26.841	Geomorphic change: southern end of elongate parabolic dune field
ZUYTDORP	Nunginjay Spring coast N - Murchison River mouth	Nunginjay Spring coast N	Murchison River mouth	114.125	-27.574	Geologic feature: Southern end of Zuytdorp Cliffs
HUTT	Murchison River mouth - Broken Anchor Bay	Murchison River mouth	Bluff Point	114.160	-27.706	Geomorphic feature: River mouth; aspect change WSW to WNW facing coast
HUTT	Murchison River mouth - Broken Anchor Bay	Bluff Point	Shoal Point	114.105	-27.850	Geologic feature: southern margin of Tumblagooda Sandstone; change in aspect WNW to WSW facing coast
HUTT	Murchison River mouth - Broken Anchor Bay	Shoal Point	Broken Anchor Bay	114.175	-28.112	Change in aspect from WSW to SW facing coast
OAKAJEE	Broken Anchor Bay - Glenfield Beach	Broken Anchor Bay	Little Bay	114.322	-28.232	Change in aspect from SW to WSW facing coast, change in geomorphology northern extent of White Cliffs
OAKAJEE	Broken Anchor Bay - Glenfield Beach	Little Bay	Bowes River	114.409	-28.343	Geomorphic feature: boundary at southern extent of White Cliffs, northern limit of active dune field and coastal lagoons
OAKAJEE	Broken Anchor Bay - Glenfield Beach	Bowes River	Coronation Beach	114.454	-28.410	Geomorphic feature: boundary at Bowes River and southern limit of coastal lagoons and dune blowouts, influence of Northampton Complex
OAKAJEE	Broken Anchor Bay - Glenfield Beach	Coronation Beach	Glenfield Beach	114.564	-28.552	Geomorphic feature: change from low blowout activity in north to higher blowout activity in south; slight change in aspect

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BEAGLE	Glenfield Beach - Cape Burney	Glenfield Beach	Point Moore	114.606	-28.685	Geologic feature: boundary, of Northampton complex
BEAGLE	Glenfield Beach - Cape Burney	Point Moore	Cape Burney	114.576	-28.784	Geomorphic feature: salient separating WNW from WSW facing coast
BEAGLE	Cape Burney - 9 Mile Beach	Cape Burney	Phillips Rd coast	114.634	-28.868	Geomorphic feature: boundary marking change from embayed coast in N to straight coast with perched beaches and dunes in S
BEAGLE	Cape Burney - 9 Mile Beach	Phillips Rd coast	Head Butts	114.690	-28.934	Geomorphic feature: low amplitude foreland and northern extent of large active blowouts; slight change in aspect from WSW to SW, northern extent of large active blowouts
BEAGLE	Cape Burney - 9 Mile Beach	Head Butts	9 Mile Beach	114.802	-29.039	Geomorphic feature: low amplitude foreland
BEAGLE	9 Mile Beach - Leander Point	9 Mile Beach	Leander Point	114.874	-29.126	Geologic feature: Southern margin of rocky shore; change in aspect from SW to WSW facing coast
BEAGLE	Leander Point - Cliff Head	Leander Point	White Point	114.915	-29.276	Geologic feature: Rocky headland and northern extent of extensive parabolic dune fields
BEAGLE	Leander Point - Cliff Head	White Point	Cliff Head	114.956	-29.395	Geomorphic feature: salient separating embayments landward of Leander Reef
BEAGLE	Cliff Head - Illawong	Cliff Head	Illawong	114.997	-29.515	Change in aspect from WSW to WNW facing coast, geomorphic boundary between parabolic dune dominated N and coastal limestone dominated S
BEAGLE	Illawong - Green Head	Illawong	Coolimba	114.959	-29.701	Geologic feature: boundary between coastal limestone dominated north and unconsolidated sandy coast south; aspect change from WNW to W facing coast
BEAGLE	Illawong - Green Head	Coolimba	Leeman	114.979	-29.856	Geologic feature: boundary bewteen unconsolidated sandy coast north and coastal limestone dominated south; change in nearshore bathymetry and reef morphology
BEAGLE	Illawong - Green Head	Leeman	Green Head	114.974	-29.946	Geomorphic feature: change in nearshore bathymetry and reef morphology; and northern boundary of irregular embayed coast with tombolos and cuspate forelands;
BEAGLE	Green Head - North Head	Green Head	Sandy Point	114.963	-30.072	Geomorphic feature: cuspate foreland at north of a broad embayment; aspect change from WNW to WSW facing coast
BEAGLE	Green Head - North Head	Sandy Point	North Head	114.992	-30.183	Geomorphic feature: tombolo at boundary between broad embayment N and foreland complex S; aspect change from WSW to W facing coast
HILL	North Head - Thirsty Point (Cervantes)	North Head	Island Point (Jurien Bay)	114.995	-30.233	Geomorphic feature: tombolo marking southern extent of foreland complex and change to broad embayment S; aspect change from W to WSW facing coast
HILL	North Head - Thirsty Point (Cervantes)	Island Point (Jurien Bay)	Booker Valley	115.020	-30.317	Geomorphic feature: large cuspate foreland on extensive foredune plain
HILL	North Head - Thirsty Point (Cervantes)	Booker Valley	Thirsty Point (Cervantes)	115.050	-30.422	Geomorphic feature: salient
HILL	Thirsty Point (Cervantes) - Wedge Island point	Thirsty Point (Cervantes)	Grey	115.058	-30.511	Geomorphic feature: cuspate foreland at northern limit of large parabolic dunes overlying limestone to landward; aspect change from WSW to SW facing coast
HILL	Thirsty Point (Cervantes) - Wedge Island point	Grey	Wedge Island point	115.134	-30.667	Geologic feature: limestone promontory separating small salients on north coast from linear coast to the south
HILL	Wedge Island point - Ledge Point	Wedge Island point	Narrow Neck	115.190	-30.825	Geomorphic feature: cuspate foreland, northern limit of extensive active parabolic dunes at the coast
HILL	Wedge Island point - Ledge Point	Narrow Neck	Edward Island	115.268	-30.912	Geomorphic feature: cuspate foreland
HILL	Wedge Island point - Ledge Point	Edward Island	Ledge Point	115.326	-31.027	Geomorphic feature: cuspate foreland
HILL	Ledge Point - Guilderton	Ledge Point	Seabird	115.371	-31.110	Geomorphic feature: salient at southern extent of N trending dunes and northern extent of E trending dunes
HILL	Ledge Point - Guilderton	Seabird	Guilderton	115.440	-31.276	Geomorphic feature,:low amplitude salient; aspect change from WSW to SW facing coast
SWAN	Guilderton - Pinnaroo Point	Guilderton	Wreck Point (Two Rocks)	115.499	-31.354	Geomorphic feature: mouth of the Moore River
SWAN	Guilderton - Pinnaroo Point	Wreck Point (Two Rocks)	Quins Rocks	115.585	-31.502	Geomorphic feature: low amplitude salient
SWAN	Guilderton - Pinnaroo Point	Quins Rocks	Pinnaroo Point	115.691	-31.676	Geomorphic feature: low amplitude salient
SWAN	Pinnaroo Point - Challenger Beach	Pinnaroo Point	Swanbourne	115.728	-31.806	Geomorphic feature: low amplitude salient separating SW and W facing coast
SWAN	Pinnaroo Point - Challenger Beach	Swanbourne	Rous Head	115.752	-31.984	Geomorphic feature: boundary separating sandy coast N and mixed sand rock coast S; aspect change from W to WNW
SWAN	Pinnaroo Point - Challenger Beach	Rous Head	Challenger Beach	115.724	-32.054	Geologic feature: limestone headlands at mouth of Swan River and southern limit of exposed beaches; aspect change from WNW to WSW facing coast
SWAN	Challenger Beach - Robert Point	Challenger Beach	Cape Peron	115.775	-32.180	Geologic feature: boundary at northern extent of Rockingham - Becher plain; aspect change from WSW to NW facing coast
SWAN	Challenger Beach - Robert Point (Mandurah)	Cape Peron	Robert Point (Mandurah)	115.685	-32.267	Geomorphic feature: tombolo linking Rockingham - Becher plain to limeston and separating Mangles Bay from Shoalwater Bay; aspect change from NW to W facing coast

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GEOGRAPHE	Robert Point (Mandurah) -Point Casuarina (Bunbury)	Robert Point (Mandurah)	Cape Bouvard	115.702	-32.520	Geologic feature: limestone headland at southern extent of Rockingham - Becher plain; aspect change from W to NW facing coast
GEOGRAPHE	Robert Point (Mandurah) -Point Casuarina (Bunbury)	Cape Bouvard	Binningup	115.607	-32.685	Aspect change from NW to WSW, northern extent of high parabolic dunes
GEOGRAPHE	Robert Point (Mandurah) -Point Casuarina (Bunbury)	Binningup	Point Casuarina (Bunbury)	115.686	-33.146	Geomorphic feature: low amplitude salient tied to coastal limestone; break in active parabolic dunes overlying older dunes on limestone ridge; aspect change from WSW to W facing coast
GEOGRAPHE	Point Casuarina (Bunbury) - Cape Naturaliste	Point Casuarina (Bunbury)	Capel River mouth	115.636	-33.309	Geologic feature: Bunbury Basalt on coast; original entrance to Leschenault Inlet; aspect change from W to WNW facing coast
GEOGRAPHE	Point Casuarina (Bunbury) - Cape Naturaliste	Capel River mouth	Bussleton	115.518	-33.512	Geomorphic feature: Boundary between northern high to low dune ridge and southern estuarine lowlands; aspect change from WNW to NW
GEOGRAPHE	Point Casuarina (Bunbury) - Cape Naturaliste	Bussleton	Point Daking	115.350	-33.642	Aspect change from NW to NNE facing coast
GEOGRAPHE	Point Casuarina (Bunbury) - Cape Naturaliste	Point Daking	Cape Naturaliste	115.107	-33.604	Geologic feature: boundary separating sandy coast from embayed coast with rocky headlands; change in aspect from NNE to NE facing coast
NATURALISTE	Cape Naturaliste - Cape Leeuwin	Cape Naturaliste	Cape Clairault	115.004	-33.531	Geologic feature: Major promontory; change in aspect from NE to W facing coast
NATURALISTE	Cape Naturaliste - Cape Leeuwin	Cape Clairault	Cowaramup Point	114.975	-33.698	Geologic feature: promontory and southern extent of embayed coast with pocket beaches; aspect change from WNW to W facing coast
NATURALISTE	Cape Naturaliste - Cape Leeuwin	Cowaramup Point	Cape Freycinet	114.975	-33.864	Geologic feature: promontory; more limestone influence on coast with associated unconsolidated sediment to south
NATURALISTE	Cape Naturaliste - Cape Leeuwin	Cape Freycinet	Cosy Corner	114.991	-34.098	Geologic feature: granitic headland, northern extent of broad emabyed coast with beaches; aspect change from W to WSW facing coast
NATURALISTE	Cape Naturaliste - Cape Leeuwin	Cosy Corner	Cape Leeuwin	115.027	-34.257	Geologic feature: granitic headland; change in aspect from WSW to SW facing coast
DONNELLY	Cape Leeuwin - Black Point	Cape Leeuwin	Ledge Point	115.136	-34.377	Geologic feature: Major promontory; change in aspect from SW to SE facing coast
DONNELLY	Cape Leeuwin - Black Point	Ledge Point	Black Point	115.237	-34.310	Aspect change from SE to SSW facing coast
DONNELLY	Black Point - Point D'Entrecasteaux	Black Point	Donnelly River mouth SE	115.541	-34.423	Geologic feature: promontory of Bunbury Basalt separating large zeta formed embayments; change in aspect from SSW to SW facing coast
DONNELLY	Black Point - Point D'Entrecasteaux	Donnelly River mouth SE	Point D'Entrecasteaux	115.751	-34.545	Geologic feature: limestone cliffs marking transition to wider foredune plain of Warren Beach coast
BROKE	Point D'Entrecasteaux - West Cliff Point	Point D'Entrecasteaux	Granite Bar	116.003	-34.842	Geologic feature: promontory on limestone cliffed coast separating regional zeta from embayments; change in aspect from SW to SSW
BROKE	Point D'Entrecasteaux - West Cliff Point	Granite Bar	West Cliff Point	116.290	-34.900	Geologic feature: change from sandy beaches in west to limestone cliffs in east; aspect change from SSW to SW facing coast
BROKE	West Cliff Point - Point Nuyts	West Cliff Point	Cliffy Head			Geologic feature: change from sandy beaches in west to limestone cliffs in east, aspect change from SSW to SW facing coast
BROKE	West Cliff Point - Point Nuyts	Cliffy Head	Point Nuyts	116.382	-34.946	Geologic feature: granitic outcrop forming western boundary of large zeta formed bay, more irregular coast west; aspect change from SW to SSW facing coast
NULLAKI	Point Nuyts - Point Irwin	Point Nuyts	Rocky Head	116.630	-35.061	Geologic feature: promontory at beginning of multiple south facing zeta form embayments to the west; aspect change from SSW to S facing coast
NULLAKI	Point Nuyts - Point Irwin	Rocky Head	Blue Holes	116.746	-35.037	Geologic feature: promontory dividingrocky coast W from zeta fromed bay E
NULLAKI	Point Nuyts - Point Irwin	Blue Holes	Point Irwin	116.823	-35.040	Geologic feature: promontory dividing zeta formed bay W from rocky coast E
NULLAKI	Point Irwin - Stanley Island/Point Hillier	Point Irwin	Quarram Beach head E	116.923	-35.064	Geologic feature: promontory dividing Nornalup Inlet coast from Irwin Inlet coast; aspect change from S to SSE facing coast
NULLAKI	Point Irwin - Stanley Island/Point Hillier	Quarram Beach head E	Stanley Island/ Point Hillier	117.020	-35.036	Geologic feature: promontory at eastern limit of Foul Bay - Quarram Beach; aspect change from SSE to SSW facing coast
NULLAKI	Stanley Island/Point Hillier - Wilson Head	Stanley Island/Point Hillier	Wilson Head	117.154	-35.068	Geologic feature: promontory dividing Irwin Inlet coast from Parry Inlet coast; aspect change from SSW to S facing coast
NULLAKI	Wilson Head - Torbay Head	Wilson Head	Knapp Head	117.324	-35.044	Geologic feature: promontory dividing Parry Inlet coast form Wilson Inlet coast; aspect change from S to SSW facing coast
NULLAKI	Wilson Head - Torbay Head	Knapp Head	Torbay Head	117.485	-35.089	Geologic feature: promontory dividing SSW facing zeta- shaped bays
NULLAKI	Torbay Head - Bald Head	Torbay Head	Mutton Bird promontory	117.639	-35.135	Geologic feature: promontory dividing Wilson Inlet coast form Torbay Inlet coast; aspect change from SSW to SE facing coast
NULLAKI	Torbay Head - Bald Head	Mutton Bird promontory	Family Rocks	117.700	-35.052	Geologic feature: promontory dividing protected embayed coast with sandy beaches west from exposed zeta-shaped bay rocky coast with perched beaches E; aspect change from SE to SSW facing coast
NULLAKI	Torbay Head - Bald Head	Famliy Rocks	Bald Head	117.851	-35.097	Geologic feature: eastern boundary of zeta-shaped bay; aspect change from SSW to S facing coast

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ALBANY	Bald Head - Herald Point E	Bald Head	Possession Point W	118.021	-35.108	Geologic feature: granite promontory at the termination of multiple south facing zeta-form embayed coast to east; entrance to South Channel and King George Sound; aspect change from S to NE facing coast
ALBANY	Bald Head - Herald Point E	Possession Point W	King Point	117.918	-35.041	Geomorphic feature: tombolo marking entrance to Princess Royal Harbour
ALBANY	Bald Head - Herald Point E	King Point	Cheyne Head	117.920	-35.036	Geologic feature: granite promontory at entrance to Princess Royal Harbour, southern boundary of zeta-shaped Middleton Bay; aspect change to SE facing coast
ALBANY	Bald Head - Herald Point E	Cheyne Head	Herald Point E	117.962	-35.013	Geologic feature: granite promontory; aspect change from SE to S facing coast
CHEYNE	Herald Point E - Cape Vancouver	Herald Point E	Cape Vancouver	118.047	-35.015	Geologic feature: granitic headland at entrance to North Channel and King George Sound; separates Nannarup Beach embayment from the irregular, small, embayed coast E
CHEYNE	Cape Vancouver - Bald Island	Cape Vancouver	Normans Beach E	118.187	-35.025	Geologic feature: granitic outcrop and Pleistocene tombolo separating Nanarup Beach embayment form Two Peoples Bay; aspect change from S to ESE facing coast
CHEYNE	Cape Vancouver - Bald Island	Normans Beach E	Bald Island	118.255	-34.918	Geologic promontory, granitic, separates embayed coast west from irregular, rocky coast east, aspect change from SE to S facing coast
CHEYNE	Bald Island - Groper Bluff	Bald Island	Hassell Beach NE	118.480	-34.930	Geologic feature: granite promontory and Island separating smaller bay coast west from larger bay coast east; aspect change from S to SE facing coast
CHEYNE	Bald Island - Groper Bluff	Hassell Beach NE	Cape Riche	118.506	-34.726	Geologic feature: granite outcrop at eastern boundary of zeta-shaped bay; aspect change from SE to SSE facing coast
CHEYNE	Bald Island - Groper Bluff	Cape Riche	Groper Bluff	118.782	-34.609	Geologic feature: granitic headland at western boundary of zeta-shaped bay; aspect change from SSE to SE facing coast
CHEYNE	Groper Bluff - Cape Knob	Groper Bluff	Cape Knob	118.913	-34.503	Geologic feature: granite outcrop separating zeta-shaped bays; aspect change from SE to SSW facing coast
CHEYNE	Cape Knob - Point Hood	Cape Knob	Point Henry	119.242	-34.535	Geologic feature: granite promontory; aspect change from SSW to SSE facing coast
CHEYNE	Point Hood - Red Island	Point Henry	Point Hood	119.382	-34.485	Geologic feature: granite promontory separating Dillon Bay from Bremer Bay
CHEYNE	Point Hood - Red Island	Point Hood	Point Ann	119.577	-34.386	Geologic feature: granite promontory at western boundary of zeta-shaped bay; aspect change from SSE to ESE facing coast
CHEYNE	Point Hood - Red Island	Point Ann	Red Island	119.588	-34.171	Geologic feature: granite outcrop separating large zeta-shaped bay south-west from smaller zeta-shaped bays north-east; aspect change from ESE to SE facing coast
MUNGLINUP	Red Island - Mary Ann Point	Red Island	Edwards Point	119.776	-34.029	Geologic feature, granite salient; aspect change form SE to SSE facing coast, primary aspect change from SE:to S facing compartment coast
MUNGLINUP	Red Island - Mary Ann Point	Edwards Point	Mary Ann Point	119.929	-33.977	Geologic feature: granite outcrop; aspect change from SSE to S facing coast
MUNGLINUP	Mary Ann Point - Mason Bay	Mary Ann Point	Mason Bay	120.123	-33.952	Geologic feature: limestone foreland and dunes separating Culham Inlet coast from straighter limestone dominated Jerdacuttup Lakes coast
MUNGLINUP	Mason Bay - Shoal Cape	Mason Bay	Munglinup Point	120.460	-33.965	Geologic feature: granite outcrop at western boundary of more irregular coast; aspect change from S to SSE facing coast
MUNGLINUP	Mason Bay - Shoal Cape	Munglinup Point	Shoal Cape	120.813	-33.893	Geologic feature: granite outcrop; aspect change from SSE to S facing coast
RECHERCHE	Shoal Cape - Observatory Point	Shoal Cape	Coomalbidgup	121.177	-33.878	Geologic feature: granite promontory separating shallow SSE and SSW facing embayments; western extent of Recherche Archipelago influence at primary scale
RECHERCHE	Shoal Cape - Observatory Point	Coomalbidgup	Observatory Point	121.506	-33.840	Geologic feature: granite outcrop; asect change from S to SSW facing coast
RECHERCHE	Observatory Point - Cape Le Grand	Observatory Point	Dempster Head	121.795	-33.909	Geologic feature: granite outcrop separating larger bays west from smaller bays west; aspect change from SSW to SSE facing coast
RECHERCHE	Observatory Point - Cape Le Grand	Dempster Head	Wylie Head	121.899	-33.872	Geologic feature: granite outcrop separating smaller more exposed bays west from larger more protected bay east; western extent of coastal engineering
RECHERCHE	Observatory Point - Cape Le Grand	Wylie Head	Cape Le Grand	121.983	-33.841	Geologic feature, granite outcrop, aspect change from SSE to SW facing shore
RECHERCHE	Cape Le Grand - Mississippi Point	Cape Le Grand	Mississippi Point	122.092	-33.993	Geologic feature: granite promontory separating large embayment west from rocky coast with small embayments east; aspect change from SW to S facing coast
RECHERCHE	Mississippi Point - Hammer Head	Mississippi Point	Hammer Head	122.277	-34.002	Geologic feature: granite promontory separating rocky coast with small embayments west from large embayment with sandy coast east; aspect change from S to SSE
RECHERCHE	Hammer Head - Tagon Point	Hammer Head	Ben Island	122.575	-33.960	Geologic and geomorphic feature: granite outcrop and tombolo separating large embayments west from smaller embayments east; aspect change from SSE to SE and S
RECHERCHE	Hammer Head - Tagon Point	Ben Island	Tagon Point	122.748	-33.896	Geologic feature: granite outcrop and island separating smaller embayments west from larger SSW facing embayment east
RECHERCHE	Tagon Point - Cape Arid	Tagon Point	Cape Arid	122.976	-33.902	Geologic feature: granite promontory separating smaller embayments west from large zeta-shaped bay east; aspect change from S to SW facing coast
RECHERCHE	Cape Arid - Cape Pasley	Cape Arid	Fern Creek	123.152	-34.011	Geologic feature: large granite salient separating large zeta-shaped bay west from rocky coast with small embayments east; aspect change from SW to SE facing coast
RECHERCHE	Cape Arid - Cape Pasley	Fern Creek	Cape Pasley	123.364	-33.897	Geologic feature: granite outcrop separating rocky coast with small embayments west from large unconsolidated emabyment east; aspect change from SE to SSW facing coast

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MALCOM	Cape Pasley - Point Malcom	Cape Pasley	Point Malcolm	123.512	-33.943	Geologic feature: granite promontory marking eastern limit of granite dominated coast at primary scale; aspect change from SSW to SSE facing coast
MALCOM	Point Malcom - Israelite Bay N	Point Malcolm	Israelite Bay N	123.764	-33.795	Geologic feature: granite outcrop at western limit of large embayment backed by coastal lagoon; aspect change from SSE to SE
MALCOM	Israelite Bay N - Wattle Campe	Israelite Bay N	Wattle Camp	123.933	-33.586	Geologic feature: granite outcrop at western limit of Israelite Bay and Great Australian Bight; eastern extent of coastal granites; aspect change from SE to ESE facing coast
MALCOM	Wattle Camp - Point Culver	Wattle Camp	Point Culver	124.081	-33.242	Geomorphic and geologic feature: limestone out crop marking local topographic high point and low amplitude salient; aspect change from ESE to SE facing coast
BAXTER	Point Culver - Point Dover	Point Culver	Point Dover	124.737	-32.900	Geomorphic and geologic feature: low amplitude salient in limestone Baxter Cliffs; aspect change from SE to SSE facing coast
BAXTER	Point Dover - Twilight Cove	Point Dover	Twilight Cove	125.532	-32.549	Geomorphic and geologic feature: low amplitude salient in limestone Baxter Cliffs; aspect change from SSE to SE facing coast
KANIDAL	Twilight Cove - Scorpion Bight	Twilight Cove	Scorpion Bight	126.036	-32.270	Geomorphic and geologic feature: boundary separating limestone cliffs west from sandy beaches east; aspect change from SE to S facing coast
KANIDAL	Scorpion Bight - Red Rocks Point	Scorpion Bight	Red Rocks Point	126.770	-32.292	Geomorphic feature: low amplitude salient at western margin of Scorpion Bight; aspect change from S to SSE facing coast
KANIDAL	Red Rocks Point - WA-SA Border	Red Rocks Point	WA-SA Border	127.528	-32.209	Geologic feature: limestone outcrop; aspect change from SSE to SE facing coast
		WA-SA Border		129.000	-31.688	Geologic and geomorphic feature: boundary separating sandy beaches west from limestone cliffs east; aspect changes from SE to SSE facing coast

APPENDIX B PRIMARY, SECONDARY AND TERTIARY COMPARTMENTS

APPENDIX B.1 THE KIMBERLEY COASTAL REGION

APPENDIX B.2 THE PILBARA COASTAL REGION

APPENDIX B.3 THE CANNING COASTAL REGION

APPENDIX B.4 EXMOUTH AND SHARK BAY COASTAL REGIONS

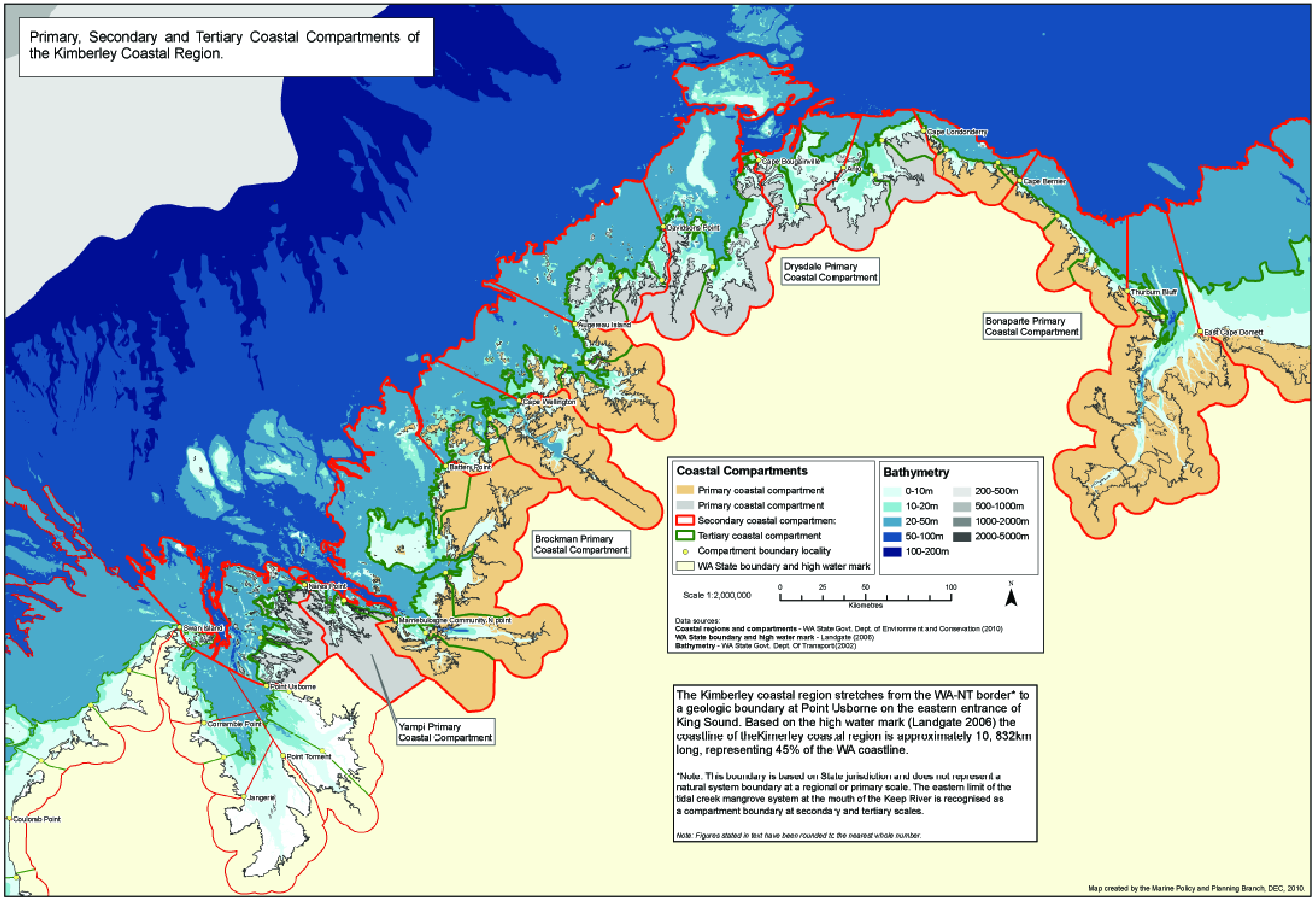
APPENDIX B.5 NORTHAMPTON AND THE MID-WEST COASTAL REGIONS

APPENDIX B.6 VLAMINGH, NATURALISTE AND FLINDERS COASTAL REGIONS

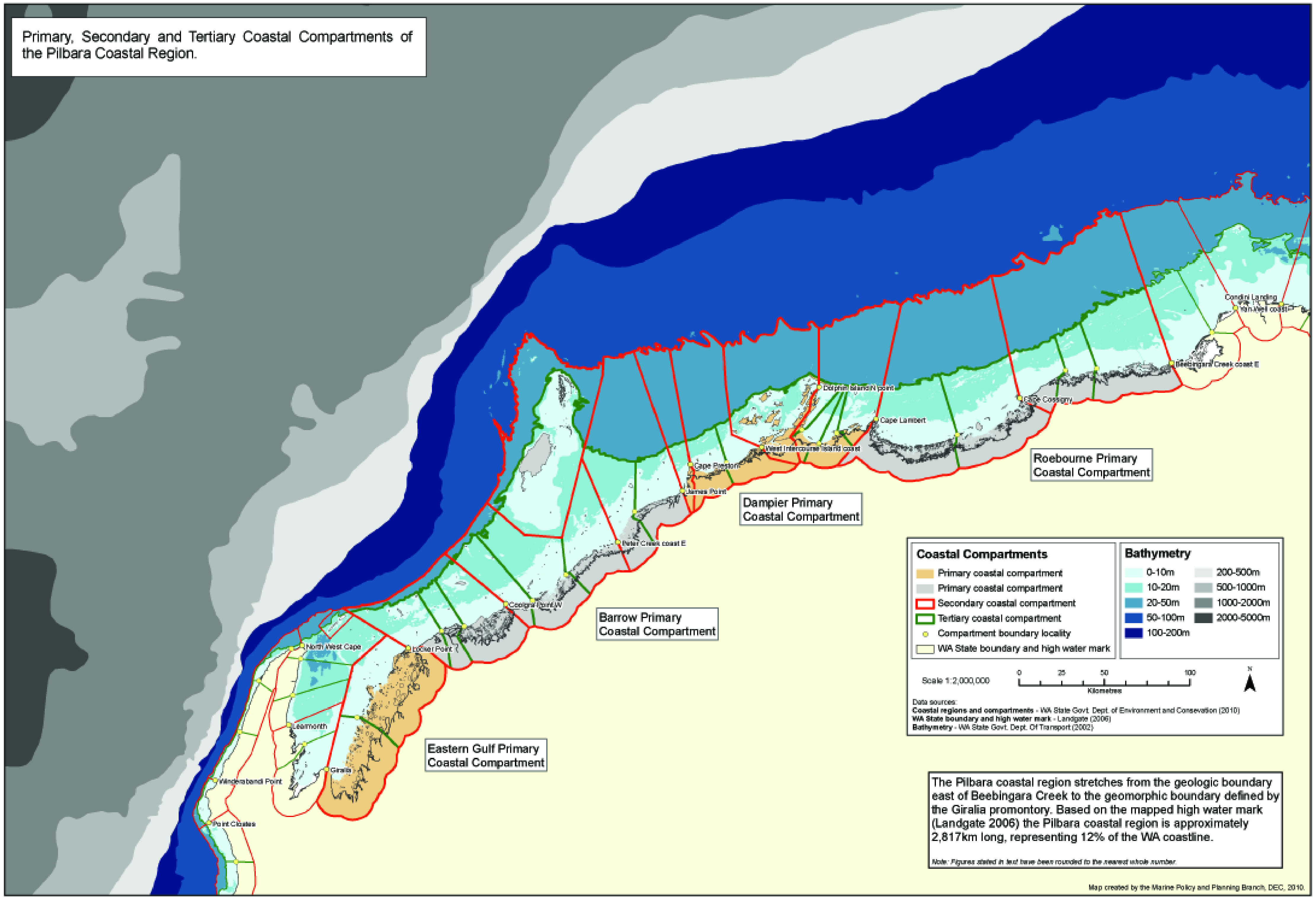
APPENDIX B.7 BAUDIN AND THIJSSEN COASTAL REGIONS

APPENDIX B.8 THE GILES COASTAL REGION

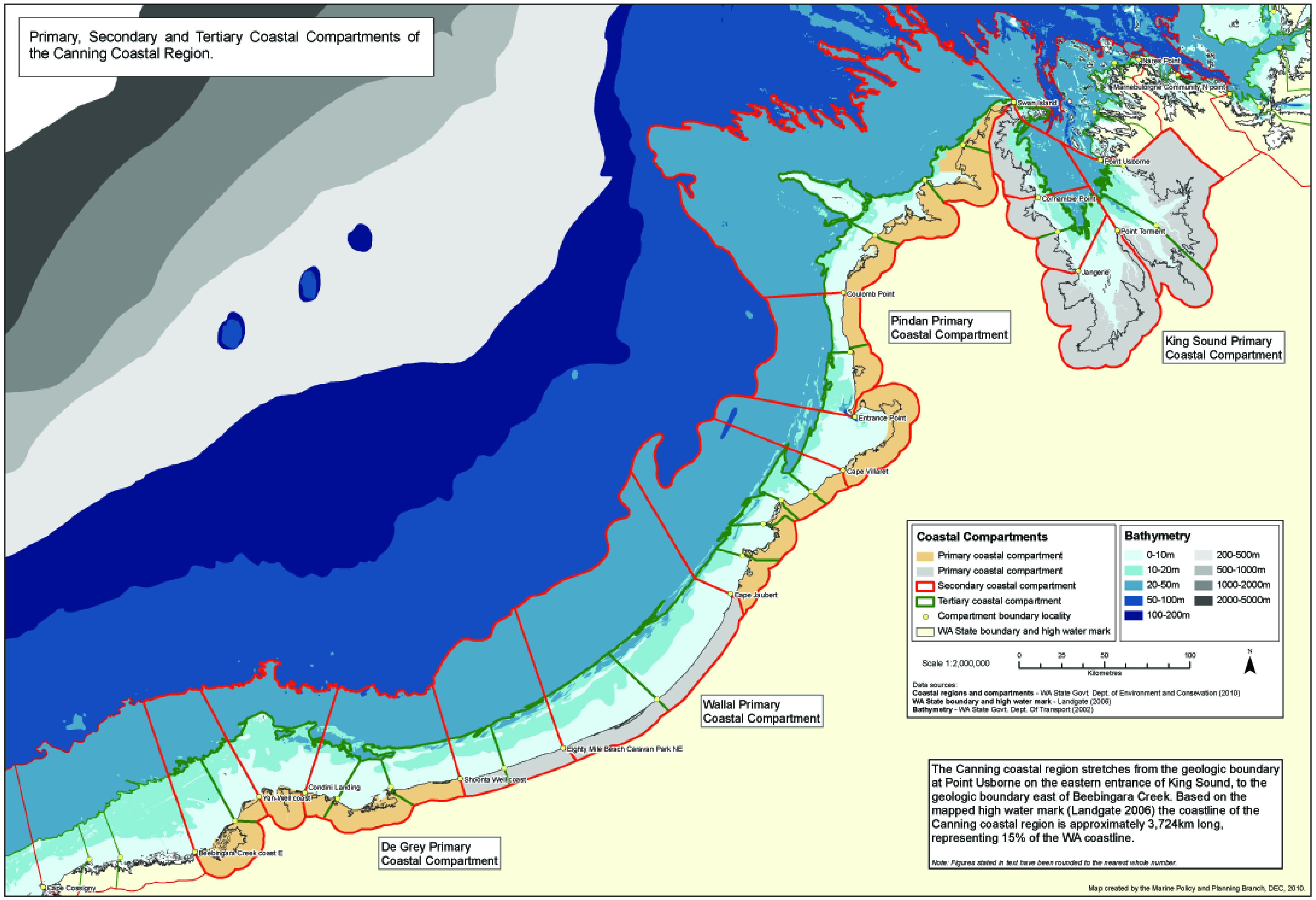
APPENDIX B.1 THE KIMBERLEY COASTAL REGION



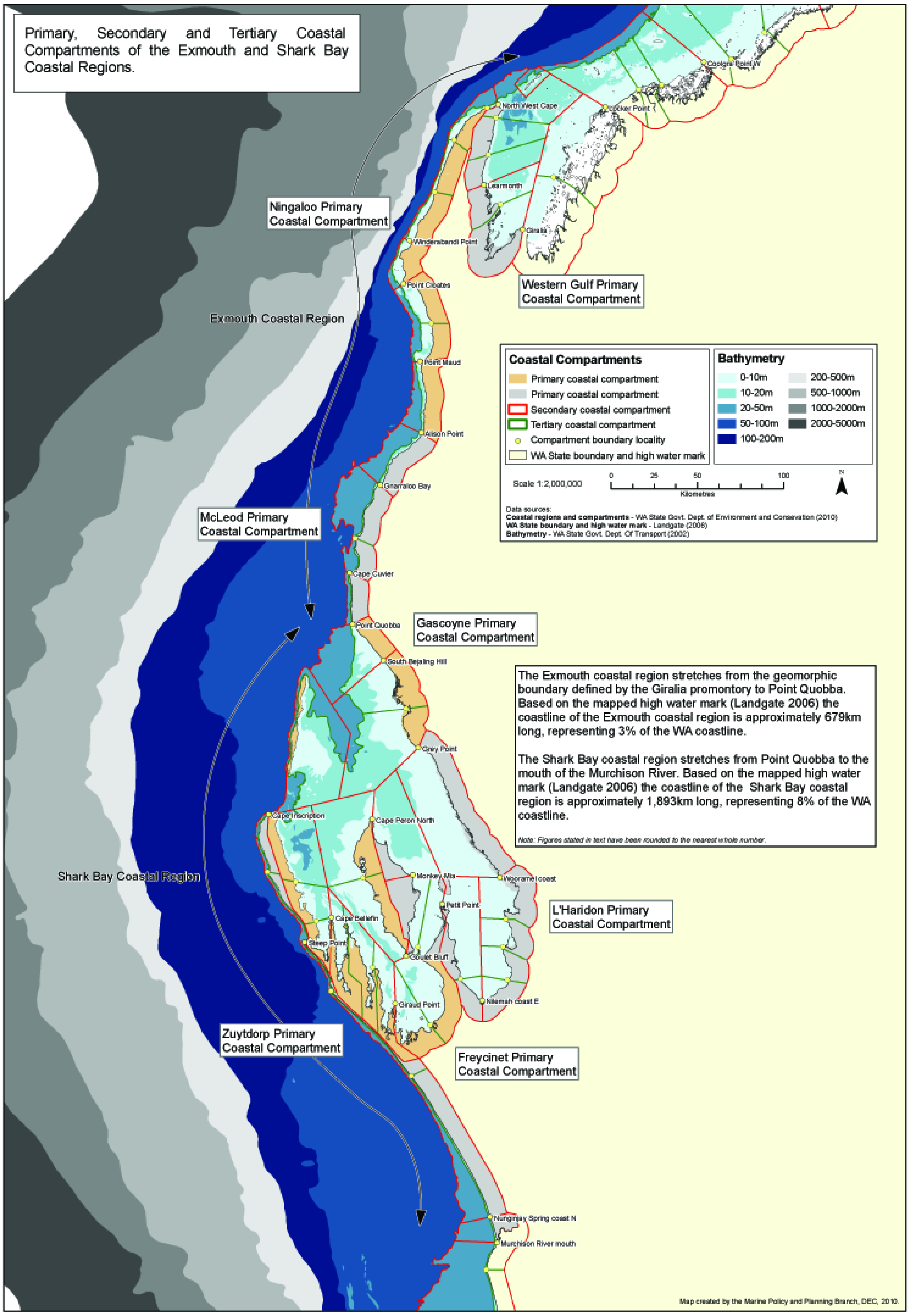
APPENDIX B.2 THE PILBARA COASTAL REGION



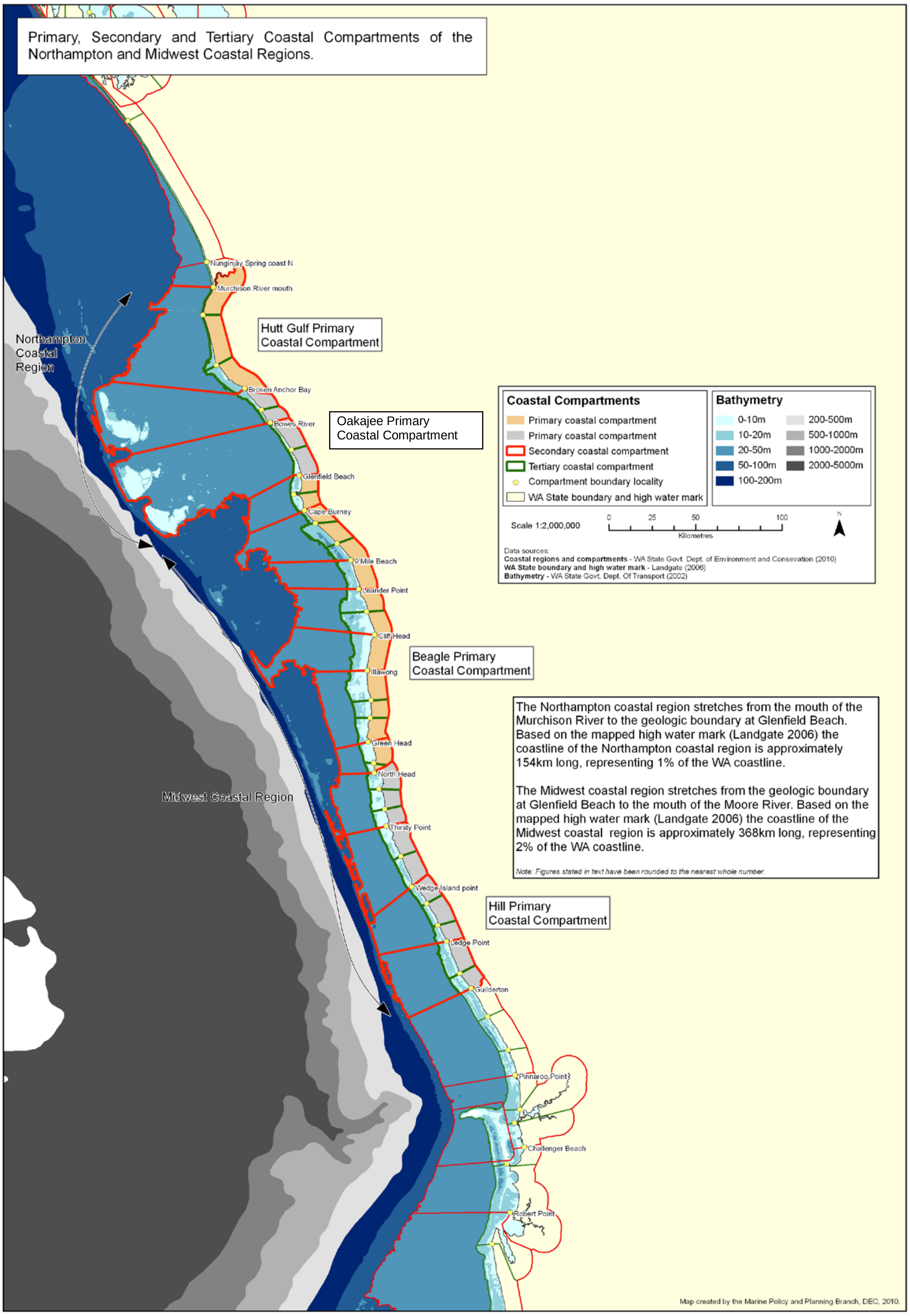
APPENDIX B.3 THE CANNING COASTAL REGION



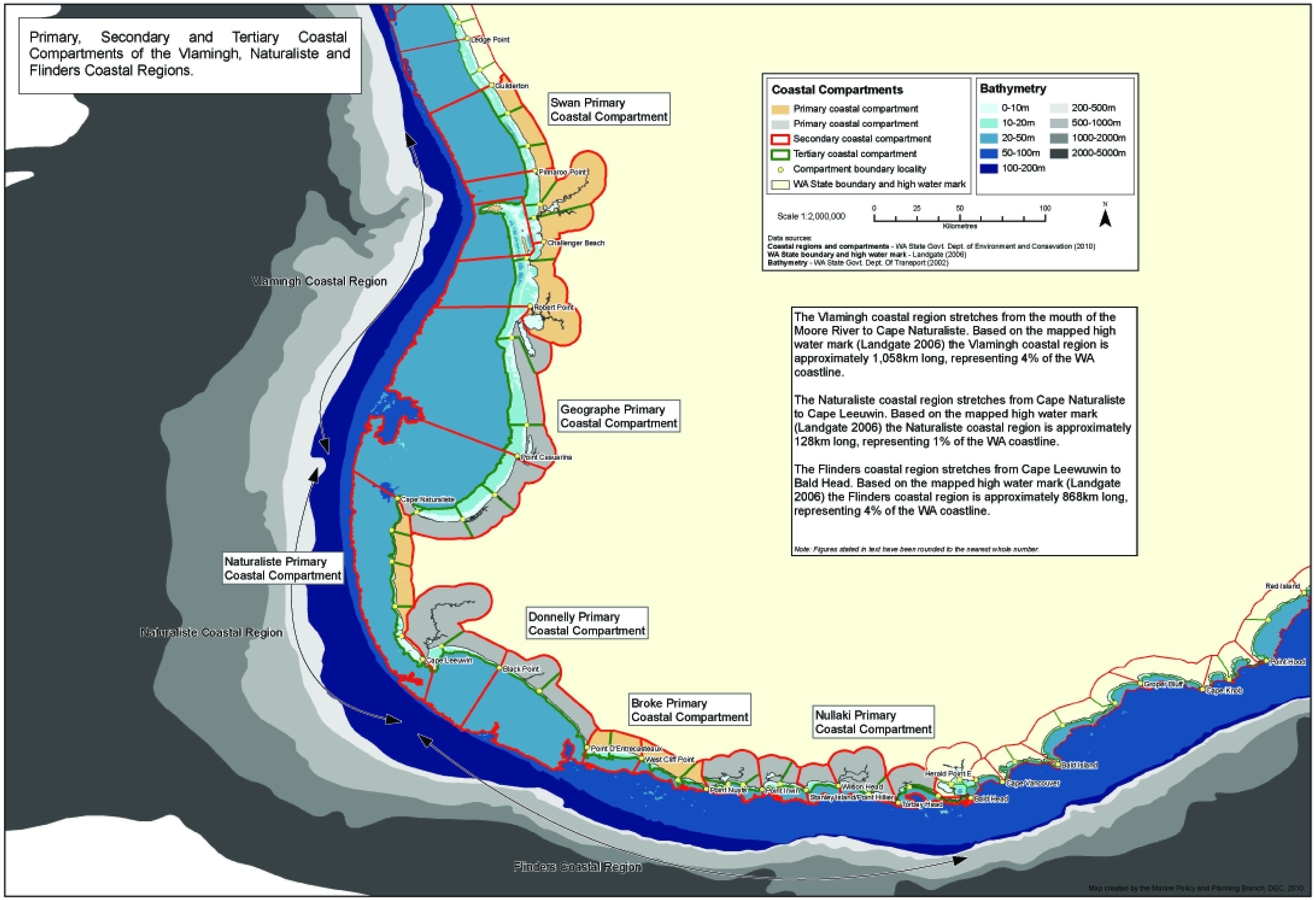
APPENDIX B.4 EXMOUTH AND SHARK BAY COASTAL REGIONS



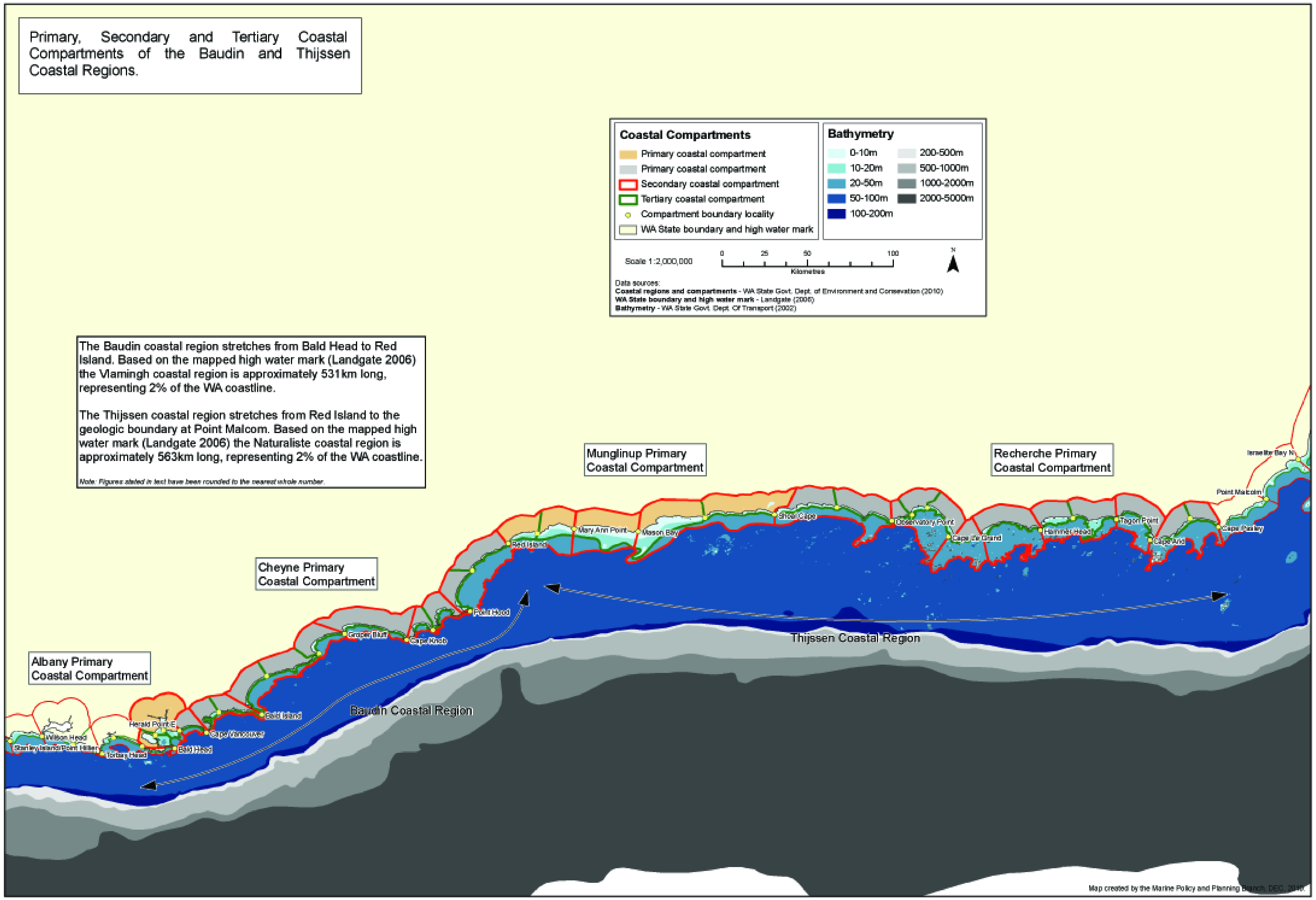
APPENDIX B.5 NORTHAMPTON AND THE MID-WEST COASTAL REGIONS



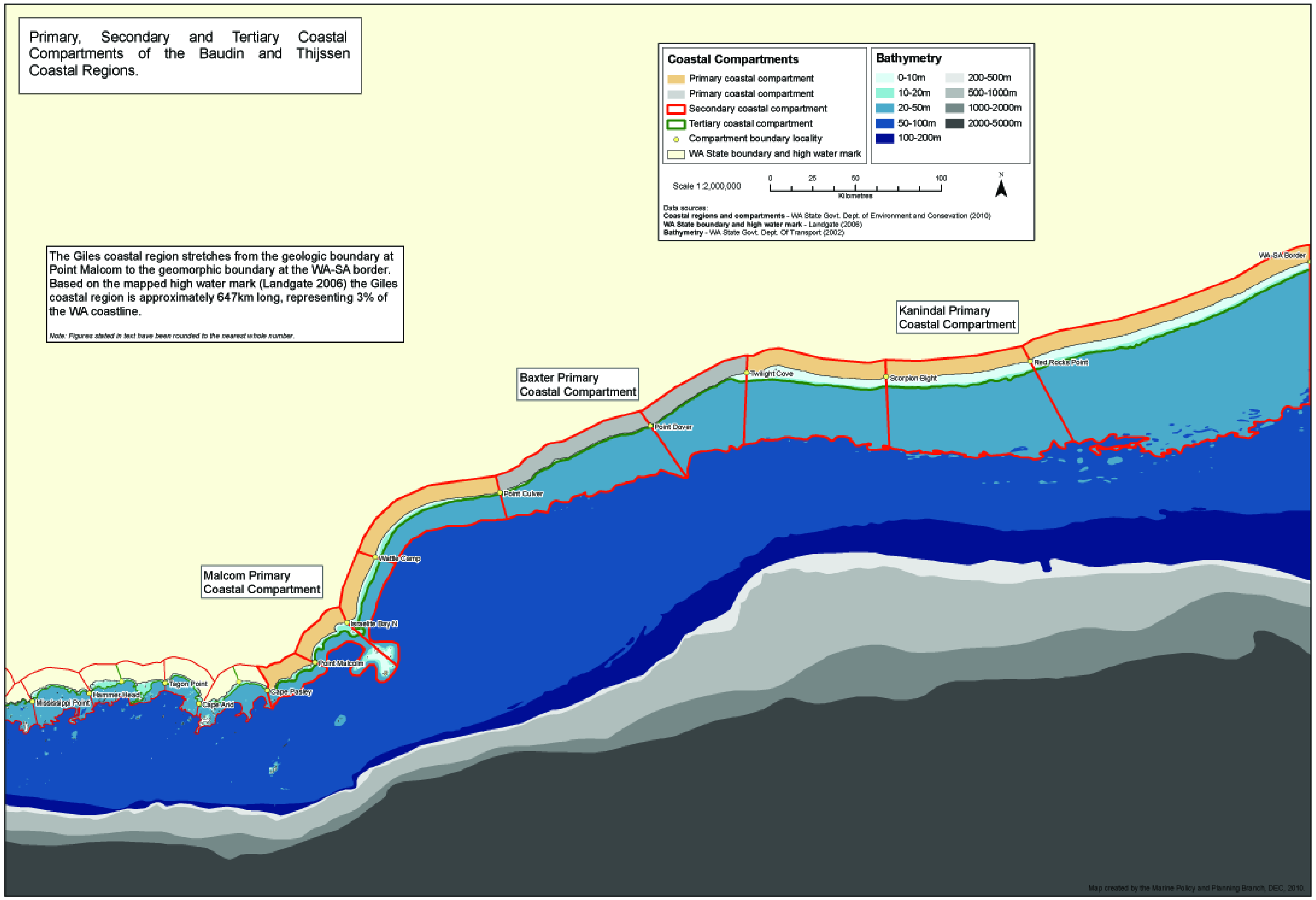
APPENDIX B.6 VLAMINGH, NATURALISTE AND FLINDERS COASTAL REGIONS



APPENDIX B.7 BAUDIN AND THIJSSEN COASTAL REGIONS



APPENDIX B.8 THE GILES COASTAL REGION



APPENDIX C LANDFORMS OF PRIMARY AND SECONDARY COMPARTMENTS

APPENDIX C.1 MAJOR LANDFORMS OF PRIMARY COMPARTMENTS

APPENDIX C.2 MAJOR LANDFORMS OF SECONDARY COMPARTMENTS

APPENDIX C.1 MAJOR LANDFORMS OF PRIMARY COMPARTMENTS

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
1.1	Kimberley	**Bonaparte**	WA-NT Border	Cape Londonderry	51	Broad, complex system of tidal channels and flats.	Dominantly sandstones with minor outcrops of basalt interbeds and volcaniclastic sequences.
					24	Beachrock & complex exposed resistant low cliffs with beach formation between headlands.	
1.2	Kimberley	**Drysdale**	Cape Londonderry	Augereau Island	50	Complex, exposed, resistant low cliffs with beaches formed between headlands.	Dominantly sandstones with minor outcrops of undiff volcaniclastic sequences.
					28	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
1.3	Kimberley	**Brockman**	Augereau Island	Shale Island	69	Complex, exposed, resistant, low cliffs with beaches formed between headlands.	Dominantly sandstones with minor outcrops of undiff volcaniclastic sequences and lutite/arenite sequences.
					23	Tidal flat development with some channels.	
1.4	Kimberley	**Yampi**	Shale Island	Helpman Island	39	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development.	Dominantly sandstone with minor outcrops of dolerites, undiff lutite/arenite sequences and undiff granitoids.
					33	Tidal flat development with some channels.	
					22	Beachrock and adjacent barrier reeflines, with some beach formation between headlands.	
2.1	Canning	**King Sound**	Helpman Island	Swan Island	82	Broad, smooth, gently sloping beach with an extensive intertidal zone, backed by an extensive supratidal zone.	Dominantly sandstone with minor occurrences of undiff lutite/arenite sequences.
2.2	Canning	**Pindan**	Swan Island	Cape Jaubert	50	Complex system of tidal channels and flats. Broad, smooth, gently sloping beaches with an extensive intertidal zone.	Dominantly sandstone with minor occurrences of undiff lutite/arenite sequences.
					37	Minor tidal flat development with narrow sandy or silty beaches with a high tide range which may back onto low cliffs and sand ridges.	
2.3	Canning	**Wallal**	Cape Jaubert	Shoonta Well	96	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Northern section dominated by undiff lutite /arenite sequences. Southern section is dominantly sandstone.
2.4	Pilbarra	**De Grey**	Shoonta Well	Beebingara Creek Coast E	58	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Northern section is dominantly sandstone. Southern section is dominated by undiff granitoids.
					30	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
3.1	Pilbarra	**Roebourne**	Beebingara Creek Coast E	Cape Lambert	62	Complex system of tidal creek channels and flats with relict sandy beaches between headlands.	Dominantly undiff granitoids. Southern end has occurrences of metamorphosed basalts and banded-iron formation rocks.
					19	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
3.2	Pilbarra	**Dampier**	Cape Lambert	Cape Preston	79	Complex system of tidal creek channels and flats with relict sandy beaches between headlands.	Long sections of undiff granitoids interspersed with headlands of medium igneous rocks, basalts, volcaniclastic sequences, gabbro, and banded-iron formations.
					11	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development.	
3.3	Pilbarra	**Barrow**	Cape Preston	Locker Point	57	Broad complex system of tidal channels and flats.	Dominantly undiff lutites (siltstones, mudstones) with the northern headland consisting of undiff volcaniclastic sequences and banded-iron formations.
					25	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	
3.4	Pilbarra	**Eastern Gulf**	Locker Point	Giralia	86	Broad complex system of tidal channels and flats.	Dominantly undiff limestones, with minor undiff lutites (siltstones, mudstones) at the northern end.
4.1	Exmouth	**Westen Gulf**	Giralia	NW Cape	62	Broad complex system of tidal channels and flats; some with complex relict sandy beaches; may back onto low cliffs and sand ridges.	Undiff limestones.
					38	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	
4.2	Exmouth	**Ningaloo**	NW Cape	Alison Point	79	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Dominantly undiff limestones with minor outcrops of aeolian calcarenite limestone at the southern end.
4.3	Exmouth	**Macleod**	Alison Point	Point Quobba	71	Beachrock dominates with some sandy sections between headlands; may have a low undercut beachrock cliff face.	Dominantly undiff limestones.
					23	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
5.1	Shark Bay	**Gascoyne**	Point Quobba	Grey Point	45	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	Undiff limestones.
					33	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
5.2	Shark Bay	**Lharidon**	Grey Point	Cape Peron North	41	Narrow sandy beach with extensive beachrock.	Undiff limestones.
					40	Variable tidal flat development; with some sandy beach material controlled by protection from offshore and onshore reef systems.	
5.3	Shark Bay	**Freycinet**	Cape Peron North	Cape Inscription	98	Narrow sandy beach with extensive beachrock.	Undiff limestones.
5.4	Shark Bay	**Zuytdorp**	Cape Inscription	Murchison River Mouth	92	Undercut steep cliff face eroding cainozoic sedimentary material.	Undiff limestones.
					8	Variable width sandy beach in association with resistant headlands; may include beachrock as low cliffs or headlands.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
6.1	Northampton	**Hutt**	Murchison River Mouth	Broken Anchor Bay	68	Narrow sandy beach with extensive beach rock; backed by continuous stable well vegetated high dunes and/or low bluffs (<50m).	Dominantly sandstones.
					25	Broad smooth gently sloping coarse grained sandy beach, sometimes formed between resistant headlands; some active dunes and unstable blowout areas.	
6.2	Northampton	**Okajee**	Broken Anchor Bay	Glenfield Beach	65	Variable width sandy beach without extensive beachrock, some as low cliffs or headlands; some backed by continuous stable well vegetated high dunes which may include calcarenite.	Dominantly lutites (siltstones, mudstones) undiff.
					21	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
7.1	Mid West	**Beagle**	Glenfield Beach	North Head	41	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Aeolian calcarenite limestone at northern end. Otherwise dominantly sandstones with minor occurrences of lutite/arenite sequences undiff.
					18	Beachrock dominates beach with occasional sandy sections; may have a low undercut beachrock cliff face	
					17	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas	
					13	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands	
7.2	Mid West	**Hill**	North Head	Guilderton	32	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Southern section dominated by calcareous lutites. Otherwise sandstones interspersed with lutites (sandstones, mudstones).
					28	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					17	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					10	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
8.1	Vlamingh	**Swan**	Guilderton	Robert Point	65	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Calcareous lutites with minor lutite/arenite sequences. Aeolian calcarenite limestones, central to and north of the Swan River.
					19	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					10	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
8.2	Vlamingh	**Geographe**	Robert Point	Cape Naturaliste	42	Broad, smooth gently sloping coarse grained sandy beach with low primary dune, showing extensive vegetation; including barrier beaches and may include marshes, swamps or echelon lake systems in swales.	Dominantly lutite/arenite sequences undiff with minor occurrences of aeolian calcarenite limestones. Gneisses/migmatites/high grade metamorphics in vicinity of Cape Naturaliste.
					24	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					13	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
9.1	Naturaliste	**Naturaliste**	Cape Naturaliste	Cape Leeuwin	75	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Gneisses/ in vicinity of Cape migmatites/high grade metamorphics Naturaliste. Otherwise aeolian calcarenite limestone interspersed with granitoids undiff.
					11	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
10.1	Flinders	**Donnelly**	Cape Leeuwin	Point D'Entrecasteaux	79	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly lutite/arenite sequences; with 'gneisses, migmatites, grade metamorphics' and amphibolites in the vicinity of Point D'Entrecasteaux
					17	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
10.2	Flinders	**Broke**	Point D'Entrecasteaux	Point Nuyts	76	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly granitoids (some metamorphosed); minor gneisses/ migmatites/high grade metamorphics.
					17	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
10.3	Flinders	**Nullaki**	Point Nuyts	Bald Head	42	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Granitoids undiff interspersed with gneisses/migmatites/ high grade metamorphics.
					38	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
					20	Narrow to wide sandy beach seaward of low bluffs (< 50m), in sedimentary rock including limestone.	
11.1	Baudin	**Albany**	Bald Head	Herald Point	75	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes; some beaches have formed between or in association with resistant headlands.	Granitoids/metamorphosed granitoids interspersed with gneisses/ /migmatites/ high grade metamorphics.
					25	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
11.2	Baudin	**Cheyne**	Herald Point	Red Island	49	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly metamorphosed granitoids (and minor undiff) with minor sections of spongolite (in lutite/arenite sequences).
					33	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands; some backed by active dunes and unstable blowout areas	
12.1	Thijssen	**Munglinup**	Red Island	Shoal Cape	39	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Dominantly metamorphosed granitoids with minor occurrences of aeolian calcarenite limestone at the western end. Interbedded quartzites and schists occur in proximity to Red island.
					31	Variable width sandy beach formed in areas protected by offshore reefs; some with extensive beachrock; may include some beachrock as low cliffs or headlands.	
					27	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
12.2	Thijssen	**Recherche**	Shoal Cape	Cape Pasley	41	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Dominantly granitoids undiff or metamorphosed granitoids with with minor spongolite (in lutite/arenite sequences).
					41	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
13.1	Giles	**Malcolm**	Cape Pasley	Point Culver	46	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Granitoids (metamorphosed and undiff) in central section. Schists/quartzites/gneisses in proximity to Point Culver. Limestone undiff in proximity to Twilight Cove.
					30	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					16	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
13.2	Giles	**Baxter**	Point Culver	Twilight Cove	100	Undercut steep cliff face eroding cainozoic sedimentary material.	Limestones undiff
13.3	Giles	**Kanidal**	Twilight Cove	WA-SA Border	52	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Limestones undiff
					28	Broad smooth gently sloping coarse grained sandy beach backed by vegetated dunes, some active; may include marshes, swamps or echelon lake systems in swales.	
					14	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	

APPENDIX C.2 MAJOR LANDFORMS OF SECONDARY COMPARTMENTS

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
1.11	Kimberley	Bonaparte	**WA-NT Border**	**East Cape Domett**	40	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Eastern section dominated by lutite/arenite sequences undiff. Western section changes to lithified clastic undiff & some carbonate rocks.
					34	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
					18	Unclassified	
1.12	Kimberley	Bonaparte	**East Cape Domett**	**Thurburn Bluff**	87	Broad complex system of tidal channels and flats	Dominantly lutite/arenite sequences and undiff lithified clastics in the delta. Some sandstones on coastal shorelines.
1.13	Kimberley	Bonaparte	**Thurburn Bluff**	**Cape Bernier**	52	Complex exposed resistant low cliffs and structurally controlled headlands; beaches may be formed between headlands due to high tidal range.	Dominantly sandstone; minor occurrences of basalt with clastic interbeds and volcaniclastic sequences undiff.
					24	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands.	
					10	Major creeks or rivers incised into sediments; some tidal flats development in areas afforded protection or extensive deposition.	
1.14	Kimberley	Bonaparte	**Cape Bernier**	**Cape Londonderry**	97	Beachrock and adjacent barrier reeflines; complex exposed resistant low cliffs; some beach formation between highly resistant and structurally controlled headlands.	Dominantly sandstones interspersed with volcaniclastic sequences undiff.
1.21	Kimberley	Drysdale	**Cape Londonderry**	**Anjo**	11	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands	Dominantly sandstones; minor volcaniclastic sequences undiff at Cape Londonderry.
					26	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range	
					16	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
1.22	Kimberley	Drysdale	**Anjo**	**Cape Bougainville**	66	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	Dominantly sandstones; volcaniclastic sequences undiff around Cape Bougainville.
					16	Unclassified.	
					10	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
1.23	Kimberley	Drysdale	**Cape Bougainville**	**Davidsons Point**	62	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	Dominantly sandstones with significant sections of volcaniclastic sequences undiff.
					26	Broad complex system of tidal channels and flats; may back onto low cliffs and sand ridges.	
1.24	Kimberley	Drysdale	**Davidsons Point**	**Augereau Island**	95	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	Dominantly sandstones with minor dolerite.
					5	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
1.31	Kimberley	Brockman	**Augereau Island**	**Cape Wellington**	59	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	Dominantly sandstones with minor occurrences of volcaniclastic sequences undiff and dolerite.
					40	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
1.32	Kimberley	Brockman	**Cape Wellington**	**Battery Point**	62	Complex exposed resistant low cliffs; beaches may be formed between highly resistant and structurally controlled headlands due to high tidal range.	Dominantly sandstones with occurrences of volcaniclastic sequences undiff in tidal channels.
					34	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
1.33	Kimberley	Brockman	**Battery Point**	**Marlembourne Community Point N**	26	Unclassified	Dominantly sandstones with minor occurrences of lutite / arenite sequences undiff.
					18	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
					15	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range	
1.41	Kimberley	Yampi	**Marlembourne Community Point N**	**Nares Point**	37	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development.	Dominantly sandstones on eastern section. Lutite/arenite sequences undiff become more dominant on progression toward Nares Pt.
					33	Unclassified	
					15	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands	
					15	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
1.42	Kimberley	Yampi	**Nares Point**	**Point Usborne**	43	Unclassified.	Dominantly sandstones with minor occcurrences of granitoids undiff and lutites with subordinate carbonates.
					26	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands.	
					21	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development.	
					9	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
2.11	Kimberley	King Sound	**Point Usborne**	**Point Torment**	75	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Dominantly sandstones with lutite/arenite in the tidal channels.
					15	Unclassified	
2.12	Kimberley	King Sound	**Point Torment**	**Jangerie**	97	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Dominantly sandstones on the eastern side of the May River delta with lutites (siltstones, mudstones) undiff dominating the western side.
2.13	Kimberley	King Sound	**Jangerie**	**Cornambie Point**	53	Variable width, smooth, gently sloping sandy beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone and/or chenniers, beach ridges or low cliffs.	Dominantly sandstones.
					43	Broad complex system of tidal channels and flats; may back onto low cliffs and sand ridges.	
2.14	Canning	King Sound	**Cornambie Point**	**Swan Island**	36	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	Dominantly sandstones.
					26	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
					23	Major tidal creek channels and flats, with complex relict sandy beaches, some tidal flat development between headlands.	
					12	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
2.21	Canning	Pindan	**Swan Island**	**Coulomb Point**	46	Broad complex system of tidal channels and flats	Dominantly sandstones.
					30	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	
					17	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	
2.22	Canning	Pindan	**Coulomb Point**	**Entrance Point**	40	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Dominantly sandstones.
					28	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
					21	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	
					11	Complex exposed resistant low cliffs; beaches may be formed between headlands due to high tidal range.	
2.23	Canning	Pindan	**Entrance Point**	**Cape Villaret**	45	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	Dominantly sandstones with lutite/arenite sequences undiff occurring toward Cape Villaret.
					47	Major tidal creek channels and flats with complex relict sandy beaches, some tidal flat development between headlands.	
2.24	Canning	Pindan	**Cape Villaret**	**Cape Jaubert**	44	Tidal creek channels and flats; some with complex relict sandy beaches; tidal flat development between headlands and may back onto low cliffs and sand ridges.	Dominantly sandstones. Lutite/arenite sequences undiff in the vicinity of Cape Villaret.
					38	Complex exposed resistant low cliffs; beachrock and adjacent barrier reeflines; beaches may be formed between headlands due to high tidal range.	
					12	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	
2.31	Canning	Wallal	**Cape Jaubert**	**Mandora**	94	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Lutite/arenite sequences undiff in the norhern section gradate to sandstones further south.
2.32	Canning	Wallal	**Mandora**	**Shoonta Well**	100	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Dominantly sandstones.
2.41	Canning	De Grey	**Shoonta Well**	**Condini Landing**	66	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	Dominantly sandstones.
					24	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	
2.42	Canning	De Grey	**Condini Landing**	**Yan Well**	100	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges.	Granitoids undiff.
2.43	Canning	De Grey	**Yan Well**	**Beebingara Creek coast E**	73	Broad smooth gently sloping sandy beach with an extensive intertidal zone; may form between or in association with resistant headlands.	Granitoids undiff.
					26	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems; may back onto low cliffs and sand ridges.	
3.11	Pilbara	Roebourne	**Beebingara Creek coast E**	**Cape Cossigny**	81	Broad complex system of tidal channels and flats; some with complex relict sandy beaches; some tidal flat development between headlands.	Granitoids undiff.
					15	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
3.12	Pilbara	Roebourne	**Cape Cossigny**	**Cape Lambert**	52	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	Dominantly granitoids undiff; with basalts or 'greenstones' and banded iron formations in proximity to Cape Lambert.
					33	Broad smooth gently sloping beach with an extensive intertidal zone, which may be backed by an extensive supratidal zone.	
3.21	Pilbara	Dampier	**Cape Lambert**	**Dolphin Island N point**	29	Broad complex system of tidal channels and flats	Dominantly banded iron formations with occurrences of volcaniclastic sequences & basalt.
					20	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development	
					14	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
					14	Unclassified	
					11	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands	
3.22	Pilbara	Dampier	**Dolphin Island N point**	**West Intercourse Island**	46	Highly resistant and structurally controlled headlands; islands or drowned river valleys; all may show minor embayments with tidal flat or small flat development.	An assortment of gabbro, metamorphosed granitoids and basic course/medium igneous rocks.
					22	Unclassified.	
					20	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
3.23	Pilbara	Dampier	**West Intercourse Island**	**Cape Preston**	73	Broad complex system of tidal channels and flats	Dominantly granitoids undiff, with minor occurrences of gabbro and volcaniclastic sequences undiff.
					20	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	
3.24	Pilbara	Dampier	**Cape Preston**	**James Point**	37	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs	
					31	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands	
					17	Unclassified	
					15	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
3.31	Pilbara	Barrow	**James Point**	**Peter Creek coast E**	48	Unclassified.	Dominantly lutites (siltstones, mudstones); with volcaniclastic sequences, banded iron formations and basalts near Cape Preston.
					32	Broad complex system of tidal channels and flats.	
3.32	Pilbara	Barrow	**Peter Creek coast E**	**Coolgra Point**	61	Broad complex system of tidal channels and flats.	Lutites (siltstones, mudstones) undiff.
					35	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	
3.33	Pilbara	Barrow	**Coolgra Point**	**Locker Point**	55	Broad complex system of tidal channels and flats.	Lutites (siltstones, mudstones) undiff.
					40	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	
3.41	Pilbara	Eastern Gulf	**Locker Point**	**Giralia**	79	Broad complex system of tidal channels and flats.	Dominantly limestones undiff; with lutites (siltstones, mudstones) undiff nearer to Locker Point.
					18	Variable tidal flat development with some channels and beach materials.	

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4.11	Exmouth	Western Gulf	**Giralia**	**Learmonth**	64	Broad complex system of tidal channels and flats; some may back onto low cliffs and sand ridges.	Limestones undiff.
					28	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
4.12	Exmouth	Western Gulf	**Learmonth**	**North West Cape**	100	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	Limestones undiff.
4.21	Exmouth	Ningaloo	**North West Cape**	**Winderabandi Point**	100	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Limestones undiff.
4.22	Exmouth	Ningaloo	**Winderabandi Point**	**Point Cloates**	100	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Limestones undiff.
4.23	Exmouth	Ningaloo	**Point Cloates**	**Point Maud**	100	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Limestones undiff.
4.24	Exmouth	Ningaloo	**Point Maud**	**Alison Point**	63	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Dominantly limestones undiff; interspersed with minor aeolian calcarenite limestone.
					37	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
4.31	Exmouth	Macleod	**Alison Point**	**Gnarraloo Bay**	45	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	Dominantly limestones undiff.
					36	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands.	
					19	Narrow sandy or silty beach with a high tide range, may be marked by chenniers, beach ridges or low cliffs.	
4.32	Exmouth	Macleod	**Gnarraloo Bay**	**Cape Cuvier**	87	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face	Dominantly limestones undiff.
					10	Beachrock and adjacent barrier reeflines, formed coast with some beach formation between headlands	
4.33	Exmouth	Macleod	**Cape Cuvier**	**Point Quobba**	100	Undercut steep cliff face eroding cainozoic sedimentary material.	Limestones undiff.
5.11	Shark Bay	Gascoyne	**Point Quobba**	**South Bejaling Hill**	47	Narrow sandy beach with extensive beachrock	Limestones undiff.
					46	Beachrock dominates beach with occasional sandy sections; may have a low undercut beachrock cliff face	
5.12	Shark Bay	Gascoyne	**South Bejaling Hill**	**Grey Point**	56	Limited tidal flat development with some channels, may back onto low cliffs and sand ridges	Limestones undiff.
					41	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
5.21	Shark Bay	Lharidon	**Grey Point**	**Wooramel coast**	100	Variable tidal flat development with some channels: some controlled by protection from offshore and onshore reef systems; may back onto low cliffs and sand ridges; some sandy and or fine grained beach material.	Limestones undiff.

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5.22	Shark Bay	Lharidon	**Wooramel coast**	**Nilemah coast E**	49	Tidal flat development is variable, with some sandy and or fine grained beach material and is controlled by protection from offshore and onshore reef systems.	Limestones undiff.
					34	Narrow sandy beach with extensive beachrock.	
					17	Major tidal creek channels with complex relict sandy beaches, some tidal flat development between headlands.	
5.23	Shark Bay	Lharidon	**Nilemah coast E**	**Petit Point**	74	Narrow sandy beach with extensive beachrock.	Limestones undiff.
					23	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	
5.24	Shark Bay	Lharidon	**Petit Point**	**Monkey Mia**	39	Narrow sandy beach with extensive beachrock.	Limestones undiff.
					34	Unclassified.	
					12	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	
5.25	Shark Bay	Lharidon	**Monkey Mia**	**Cape Peron North**	52	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face	Limestones undiff.
					48	Narrow sandy beach with extensive beachrock.	
5.31	Shark Bay	Freycinet	**Cape Peron North**	**Goulet Bluff**	100	Narrow sandy beach with extensive beachrock.	Limestones undiff.
5.32	Shark Bay	Freycinet	**Goulet Bluff**	**Giraud Point**	95	Narrow sandy beach with extensive beachrock.	Limestones undiff.
5.33	Shark Bay	Freycinet	**Giraud Point**	**Cape Bellefin**	96	Narrow sandy beach with extensive beachrock.	Limestones undiff.
5.34	Shark Bay	Freycinet	**Cape Bellefin**	**Cape Inscription**	93	Narrow sandy beach with extensive beachrock.	Limestones undiff.
5.41	Shark Bay	Zuytdorp	**Cape Inscription**	**Steep Point**	100	Undercut steep cliff face eroding cainozoic sedimentary material.	Limestones undiff.
5.42	Shark Bay	Zuytdorp	**Steep Point**	**Nunginjay Spring coast N**	94	Undercut steep cliff face eroding cainozoic sedimentary material.	Dominantly limestones undiff.
5.43	Shark Bay	Zuytdorp	**Nunginjay Spring coast N**	**Murchison River Mouth**	67	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	Dominantly sandstones with lutites (siltstones, mudstones) undiff near Second Gully.
					33	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
6.11	Northampton	Hutt	**Murchison River Mouth**	**Broken Anchor Bay**	26	Narrow to wide sandy beach seaward of low bluffs (< 50m), in sedimentary rock including limestone	Dominantly sandstones.
					24	Narrow sandy beach with extensive beachrock.	
					18	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
					15	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					10	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
6.21	Northampton	Okajee	**Broken Anchor Bay**	**Bowes River**	54	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly sandstones.
					26	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					11	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
					9	Narrow sandy beach with extensive beachrock	

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6.22	Northampton	Okajee	**Bowes River**	**Glenfield Beach**	67	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	Lutites (siltstones, mudstones) undiff.
					12	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					11	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face	
					10	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
7.11	Mid West	Beagle	**Glenfield Beach**	**Cape Burney**	71	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Lutites (siltstones, mudstones) undiff dominate in north; with aeolian calcarenite limestone becoming dominant in association with Chapman River.
					15	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					14	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
7.12	Mid West	Beagle	**Cape Burney**	**9 Mile Beach**	100	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Aeolian calcarenite limestone dominates the northern half; changing to lutites (siltstones, mudstones) undiff further south; sandstones dominate at the southern end of the compartment.
7.13	Mid West	Beagle	**9 Mile Beach**	**Leander Point**	76	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Dominantly sandstones.
					24	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
7.14	Mid West	Beagle	**Leander Point**	**Cliff Head**	92	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly sandstones.
					8	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	
7.15	Mid West	Beagle	**Cliff Head**	**Illawong**	100	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face	Lutites (siltstones, mudstones) undiff with minor aeolian calcarenite limestone.
7.16	Mid West	Beagle	**Illawong**	**Green Head**	36	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Lutite/arenite sequences undiff dominate the northern section; and are interspersed with sandstones and aeolian calcarenite limestone in the southern half of the compartment.
					21	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
					17	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					11	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas	
					10	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face	
7.17	Mid West	Beagle	**Green Head**	**North Head**	32	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	Lutites (siltstones, mudstones) undiff with minor outcropping of aeolian calcarenite limestone.
					18	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					18	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					17	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					16	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	

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7.21	Mid West	Hill	**North Head**	**Thirsty Point**	25	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Lutites (siltstones, mudstones) undiff.
					19	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
					18	Major creeks or rivers incised into sediments; some tidal flats development in areas afforded protection or extensive deposition.	
					16	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
7.22	Mid West	Hill	**Thirsty Point**	**Wedge Island Point**	40	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Lutites (siltstones, mudstones) undiff with sandstones occurring in proximity to Wedge Island Point.
					31	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
					15	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
7.23	Mid West	Hill	**Wedge Island Point**	**Ledge Point**	86	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Sandstones in proximity to Wedge Island Point; grading to lutite/arenite sequences undiff; Calcareous lutites dominate the southern half of the compartment.
					9	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
7.24	Mid West	Hill	**Ledge Point**	**Guilderton**	85	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Calcareous lutites
					10	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
8.11	Vlamingh	Swan	**Guilderton**	**Pinnaroo Point**	42	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly calcareous lutites in northern half of the compartment. Changes to lutite/arenite sequences undiff alternating with soft limestone undiff in the southern section.
					35	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					22	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
8.12	Vlamingh	Swan	**Pinnaroo Point**	**Challenger Beach**	79	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Aeolian calcarenite limestone dominte the Swan River estuary and northern region; Lutite/arenite sequences undiff and soft limestone dominate south of the estuary.
					15	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
8.13	Vlamingh	Swan	**Challenger Beach**	**Robert Point**	82	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Dominantly lutite/arenite sequences undiff.
					9	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	
					9	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	

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8.21	Vlamingh	Geographe	**Robert Point**	**Point Casuarina**	47	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly lutite/arenite sequences undiff; with minor aeolian calacarenite limestone outcrops near Robert Point and minor outcrops of basalt near Point Casuarina.
					25	Broad, smooth gently sloping coarse grained sandy beach with low primary dune, showing extensive vegetation; including barrier beaches and may include marshes, swamps or echelon lake systems in swales.	
					20	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
8.22	Vlamingh	Geographe	**Point Casuarina**	**Cape Naturaliste**	65	Broad, smooth gently sloping coarse grained sandy beach with low primary dune, showing extensive vegetation; including barrier beaches and may include marshes, swamps or echelon lake systems in swales.	Dominantly lutite / arenite sequences undiff; Granitoids undiff / gneisses, migmatites, high grade metamorphics occur in proximity to Cape Naturaliste.
					15	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					10	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
					10	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
9.11	Naturaliste	Naturaliste	**Cape Naturaliste**	**Cape Leeuwin**	77	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	A combination of; gneisses, migmatites, high grade metamorphics; metamorphosed and undiff granitoids; and aeolian calcarenite limestone.
					9	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					9	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
10.11	Flinders	Donnelly	**Cape Leeuwin**	**Black Point**	88	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly lutite/arenite sequences undiff; with minor occurrences of aeolian calcarenite limestone near the Blackwood River and granite gneiss near Black Point.
					12	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
10.12	Flinders	Donnelly	**Black Point**	**Point D'Entrecasteaux**	66	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Dominantly lutite/arenite sequences undiff; with gneisses, migmatites, high grade metamorphics alternating with amphibolites in proximity to Point D'Entrecasteaux.
					23	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	
10.21	Flinders	Broke	**Point D'Entrecasteaux**	**West Cliff Point**	66	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Amphibolites occur near Point D'Entrecasteaux, then grade into granitoids undiff; gneisses, migmatites, and high grade metamorphics occur toward Broke Inlet.
					25	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
10.22	Flinders	Broke	**West Cliff Point**	**Point Nuyts**	71	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Gneisses, migmatites, high grade metamorphics in in the midsection of the compartment; metamorphosed granitoids dominate towards Point Nuyts.
					20	Narrow sandy beach with extensive beachrock.	

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10.31	Flinders	Nullaki	**Point Nuyts**	**Point Irwin**	66	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Metamorphosed granitoids dominate up to estuary and then changes to dominantly gneisses, migmatites, high grade metamorphics.
					34	Narrow sandy beach with extensive beachrock.	
10.32	Flinders	Nullaki	**Point Irwin**	**Stanley Island**	79	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Gneisses, migmatites, high grade metamorphics dominate at both compartment boundaries with undiff granitoids dominating the middle section.
					21	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
10.33	Flinders	Nullaki	**Stanley Island**	**Wilson Head**	57	Narrow to wide sandy beach seaward of low bluffs (< 50m), in sedimentary rock including limestone.	Gneisses, migmatites, high grade metamorphics dominate at both compartment boundaries with undiff granitoids dominating the middle section.
					30	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
					13	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
10.34	Flinders	Nullaki	**Wilson Head**	**Torbay Head**	52	Narrow to wide sandy beach seaward of low bluffs (< 50m), in sedimentary rock including limestone.	Gneisses, migmatites, high grade metamorphics dominate around Wilson Head; central section is dominantly undiff granitoids; which grades into soft limestone before dolerite dominates at Torbay Head.
					48	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
10.35	Flinders	Nullaki	**Torbay Head**	**Bald Head**	77	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Soft limestones undiff interspersed with granitoids and gneisses, migmatites, high grade metamorphics.
					23	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
11.11	Baudin	Albany	**Bald Head**	**Herald Point E**	46	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Soft limestones occur near Bald Head; the remainder of the compartment is a mix of granitoids, metamorphosed granitoids and gneisses, migmatites, high grade metamorphics.
					30	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
					24	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
11.21	Baudin	Cheyne	**Herald Point E**	**Cape Vancouver**	50	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly spongolite (in lutite/arenite sequences); minor soft limestones and metamorphosed granitoids at Herald Point.
					38	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					12	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
11.22	Baudin	Cheyne	**Cape Vancouver**	**Bald Island**	90	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Spongolites (in lutite/arenite sequences) occur near Cape Vancouver; remainder of compartment is dominated by granitoids undiff.
					10	Variable width sandy beach, which may be cuspate or crenulate; may be formed between resistant headlands; may be be backed by low bluffs (<50m).	

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11.23	Baudin	Cheyne	**Bald Island**	**Groper Bluff**	32	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly metamorphosed granitoids (and minor gneisses, migmatites, high grade metamorphics); with spongolites (in lutite/arenite sequences) occurring along Hassell Beach and the central section of Cheyne Bay.
					27	Narrow to wide sandy beach seaward of low bluffs (< 50m), in sedimentary rock including limestone.	
					22	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					19	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
11.24	Baudin	Cheyne	**Groper Bluff**	**Cape Knob**	41	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Dominantly metamorphosed granitoids.
					31	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					28	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
11.25	Baudin	Cheyne	**Cape Knob**	**Point Hood**	72	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly metamorphosed granitoids; spongolite (in lutite/arenite sequences) occur along Bremer Beach.
					28	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
11.26	Baudin	Cheyne	**Point Hood**	**Red Island**	44	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Metamorphosed granitoids occur near Point Hood; spongolites (in lutite/arenite sequences) occur in the first embayment of Doubtful Islands Bay; remainder of the compartment is interbedded folded quartzites & schists.
					37	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	
					11	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
					8	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
12.11	Thijssen	Munglinup	**Red Island**	**Mary Ann Point**	62	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly interbedded folded quartzites & schists; with metamorphosed granitoids occurring in proximity to Mary Ann Point.
					32	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
12.12	Thijssen	Munglinup	**Mary Ann Point**	**Mason Bay**	53	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Metamorphosed granitoids interspersed with aeolian calcarenite limestone.
					47	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
12.13	Thijssen	Munglinup	**Mason Bay**	**Shoal Cape**	55	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Dominantly metamorphosed granitoids.
					22	Narrow sandy beach with extensive beachrock.	
					17	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
12.21	Thijssen	Recherche	**Shoal Cape**	**Observatory Point**	40	Dominantly metamorphosed granitoids.	Dominantly metamorphosed granitoids.
					26	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
					14	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	
					12	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
12.22	**Thijssen**	Recherche	**Observatory Point**	**Cape Le Grand**	38	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Granitoids undiff.
					28	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					27	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
12.23	Thijssen	Recherche	**Cape Le Grand**	**Mississippi Point**	93	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Granitoids undiff.
					7	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
12.24	Thijssen	Recherche	**Mississippi Point**	**Hammer Head**	63	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Granitoids undiff dominate both ends of the compartment; spongolite (in lutite/arenite sequences) dominates the embayments.
					37	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
12.25	Thijssen	Recherche	**Hammer Head**	**Tagon Point**	86	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Dominantly granitoids undiff; with occurrences of spongolite (in lutite/arenite sequences) in the embayments.
					14	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
12.26	Thijssen	Recherche	**Tagon Point**	**Cape Arid**	56	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Spongolite (in lutite/arenite sequences) dominates the first half of the embayment; then grades into granitoids undiff; before changing to metamorphosed granitoids.
					35	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
					9	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
12.27	Thijssen	Recherche	**Cape Arid**	**Cape Pasley**	72	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	Dominantly metamorphosed granitoids; with a minor occurrence of schists/quartzites/gneisses near Cape Pasley.
					28	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	
13.11	Giles	Malcolm	**Cape Pasley**	**Point Malcolm**	57	Broad smooth curving sandy beach, which may be cuspate or crenulate, formed between or in association with resistant headlands.	Schists/quartzites/gneisses.
					30	Exposed high energy shorelines with eroded igneous or metamorphic rocks associated with overlying beachrock or aeolean limestone.	
					13	Narrow sandy beach without extensive beachrock backed by continuous stable well vegetated high dunes which may include calcarenite.	

CCID	Region	Primary	From	To	%	OSRA - landform	Smartline - geology
13.12	Giles	Malcolm	**Point Malcolm**	**Israelite Bay N**	98	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Schists/quartzites/gneisses dominate through the first half of the embayment before changing to metamorphosed granitoids.
13.13	Giles	Malcolm	**Israelite Bay N**	**Wattle Camp**	78	Broad smooth sloping sandy beach with well vegetated primary dune, often backed by parallel beach ridges or stabilised parabolic dunes.	Metamorphosed granitoids.
					22	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
13.14	Giles	Malcolm	**Wattle Camp**	**Point Culver**	65	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	Metamorphosed granitoids; grading into limestones undiff.
					25	Undercut steep cliff face eroding cainozoic sedimentary material.	
					10	Broad, smooth gently sloping coarse grained sandy beach with low primary dune, showing extensive vegetation; including barrier beaches and may include marshes, swamps or echelon lake systems in swales.	
13.21	Giles	Baxter	**Point Culver**	**Point Dover**	100	Undercut steep cliff face eroding cainozoic sedimentary material.	Limestones undiff.
13.22	Giles	Baxter	**Point Dover**	**Twilight Cove**	100	Undercut steep cliff face eroding cainozoic sedimentary material.	Limestones undiff.
13.31	Giles	Kanidal	**Twilight Cove**	**Scorpion Bight**	59	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Limestones undiff.
					25	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
13.32	Giles	Kanidal	**Scorpion Bight**	**Red Rocks Point**	100	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	Limestones undiff.
13.33	Giles	Kanidal	**Red Rocks Point**	**WA-SA Border**	28	Beachrock dominates beach with occasional sandy sections; may have a low underct beachrock cliff face.	Limestones undiff.
					24	Variable width sandy beach formed in areas protected by offshore reefs; may include some beachrock as low cliffs or headlands.	
					22	Broad smooth gently sloping coarse grained sandy beach with some active dunes and unstable blowout areas.	
					19	Broad, smooth gently sloping coarse grained sandy beach with low primary dune, showing extensive vegetation; including barrier beaches and may include marshes, swamps or echelon lake systems in swales.	