Eyre Peninsula Coastal Action Plan
and Conservation Priority Study
VOLUME 1

Australian Government

Government of South Australia

Eyre Peninsula Coastal Action Plan

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2011

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This plan is a coastal conservation assessment and coastal action plan for the Eyre Peninsula coast between Two Hummocks Point in Spencer Gulf to the eastern boundary of Wahgunyah Conservation Park and builds upon the Conservation Assessment of the Northern and Yorke Coast, the Southern Fleurieu Coastal Action Plan and Conservation Priority Study, the Far West Coastal Action Plan and Conservation Priority Study and Metropolitan Adelaide and Northern Coastal Action Plan.

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Cover photos
Front cover (clockwise from top left): Eastern Osprey (*Pandion cristatus*), Andrew Brooks; Australian Sea-lion (*Neophoca cinerea*), Ceduna DENR Office; Entrance Beach, David Armstrong; Mangrove flower (*Avicennia marina ssp. marina*), Sharie Detmar; Hooded Plover (*Thinornis rubricollis*), Jason Quinn.
Back cover: Tern colony, Ceduna DENR Office; Wanna, Coast Protection Board, 2007.

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There are also many other individuals and groups across the region that provide an invaluable contribution in providing information and managing the coastal environment and have assisted in the project.

The project was based on a methodology devised by Doug Fotheringham, Nerissa Haby and Matthew Royal for a study of the Northern and Yorke Natural Resources Management Region (Caton et al. 2007a), which arose from an idea of Tim Noyce from the Department of Environment and Natural Resources.

Executive Summary

This report provides the methodology and results of a conservation assessment and action plan for the coastal area of the Eyre Peninsula NRM region, between Two Hummock Point north of Point Lowly and Wahgunyah Conservation Park, west of Cape Adieu. The Eyre Peninsula Natural Resources Management (EP NRM) Board secured funding from the Commonwealth 'Caring for our Country' initiative and commissioned the South Australian Department for Environment and Natural Resources (DENR) to conduct the study. DENR has also provided resources to enable consultants and DENR staff to undertake this project. The project follows the methodology that has been established and used for similar studies in other South Australian NRM regions over the last 5 years.

The aim of the study was to improve the understanding of the region's coastal natural resources to provide better protection, conservation and management, and to establish conservation priorities for places and areas within the region. The EP NRM Board recognised the need:

- for a detailed review of the region's coastal natural resource assets, thus establishing a baseline statement for the region,
- to examine the threatening processes impacting on these assets,
- to identify opportunities for more effective management at the local scale and to define specific management actions and their priority, and
- to establish a framework of broad actions and targets to guide the regional community, regional NRM investment and other investment opportunities in the coast.

For the purposes of the assessment a coastal boundary was defined based on natural coastal features such as dunes and salt marshes; where coastal landforms were ill-defined a default distance of 500 metres from the high water mark was used. In order to facilitate the analysis and discuss management issues at the local scale within this coastal zone, it was divided into 85 'cells' or small sub regional landform units with an average mapping length of approximately 27 kilometres. These cells were used as a means to analyse, describe and map significant area.

The study used Geographic Information Systems (GIS) software to collate, analyse and present information retrieved from government databases, together with information from community groups and local and/or specialist experts. Thirty-two conservation and 19 threat themes were used to create 51 digital maps (or 'layers'). Each layer showed values from 0 to 9 for each pixel on the map: any one layer consisted of millions of such values set out on a fixed grid. Thus conservation values or threat values could be summed for each point on the map of the region. As an example a detailed map of the sum of conservation values and the sum of threat values for the area in and around cell EP10, Franklin Harbour, is shown below in Figures 1.3 and 1.4, Introduction.

Conservation and threat values were determined for all cells, both in detail and as averages for the whole cell. Where high conservation values occur in the same location as high threat values, this was taken to indicate a high priority for action to manage the threat. A major part of the report is the description and analysis of 56 of the 85 cells containing high value areas, including local management action recommendations. Where local conservation values and threats identified a wider regional issue and appropriate action, these have been detailed in the Regional Management Proposals section of the report.

The authors of the report believe this represents an objective and verifiable way of establishing priority for action in managing conservation values of the Eyre Peninsula coastal region. In the future it could be used as a baseline statement in a long term process of adaptive management.

The final report of the project is in hard copy, and on DVD, which includes the digital maps, data layers, the report and some additional information such as species lists.

Regional management proposals for action are set out below. Local management actions are included in the detailed cell descriptions in Chapter 6.

Regional Management Proposals

[Local management actions derived from individual cell analysis are described in Chapter 6.]

Recommendation 1. Adequacy of Data and Managing Change

The data upon which this project is based is a collation and review as at 2010. But change is occurring rapidly, including change as a result of management actions. In order to continue to manage effectively, survey and monitoring will need to take place in an ordered way in the future.

Objective

- To improve and regularly update the databases on which this project is based, in order to manage change within the coastal region of the Eyre Peninsula.

Actions:

1.1 EP NRM Board and DENR to work together to regularly update the databases within the project area. In particular, continue survey work to improve the resolution and reliability of existing floristic mapping; consider specifically mapping coastal plant associations identified by Oppermann 1999; and wetland and grassland plant associations.

1.2 EP NRM Board to consider using the coastal conservation methodology for conservation and threat assessment in its future planning for monitoring change and adaptive management.

1.3 Ensure that DENR plans for biological survey and monitoring take into account the data deficiencies revealed by this study.

1.4 Increase the number of permanent monitoring sites to measure long term change to plant communities along the EP coast, covering the full range of coastal vegetation environments.

1.5 Resurvey previous flora and fauna survey sites (such as the Coastal Dune and Clifftop surveys and salt marsh profiles) to identify and/or monitor change.

1.6 DENR to maintain biological surveys of fauna to improve information about: total species within the region; population dynamics; habitat requirements.

1.7 Identify flora and fauna records and surveys that are not in the Biological Database of South Australia (BDBSA) (eg. private surveys/records, government surveys not yet entered). Evaluate/ verify data and enter into the BDBSA.

1.8 Conduct an extensive fauna and flora survey to enhance existing baseline data, identify species extent and distribution, and validate existing records suggesting range extensions. Particularly focusing on areas with no, or few, current records and species with few records (eg. mammals, reptiles, amphibians and invertebrates).

1.9 Support research into fauna ecology and resource requirements in the EP coast.

1.10 Support volunteer groups, individuals, community groups, environmental organisations and education bodies in undertaking regular surveys to supplement and update current data.

(NRM/ DENR)

Recommendation 2. Conserving Valuable Areas and Species

Approximately 43% of the study area is within National Parks and Wildlife parks or reserves, vegetation Heritage Agreements or Aquatic Reserves. This demonstrates the conservation significance of the region's coastal natural areas. Protection and management of these dedicated conservation areas could be improved through increased resourcing and further community engagement. However, there are also areas of high conservation value which are important for threatened flora species, fauna species and/or plant communities that would benefit from protection and/or improved management. The study found 11 flora and 19 fauna species recorded within the study area that are listed as threatened under the national *Environmental Protection and Biodiversity Conservation Act 1999* and 65 flora and 74 fauna species within the study area that are listed as threatened under the state *National Parks and Wildlife Act 1972*. In addition, numerous rare and/or endemic plant communities were identified, some of which only occur within the Eyre Peninsula coastal region.

Objective

- To raise the conservation status and management investment in selected significant areas within the region and for selected species and vegetation associations.
- Conserve and protect native flora and fauna species and vegetation communities from threatening processes

Actions:

2.1 Protect, improve and (where possible) expand remnant vegetation patches across the region.

2.2 Manage and protect the 37 floristic communities identified by the Coastal Dune and Clifftop Survey as both rare in the State (less than 20 sites in SA) and having >50% sites recorded along the EP Coast (see Section 3.1.2, Table 3.2) (particularly *Triodia compacta*, *Eucalyptus incrassate, Leucopogon parviflorus / Acrotriche patula, and Meleleuca brevifolia / Gahnia filum* communities which have 100 percent of records within the Eyre coastal region).

2.3 Improve the awareness of and engage the community in threatened species preservation and protection of unique habitat in the Eyre coastal region (e.g. utilising focal species as detailed in Section 3.2) (see also Recommendation 10.3 & 10.7 Capacity Building)

2.4 Prevent the drainage, water extraction or alteration of floodplains, wetlands, swamps, creeks and groundwater resources without thorough investigation and research on the potential ecological impacts that may occur and mitigation actions to prevent or minimise these impacts. These areas provide habitat to numerous water dependent plants and animals.

2.5 Prepare management plans for parks within the region that don't have plans, notably Acraman Creek CP, Chadinga CP, Fowlers Bay CP, Franklin Harbor CP, Laura Bay CP, Munyaroo CP, Point Bell CP, Sceale Bay CP, Tumby Island CP and Wittelbee CP. Review / update older reserve management plans across the region, such as Point Labatt CP and Lake Newland CP.

2.6 Investigate opportunities to increase the percentage of salt marsh habitats protected under the reserve system.

2.7 Investigate opportunities to add high conservation value land to the state's reserve system

2.8 Limit or restrict access to known high sensitivity areas (e.g. breeding areas of beach nesting birds and White-bellied Sea-Eagle during nesting seasons, unstable or semi stable dune systems with high conservation values, etc).

2.9 Protect and increase areas of larval food species for butterflies (eg. increase the size and numbers of patches of Berry broombush to aid in the conservation of the endangered butterfly Small Bronze Azure, *Ogyris otanes)*.

2.10 Develop and implement recovery plans for animal and plant species and plant associations that are considered threatened.

2.11 Encourage, support and/or undertake monitoring programs for animal and plant species and plant associations that are considered threatened.

2.12 Develop and implement species management plans for threatened raptor species (ie. White-bellied Sea-Eagle and Eastern Osprey), including habitat and land management protocols, population monitoring programs, education programs, population conservation goals, recommended areas for research.

2.13 Develop and implement shorebird management plans for significant shorebird habitat areas, including management and monitoring strategies such as interpretive signage, fencing off nests, use of chick shelters, temporary signage in breeding territories, permanent, temporal or spatial beach closures to vehicles and off-leash dogs, undertaking and/or supporting ongoing shorebird monitoring programs, community education and awareness programs, eg. "chicks on beach".

2.14 Investigate the impacts of activities permitted along the coast, such as driving on beaches, managing pests and beach access, in areas where sensitive species inhabit (e.g. shorebirds, raptors), particularly during breeding seasons.

2.15 Where possible reduce the use of pesticides and chemicals, especially around wetlands and coastal embayments.

(NRM, DENR, Council, community)

Recommendation 3. Climate Change and Improving Ecosystem Resilience

> ***"Ecosystem resilience:*** *A measure of the ability of an ecosystem to withstand and recover from environmental stresses and perturbations."*
>
> (Commonwealth of Australia, 2004, p.40).

Climate change is already occurring: measured trends in sea level change, in mean air and ocean temperatures, in latitudinal migration of the climate belts and climate variability are becoming clear. These changes impact on our natural assets.

On-going climate change underpins many of the regional recommendations for action proposed here. Migration and adaptation of plant and animal species in response to climate change has occurred throughout historic and geologic time. Current adaptation to climate change is problematic because the speed of change is rapid, the barriers to ecosystem migration have increased through clearance, and habitat is heavily stressed by other current threats. There is a need to enhance ecosystem health to allow natural processes such as selection, migration and community composition to occur. Strategies to improve ecosystem resilience are already core business for many land managers; many local actions proposed in the cells section support this work. The threat of climate change underlines the need for renewed effort: in particular, increasing species numbers and combating habitat degradation by exotic species, as well as by erosion. Improving the connectivity between vegetation blocks and ensuring water for wetlands is a clear way to assist plants and animals to adapt to change.

Some 'no regrets' adaptations and necessary monitoring are proposed below.

Objectives

- To build ecosystem resilience to current pressures and as a precautionary adaptation to climate change.
- To begin to adjust now to climate change impacts on coastal habitats.
- To avoid decisions now which compromise future adaptation to change, and avoid unnecessary expense.

Actions:

3.1 For the NRM Board & DENR to adopt the vegetation linkages concept as a means of building resilience, and to build partnerships with private landowners, community groups and the Nature Foundation SA, to advance this concept within the coastal lands of the EP region.

3.2 Investigate the feasibility of establishing two large Coastlinks projects: (i) from Point Boston to Two Hummocks Point; (ii) from Proper Bay to Wahgunyah CP; using unalloted Crown land, all forms of existing Reserves, existing Heritage Agreements, land purchase and private property.

3.3 To facilitate a review throughout the region of areas suitable as buffer zones for salt marsh retreat, together with tidal flows and potential tidal flows in those areas. Also to review establishment of buffer zones for dune retreat. To establish setback buffer areas on the Council Development Plans in order that development now does not compromise adaptation to sea level rise in the future. A regional review of salt marsh and sand dune retreat areas/ buffer zones is also necessary to assist the implementation of the Better Development Plan process. From the Planning SA website - Better Development Plan Policy - Coastal Areas, p.26:-
"8. Development should be designed and sited so that it does not prevent natural landform and ecological adjustment to changing climatic conditions and sea levels and should allow for the following:

(a) the unrestricted landward migration of coastal wetlands
(b) new areas to be colonised by mangroves, samphire and wetland species
(c) sand dune drift
(d) where appropriate, the removal of embankments that interfere with the abovementioned processes"

3.4 Investigate opportunities to obtain LIDAR data coverage for the Eyre Peninsula coast to assist in identifying areas vulnerable to sea level rise and climate change.

3.5 For DENR and the EP NRM Board to review the coverage of the DENR beach and salt marsh profiles to ensure that adequate monitoring of shoreline, dune and salt marsh changes is carried out. The existing network of DENR profiles of beaches, foredunes, and wetlands will need to be extended to include more locations vulnerable to change resulting from sea level rise/ climate change. Such locations are proposed within the cell descriptions.

3.6 Investigate cliff retreat rates for various cliffs and cliff types around the region (eg. establish surveyed marker points).

3.7 Undertake a climate change vulnerability assessment on flora and fauna species and vegetation communities.

3.8 Currently change in the region is described, in certain aspects, by the existing time series of aerial photography. Because of changing technology in imaging it will be necessary to ensure that future imagery is of appropriate resolution to track coastal changes, such as dune, salt marsh and swamp migration, together with shoreline and cliff edge change.

3.9 Support and/or undertake research into the hydrological and ecological requirements of wetlands, swamps, soaks, lakes and groundwater ecosystems, the possible impacts of climate change on these areas and recommended management actions to conserve these areas.

(NRM, Councils, EP LGA, DPLG, Dept Premier and Cabinet, DENR, Coast Protection Board)

Recommendation 4. Recreational Activities

Recreational activities are popular along the Eyre Peninsula coast, but the vehicle and foot traffic associated with it needs management to reduce or prevent degradation of the features that make the coast such a valuable asset to the region. The numerous impacts along the coast from these activities include wildlife disturbance, vegetation destruction, dune destabilisation, soil disturbance and compaction, weed introduction and litter. Many of these impacts are concentrated around settlements, formal and informal car parks and camping areas.

Off-road vehicle tracks were identified as a significant threat throughout the study area. The mapping undertaken for this project identified a considerable increase in the number of tracks, car parks and camping areas within the coastal area compared to earlier aerial imagery and/or earlier track mapping. The mapping also identified a number of off-road tracks and car parks that are located close to undercut and unstable cliffs, presenting a significant safety hazard. A current baseline map of tracks, car parks and camping areas can be used to guide future management and indicate changes such as the appearance of new tracks or rehabilitation of closed tracks.

A series of actions are listed below to achieve the stated objective: when put together these actions amount to a major project, beginning with improved mapping of tracks, informal camping and parking sites.

Access and off-road vehicle use (tracks)

Objective

- To manage access to beaches, dunes, cliffs, samphire and other coastal areas to reduce damage by vehicles and pedestrians to flora, fauna, coastal habitats and landforms.

Actions:

4.1 Establish a process of regularly updating the digital maps of tracks established for this study. Review the mapping taking into consideration high conservation priority areas, destabilised dunes and sensitive coastal areas such as raptor breeding sites, shorebird feeding/ nesting sites and samphire areas that are often very slow to recover from damage.

4.2 Review the mapping, in consultation with key players, with a view to rationalising unnecessary, inappropriate and hazardous tracks and rehabilitation of degraded areas.

4.3 Determine effective means of closing and rehabilitating tracks and undertake a program to do so, including maintenance of track closures and clear directional signage.

4.4 Undertake education and compliance program on the use of unregistered vehicles (eg. quad bikes, trail bikes) on public land, such as coastal reserves, beaches, parks etc.

4.5 Develop and implement regional beach driving strategy to minimise impacts of vehicles on beaches, including review/ rationalise locations where vehicles allowed on beaches, impact monitoring program, education program, consistent speed limits, rules and signage.

4.6 Regional review of beach boat launching locations, with a view to monitor impacts and rationalise locations.

4.7 Review pedestrian access in high visitation areas, with a view to formalise and maintain access in locations where unrestricted access is causing damage.

4.8 Develop coastal access infrastructure maintenance program, using the information from the EP NRM coastal infrastructure audit.

4.9 Work with other coastal NRM regions and LGAs to develop a consistent state-wide approach to ORVs.

(DENR, NRM, Councils, SAPOL, DTEI)

Formal and informal car parks and camp sites

Objective

- Minimise the impact of camping and car parks on the natural environment.

Actions:

4.10 Regularly map and monitor impacts of informal camping and car parks. Review locations, management and need for camping and car parks in those locations. Close, rehabilitate, sign and maintain areas inappropriate for camping and car parks. Formalise, manage & maintain (eg. develop camping management plan, fencing, signs, weed management) areas where camping and car parks are permitted.

4.11 Monitor, manage, maintain and/or upgrade formal camping areas. Develop local and/or regional camping management plan, with actions to minimise visitor impacts, eg. barriers/fencing to prevent spread and informal tracks, signage, provision of appropriate amenities, weed management, waste/ litter management, regular patrols/ inspections, education programs, maintenance of facilities/ infrastructure.

4.12 Encourage and investigate opportunities for developing camping areas on privately owned and managed land with the view to rationalise camping areas on public land.

4.13 Consider a survey of campers to determine their expectations and/or wants for the area.

(NRM, DENR, Councils, DTEI)

Recommendation 5. Weeds Strategies / Priorities

Collation of existing vegetation surveys, together with additional information provided by EP NRM regional staff, suggests this region has a high level of weed threat. Entry points for weeds are widespread and include ORV tracks, car parks, camping and agricultural areas. In addition, the proximity of high value conservation areas to development nodes and settlements places vegetation at risk.

Objective

- To manage weed threats in high importance areas as detailed in this report through recovery and action plans focused on red alert and declared non-indigenous species.

Actions:

5.1 Develop and implement local and regional weed management plans (including monitoring, recording and mapping weed species, removal and rehabilitation as required).

5.2 Develop a centralised GIS based storage and collection system that links into State databases.

5.3 Establish permanent vegetation survey and monitoring sites to detect changes in weed extent and impacts.

5.4 Support research into improved methods of weed control (particularly for high impact or invasive weeds such as Polygala) and impacts of weeds on native coastal species, communities and habitats.

5.5 Protect high conservation value areas from weed invasion; identify areas to prioritise for diligent maintenance of "weed free areas".

5.6 Develop a weeds watch early warning system with a rapid response capability to tackle coastal weed outbreaks.

5.7 Education initiative targeting residents, community, holiday home owners, plant nursery suppliers and councils on the identification and impact of known and potential weed species and suggested management actions, including information on garden plants that can become weeds and alternative native species that can be used.

5.8 Run workshops for the local community to learn more about landscaping with local species and creating biodiversity in their garden.

(NRM, DENR, Councils, Community)

Recommendation 6. Introduced Animals

A number of introduced animals have been recorded in the Eyre Peninsula coast, including rabbits, foxes, cats, starlings and black birds. These species are known to impact on native wildlife through predation or competition.

Objective

- Minimise the impact of introduced fauna species on native flora and fauna.

Actions:

6.1 Establish a monitoring program for pest animals, particularly rabbits (and rabbit warrens), foxes and feral cats to identify distribution, abundance and impacts.

6.2 Develop and implement an introduced animal management strategy for Eyre Peninsula, including the establishment, continuation and/or expansion of control programs for introduced species where necessary and monitoring the effectiveness of control programs.

6.3 Support private landholders in pest control effort.

6.4 Conduct or support research into the impacts of pest animals on native flora and fauna.

6.5 Conduct or support research into improved methods and tools for monitoring and controlling pest animals.

(DENR, NRM)

Recommendation 7. Potential Acid Sulfate Soils

See
http://www.environment.sa.gov.au/Conservation/Coastal_Marine/Coast_Protection_Board/Coastal_acid_sulfate_soils

Objective

- To avoid the inadvertent disturbance of potential acid sulfate soils.

Actions:

7.1 The EP NRM Board in partnership with the Coast Protection Board, work with Councils to ensure that within Development Plans: (i) Areas mapped as hazardous are appropriately zoned. (ii)Principles of such zones take regard of potential coastal acid sulphate soil.

(NRM, Coast Protection Board, Councils)

Recommendation 8. Aboriginal Sites / Indigenous Consultation and Engagement

Objective

- Identify, manage and protect sites of Aboriginal significance and engage, involve and educate the local and broader indigenous community in coastal management.

Actions:

8.1 Encourage and support Aboriginal communities to register sites of Aboriginal significance with the Aboriginal Affairs and Reconciliation Division, Department for the Premier and Cabinet.

8.2 Encourage and support further surveys through the area to identify areas of Aboriginal significance, particularly a regional, all-encompassing Aboriginal cultural heritage survey.

8.3 Support and assist management and protection of sites of Aboriginal significance.

8.4 Enhance traveller awareness of conservation values, threatening processes and Aboriginal heritage on signs at key car parks and through other interpretive media.

8.5 Explore and promote opportunities for training and employing Aboriginal people in coastal land management.

8.6 Capture, document and use local indigenous knowledge on the coastal environment and coastal land management.

8.7 Engage Aboriginal communities to identify and address cultural heritage values in the coastal environment and coastal land management.

8.8 Engage and/or consult local Aboriginal people prior to undertaking land management works to ensure significant sites are not impacted.

(NRM, DENR, Dept Premier & Cabinet)

Recommendation 9. Capacity Building and Community Awareness

The effectiveness of many coastal management actions relies heavily on local and non-local community awareness and understanding.

Objective

- To build capacity in managing coastal areas and raise community awareness of coastal conservation and threat issues.
- To maximise the benefit of Coastcare effort within the region.

Actions:

9.1 Educate and involve local school children in coastal land management and the values of their nearby natural areas (e.g. plants, animals and heritage; site rehabilitation; clean up projects; monitoring programs).

9.2 Collaborate with educational institutions (e.g. TAFE) to develop and implement programs to increase community understanding about the coastal environment, human impacts and management options

9.3 Enhance community awareness of: (i) coastal areas in their natural state; ii) the value and function of birds of prey; (iii) the pressures on beach nesting shorebirds; iv) the impacts of driving on beaches; v) the threat of weeds and garden escape plants; vi) the heritage values of the coast; vii) impacts of marine debris.

9.4 Support and encourage native fauna and flora monitoring programs along the EP coast.

9.5 The NRM Board undertake and promote a guide for coastal urban gardens that encourages the use of local species. Develop and promote a pamphlet identifying known and potential weeds with suggestions for action.

9.6 Councils, the NRM Board and DENR continue to support and guide local Coastcare and 'Friends of' groups and to consider the need for greater emphasis on maintenance and follow up, to back up community effort.

9.7 Continue to encourage, support and work with community groups on coastal management activities, such as interpretive events, volunteer opportunities, media releases and further development of interpretive signs, guides and walks.

(NRM, Councils, DENR)

Recommendation 10. Implementation of this Project

Objective

- The actions to implement this project cross existing lines of responsibility and traditional concerns. Stakeholders will need to be made responsible to drive the process.

Action:

10.1 For the NRM to form working groups and appoint officers to drive the implementation part of the process of this project.

(NRM, DENR, Councils)

1 Introduction

1.1 Purpose of the study

The purpose of this study is to understand and facilitate the conservation, protection and management principles of the coastal resources of the Eyre Peninsula (EP) Natural Resource Management (NRM) region[1], and to establish conservation priorities for places and areas within the region. The study aims to provide a rational basis for conservation priority actions and places within the defined coastal region; it suggests actions to address threatening processes at specific locations within the region. The study also establishes a coastal database in map and table form, as a tool for ongoing adaptive management.

1.2 Extent of the Eyre Peninsula coastal project area

The coastal area under study extends from Two Hummocks Point on the western side of the Spencer Gulf to the eastern boundary of Wahgunyah Conservation Park (CP), in the far west of the state (Figure 1.1). The coastline is approximately 2,475 kilometres (km) in length or nearly half the coastline of the state.

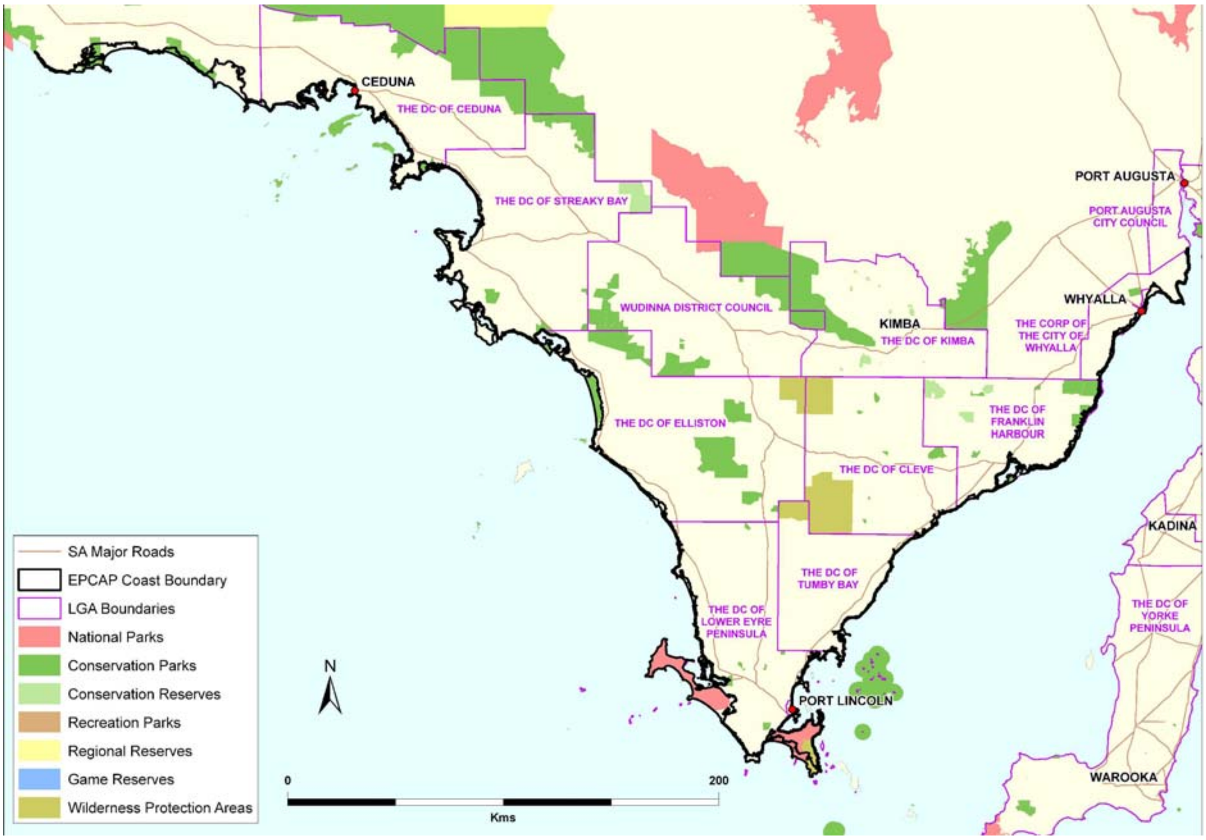


FIGURE 1.1 The extent of the Eyre Peninsula study area

The coast is defined for this study to include land above mean low water mark that, because of its vegetation, its landforms or its interaction with coastal processes can be described as coastal in

[1] Wahgunyah Conservation Park has not been include in the study area although it falls within the Eyre Peninsula Natural Resources Management Region; Wahgunyah Conservation Park was included within the Far West Coastal Action Plan and Conservation Priority Study

nature. Elsewhere the boundary has been taken as 500 metres (m) from low water. Thus, south of Cape Bauer the coastal boundary extends inland over two km to include areas containing coastal vegetation and sand dune areas (Figure 1.2), near Point Gibson the study area includes all of the salt marsh habitat. However, at Streaky Bay and the coast to the north, which are largely urban and/or agricultural land, the boundary defaults to the 500m where there are no identified coastal features beyond this.

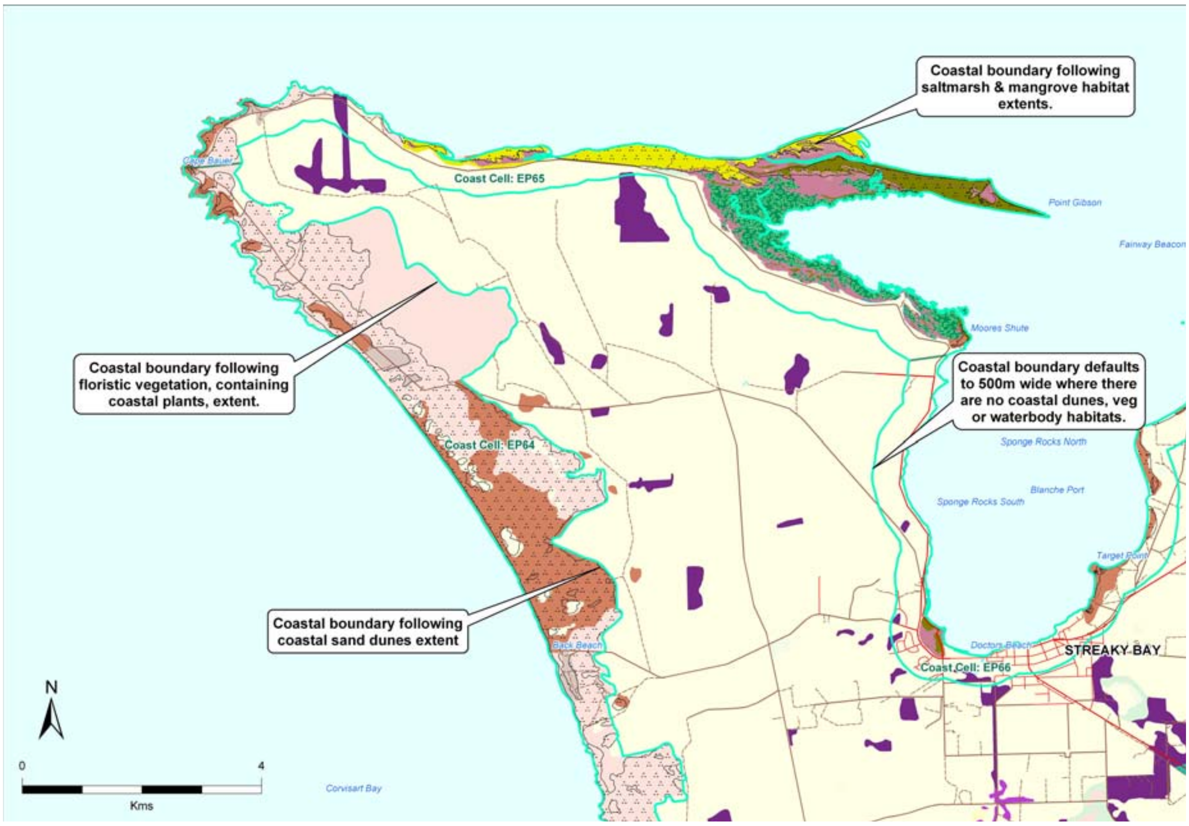


FIGURE 1.2 An example of the definition of the coastal boundary in this study

Many offshore islands have not been included within this study due to the unique and distinctive conservation values, threatening processes and management procedures of these islands. Islands that have been incorporated into the study include those nearshore islands within enclosed embayments or that have an impact on the coastal processes occurring on the mainland, ie. generally within 400m of the mainland.

The project area comprises 193,751 hectares, of which 72% is native vegetation and 0.42% is urbanised. This surprisingly large area of native vegetation is mainly coastal shrubland, together with mangrove and salt marsh. A considerable portion of the study area is protected: NPWSA reserve 36%; Crown Lands Act reserve 2.3%; Aquatic Reserve 0.28%; and Vegetation Heritage Agreement 6.7%.

The Eyre Peninsula coastal region comprises a variety of coastal environments. The medium to low energy coast of Spencer Gulf, from Two Hummocks Point to Cape Catastrophe, shows low sand storage either in Pleistocene calcarenite or unconsolidated sand from the Holocene to recent geological period. It is characterised by low cliffs, narrow beach and dune complexes, and many areas of salt marsh and mangrove, the most notable being at False Bay, Franklin Harbour and Tumby Bay. The south to south-west facing coast from Cape Catastrophe to Wahgunyah CP receives high wind and wave energy from the Southern Ocean, except where it sheltered by islands, reefs and peninsulas, or within sheltered embayments such as Coffin Bay, Venus Bay, Baird Bay or Tourville Bay. Large areas of this part of the coast comprise lithified Pleistocene calcareous dunes, often exposed in cliffs; while in the highest energy areas large accumulations of Holocene sands in offshore, beach and dune storage occur.

1.3 Definition of Coastal Cells

The Eyre Peninsula coast has been divided into 85 coastal cells, which have been defined on the basis of physical parameters: landform, coastal wind and wave energy levels (see reference maps in Appendix 1). These cells are used in the report for mapping, analysis and descriptive units, i.e. as the geographical units for which conservation priority, threats and actions are to be established. The cells are numbered EP1 immediately south of Two Hummocks Point, then sequentially to EP85 at the eastern boundary of Wahgunyah CP.

The cells define relatively small landform units at a sub-regional scale: thus a bay between headlands, a sand dune mass, or an area of low cliffs of common orientation, may be coastal cells. The size of individual cells varies (Appendix 2), but the average length of coastline of a cell is approximately 29 kilometres. The cells are units of workable scale; they bring together a large amount of data for an area small enough to discuss local management issues which can be assembled to inform regional management issues.

1.4 Methods Used

The core of the methods used involves the assembly of data on conservation (32 sets) and threats (19 sets) within the defined coastal area. Within each set of data, values (from 0 to 9) are ascribed, with expert help, for presence or absence, frequency, or rareness. These values are placed on digital maps (or layers): each layer showing values from 0 to 9 for each pixel on the map; any one layer consisting of millions of such values set out on a fixed grid. Geographic Information Systems software was used to obtain statistics and summaries for the cell and the region; conservation or threat values can be summarised for each point on the map. For example, in Figure 1.3 below the conservation values are summarised for the Franklin Harbour area. When this is compared with the threat values in Figure 1.4, spatial correlation is visually apparent.

These methods depend on spatial layout and their value is most visually apparent at the local (or cell) scale. However statistics for the whole region can be derived from the analysis and used to focus on features of the whole regional map.

The data is presented as a snapshot in time (although the most recent survey data is used, the dates vary); however, the most significant thing about many sets of data is change and the direction of change. Notably change in extent of habitat is critical for fauna. If there is repetition at a later date of this methodology for the region, then this will become apparent with each future iteration of the process. In this project, the local 'cell descriptions' are used to note local changes, where these can be identified and where they are a concern to the conservation of the natural assets of the region.

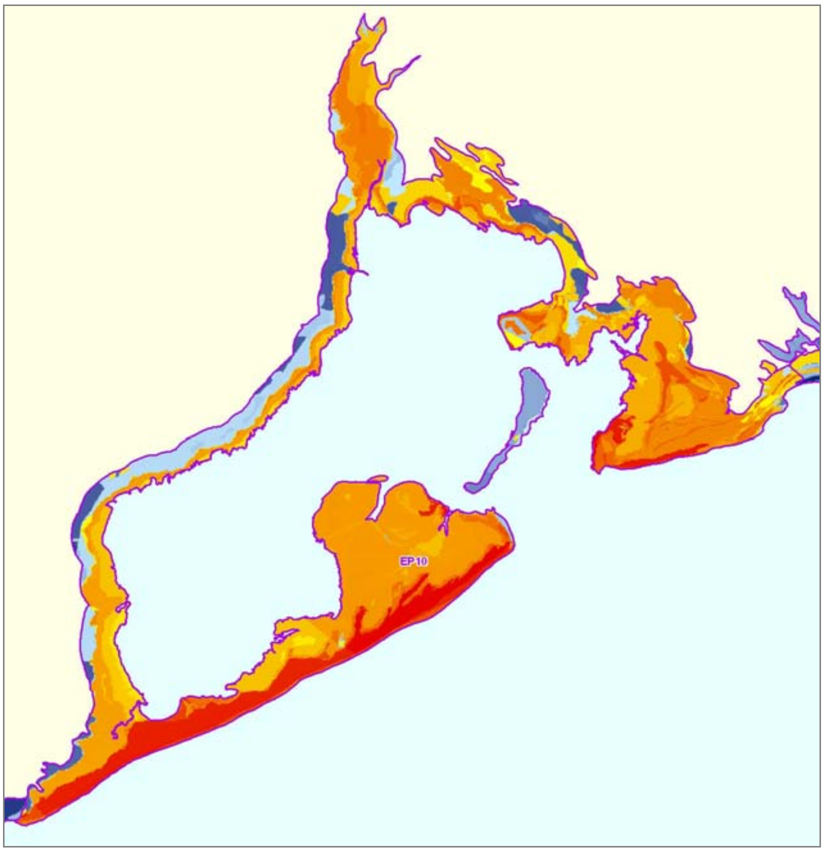


FIGURE 1.3 Summarised conservation values for EP10 Franklin Harbour, red indicates highest values, blue indicates lowest values

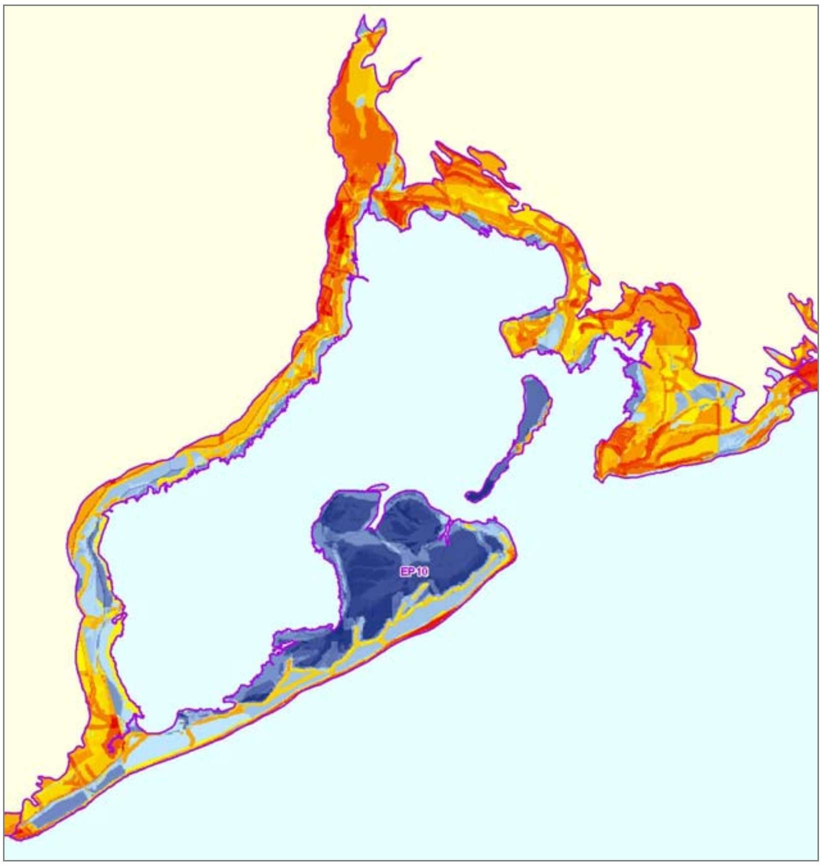


FIGURE 1.4 Summarised threat values for EP10 Franklin Harbour, red indicates highest values, blue indicates lowest values

1.5 Management Context

This project sits within, or is related to, a number of on-going processes within the region; the diagram below attempts to indicate the principal elements of these processes.

The EP coastal project aims to establish conservation priority of areas and places to support and inform the work of the EP NRM Board. This has been undertaken in two steps in defining priority:

- the first step assembles data relating to biota, geology and heritage distributed throughout the region;
- the second step looks at threatening processes impacting these features.

The combination (see Chapter 5) gives a statement, in mapped form, which allows discussion of priority actions to achieve the goals of the EP NRM Board for its coastal regions.

The whole of the process outlined in the flow diagram above may be said to encompass the elements of an ecosystem based management system (Smyth et al, 2003). This process has been described by Smyth et al, 2003, and has been summarised below, with minor changes:

1. Holistic Integrated Science

Recognition that systems are open, complex and inter-active. Change in one system may impact others. Achieving management objectives involves considering cumulative impacts. The best available science must be used throughout the management process. Scientists must view impacts as cumulative and consider the ecosystem as a whole.

2. Adaptive Management

Sparse and incomplete knowledge requires management that can respond to change, in societal needs, and change in ecosystems, some of which may have resulted from previous management actions. Management plans are a work in progress, and are able to respond to the results of monitoring key indicators. This is not a 'try it and see' approach, but a management style that recognises constant change in the environment, and, in responding, acknowledges the precautionary principle.

3. Collaborative Decision Making

When management is based on ecosystem features rather than political boundaries, a range of political, ecological, generational and cultural expertise is necessary for decision-making.

4. Socially Defined Goals and Perspectives

"Management should become a reflection of societal values rather than narrow scientific concepts that focus on single issues. However, management goals and objectives must be tempered by an understanding that ecosystem processes must be protected above all other values" (Smyth et al, 2003, p.15.).

The Eyre Peninsula NRM coastal management project is seen as contributing strongly to points 1 and 2 above. Particularly, the spatially based process for defining conservation priority for particular places and areas addresses the issue of cumulative impact. The data used in this study is a summation of the best available expert work in biodiversity, assembled through a spatial information system. The work may be seen as establishing base line data from which monitored change may be put in perspective and serves as the foundation of an adaptive management approach.

Many parts of the on-going work of the NRM Boards, including the NRM regional plans are essential components of elements 3 and 4 above.

1.6 Product

This project is a data assemblage and decision support system to assist in addressing the responsibilities of the NRM Regional Board. It is also useful for other managers, such as community groups, councils and state agencies. It provides a baseline statement against which future managers can evaluate management outcomes, as well as the impact of climate change. This document is produced on DVD and in hardcopy; the DVD allows detailed interrogation of the digital maps and data.

The report has been divided into two volumes: Volume 1 describes methodology, and provides a description of the conservation themes, including flora, fauna, heritage and geomorphology and describes the threatening processes such as recreational activities, development, weeds and hazards for the region; Volume 2 details the results of the analysis and provides the detailed descriptions and actions for the individual cells.

2 Description of Themes and Databases

This section draws heavily on 'Description of themes and databases' by Nerissa Haby, in Caton et al 2006, and the careful records of the processes used, kept by Matthew Royal.

A variety of data was used to describe conservation values and threats along the Eyre Peninsula coast. The extent and representation of data for the Eyre Peninsula coast was limited to information available at the time of the analysis. In all, 51 data themes were assembled, 32 conservation layers and 19 threatening process layers, as described below.

2.1 Framework of layers

2.1.1 Conservation layers

Communities and species with threatened status

- 1A. Priority of vegetation species based on the status of the community (threatened status) (coastal dune and clifftop communities)
- 1B. Priority of vegetation assemblage based on the rarity of the community in SA (those with <20 records within SA) (coastal dune and clifftop communities)
- 1C. Priority of sites with threatened flora (threatened status)
- 1D. Priority of sites with threatened fauna (threatened status)
- 1E. Priority of sites based on total number of threatened species (total number of threatened species)

Endemic species and communities; biodiversity

- 2A. Priority of vegetation assemblage based on the distribution of endemic plant communities (>50 % of records within the Eyre Peninsula coast) (coastal dune and clifftop –species and floristic)
- 2B. Priority of vegetation assemblage based on the distribution of endemic habitat (>50 % of habitat within the Eyre Peninsula coast) (saltmarsh communities)
- 2C. Priority of vegetation assemblage based on the distribution of endemic habitat (>50 % of habitat within the Eyre Peninsula coast) (floristic vegetation)
- 2D. Priority of sites based on species richness (total number of species)

Significant bird habitat

- 3A. Priority of sites as habitat for threatened bird species
- 3B. Priority of sites as habitat for all existing birds

Significant reptiles and amphibian habitats

- 4A. Priority of sites as habitat for threatened reptile and amphibian species
- 4B. Priority of sites as habitat for all existing reptile and amphibian species

Significant mammal habitats

- 5A. Priority of sites as habitat for threatened mammal species
- 5B. Priority of sites as habitat for all existing mammals

Significant butterfly habitats

- 6A. Priority of habitat for butterflies based on vegetation assemblage

Focal species

7A. Priority of location based on Australian Sea-lion colonies

7B. Priority of location based on the habitat of the Australian Pied Oystercatcher

7C. Priority of location based on Eastern Osprey nesting sites and territory

7D. Priority of location based on White-bellied Sea-Eagle sites and territory

7E. Priority of location based on the habitat of the Beach Slider

7F. Priority of location based on the habitat of the Bight Coast Skink

Visual amenity

8A. Viewshed analysis (sea views from the land)

8B. Viewscape analysis (perceived visual appeal of coastal landscape)

Vegetation patch metrics

9A. Priority of remnant vegetation based on patch size

9B. Priority of vegetation assemblage based on connectivity (minimum distance to nearest patch)

9C. Priority of vegetation assemblage based on the presence of remnant vegetation (< 1 ha)

9D. Priority of vegetation assemblage based on patch shape (edge to interior ratio)

Heritage

10A. Aboriginal/ Indigenous heritage sites

10B. European/ non-indigenous heritage sites

10C. Geological heritage (significant geological features)

Wetlands

11A. Priority of location based on the significance of wetland

2.1.2 Threatening process layers

Recreation / visitation impacts

1A. Campsites and day use areas

1B. Off-road vehicle tracks

Development impacts

2A. Development zoning

2B. Land ownership

2C. Viewshed analysis (increased threat due to sea views)

2D. Viewscape analysis (increasing threat due to aesthetics of the coastal zone)

2E. Existing development

Land use impacts

3A. Land use

3B. Mining activities

3C. Wastewater treatment plants / rubbish dumps / tailings / evaporation pans

Threats to habitat integrity

4A. Vegetation isolation (lack of connectivity between vegetation patches)

4B. Vegetation degradation

4C. Vegetation shape (shapes allowing increased invasion)
4D. Vegetation patch size (smaller patches allowing increased invasion)
4E. Distribution of known environmental weeds
4F. Feral species (rabbits)

Hazards
5A. Dune stability
5B. Cliff stability
5C. Acid sulfate soils

These datasets were selected from what was available at the time of analysis. Although considerable processing of information was done, a number of new sets of data were created from a variety of sources, such as previously mapped information and aerial photography, some include: off-road vehicle tracks, campsites, cliff stability and acid sulfate soils. However, local and non-local expert knowledge was generously provided and used to greatly improve the report.

Data was categorised, with expert advice, into low to high importance and assigned scores 0 to 9, as set out below. The analysis of the data using GIS software is described in Section 2.2; listing of ownership of datasets is in Section 2.5 and limitations of the data and methodology are outlined in Section 2.6.

The biological survey of the South Australian coastal dune and clifftop vegetation (CDCS) provides the most extensive distribution of flora survey sites throughout the South Australian coastal zone (Oppermann 1999). This survey applied a standard and systematic method, leading to the collection of consistent data that may be used for a variety of purposes, such as assessing the distribution of threatened, endemic and rare communities.

Assumptions used to enhance the representation of data throughout the region and ease of processing this information in the analysis include:

- flora and fauna detected at a survey site within a remnant patch of vegetation were assumed to occur within suitable habitat to the extent of that patch, unless there was evidence to the contrary. The floristic vegetation dataset derived from aerial photograph analysis was frequently used to enhance the information available from the survey point data
- fauna recorded within the coastal boundary was assumed to be likely to be found in nearby suitable habitat, whether recorded by survey within the vegetation patch or not. This was particularly significant in the distribution of reptiles and butterflies.

2.2 Method of rating priority

A key feature of the Eyre Peninsula Coastal Action Plan is highlighting areas of conservation priority in the coastal zone using desktop GIS techniques. Moreover, areas in need of more protection or management can be pinpointed by comparing areas of high conservation priority to those areas with perceived threat processes operating. To do so, data from numerous databases, not often drawn together, was combined to add as much up-to-date information from as many sources as possible. The many data sources used and created in this project are listed in Section 2.5.

The analysis in this study can be separated into two components, both following a similar workflow: analysis of conservation priorities and analysis of threat processes. In general the analysis began using data in its original base GIS state, whether the layers currently existed in databases or were created from additional data sources specifically obtained for the project.

Features within each GIS layer were categorised from low importance to high importance using priority values (scaled 0 to 9) established for each data theme by the working group, depending on the characteristics of the features of each GIS layer (see Sections 2.3 and 2.4 for a more detailed explanation of the priority values and how they were applied to the data).

Once each GIS layer was characterised using conservation priority or threat process values each data theme was rasterised as a geo-referenced 25 × 25 m grid layer. These raster layers, covering the entire Eyre Peninsula coast, used priority values assigned to the features within each base GIS layer to provide grid values. The conversion of base GIS layers to raster grids allows the vast amount of spatial data used to be quickly and effectively summarised and analysed using the raster layers' coincident grid nature.

Once each of the conservation priority and threat process data layers was successfully rasterised, those numerous layers were combined into two raster layers: one focused on the combined conservation priority values and the other on the combined threatening process values. The resulting 'detailed conservation priority raster analysis layer' and the 'detailed threatening processes raster analysis layer' form the basis for many of the GIS conclusions drawn in the project (these can be viewed on the CD). These layers allow areas of high conservation priority and contrasting high threat, from numerous coincident conservation and threat types, to be pinpointed at the base grid level of 25 × 25 m. Small portions of the landscape with higher conservation or threat levels are easily highlighted; however, they need to be generalised to a manageable scale to identify areas of higher priority. Thus the 'conservation priority analysis coastal cell summary' and the 'threatening processes analysis coastal cell summary' were created.

Both final summary layers are the result of statistical analysis carried out on each individual conservation priority and threat process raster layer. Each was statistically summarised by calculating the mean of all grid cell values within each coastal cell. This gives the priority value for the entire coastal cell. Furthermore, by combining the raster analysis layer summaries together (finding the total sum of the means for all themes within the coastal cells) a combined 'conservation priority analysis coastal cell summary' and a combined 'threatening processes analysis coastal cell summary' were created (see Figures 5.1 and 5.2 in Volume 2, also available on the DVD; Appendices 4 and 5 show individual cell scores).

These combined coastal cell summary layers form the basis of a number of conclusions drawn within this study. The higher the mean, the greater the proportion of area within that coastal cell that has a higher combined conservation value or higher combined threat process value. The coastal cells with a high combined conservation priority due to higher conservation priorities within a number of the layers can be determined by working out those coastal cells with the highest combined conservation priority value – a process that quickly yields the coastal cells requiring more attention than others. The same process applied on the combined threatening process layer, can quickly determine the coastal cells influenced by a number of significant threatening processes. The identified high conservation priorities and threatening processes at a coastal cell level will serve as a pointer to specific areas within these coastal cells requiring conservation management by reverting back to the detailed 25 × 25 m raster analysis layers created earlier.

The GIS analysis was an effective means of pinpointing areas in the Eyre Peninsula coast that have high conservation value by reinforcing a variety of conservation priorities in some areas and not others. Specifically, the ability to interrogate numerous sources of data within multiple data themes makes it a comprehensive and reliable desktop analysis using the most up-to-date information available. The analysis layers can also be quickly updated if additional detailed or current information becomes available.

2.3 Layers used in the conservation analysis

2.3.1 Communities and species with threatened status

1A. Priority of vegetation species based on the status of the community (threatened status) (coastal dune and clifftop communities)

The floristic field survey of the South Australian Coastal Dune and Clifftop Survey, Oppermann 1999, (CDCS below) provides the most extensive distribution of flora survey sites throughout the Metropolitan Adelaide coastal zone. This survey applied a standard and systematic method (Heard & Channon, 1997), leading to the collection of consistent data that may be used, for instance, to assess the distribution of threatened, endemic and rare communities.

Vegetation communities identified as nationally and / or state threatened in the CDCS were rated (0 – 9), as below.

TABLE 2.1 Priority assigned to threatened flora communities

Priority	5	7	9
National status		V	E
SA status	R	V	E

R: Rare, V: Vulnerable, E: Endangered

1B. Priority of vegetation assemblage based on the rarity of the community in SA (those with < 20 records within SA; coastal dune and clifftop communities)

The state-wide coverage of CDCS was used to identify rare coastal communities. These were specified as those with less than 20 records within South Australia (Table 3.2). Each patch of remnant vegetation containing a site was assigned a priority value, based on the degree of rarity for vegetation community.

TABLE 2.2 Priority assigned to rare flora communities

Priority	6	7	8	9
	16–20 records in SA	11–15 records in SA	6–10 records in SA	1–5 records in SA

1C. Priority of sites with threatened flora (threatened status)

This drew on existing databases containing the national and state status of species of flora. 61 species found within the Eyre Peninsula coastal boundary have a state conservation status. There were 10 flora species recorded with a national rating.

TABLE 2.3 Priority assigned to threatened flora species

Priority	5	7	9
National status (EPBC Act Status Code)		V	E
SA Status (Review of the Status of Threatened Species 2003)	R	V	E

R: Rare, V: Vulnerable, E: Endangered

1D. Priority of sites with threatened fauna (threatened status)

Existing databases were used to identify fauna species with national and state status, together with expert contributions. Values obtained from these ratings were combined to produce a single layer for analysis.

M (Migratory): species listed under the Bonn Convention, Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) Conventions, or other international agreement approved by the Minister.
R (Rare): has a low frequency of occurrence; not currently threatened but warrants monitoring and protective measures to prevent reduction of population size.
V (Vulnerable): high risk of extinction in the wild in medium-term future.
E (Endangered): very high risk of extinction in the wild in the near future.

TABLE 2.4 Priority assigned to threatened fauna species

Priority	1	5	9
National status (EPBC Act Status Code)		V, M	E
SA Status (Review of the Status of Threatened Species 2003)	R	V	E

R: Rare, V: Vulnerable, E: Endangered, M: Migratory

1E. Priority of sites based on total number of threatened species (total number of threatened species)

The total numbers of threatened flora and fauna species were summarised at all locations within the coastal boundary, using a combination of the data on which layers 1C and 1D are based.

TABLE 2.5 Priority assigned to the number of threatened flora and/or fauna species

Priority	3	4	5	6	7	8	9
No. of threatened species of plant and/or animal	1-6	7-11	12-16	17-21	22-27	28-33	>34

'Threatened' incorporates both flora and fauna and up to 3 categories, R: Rare, V: Vulnerable, E: Endangered, for each

2.3.2 Endemic species and communities; biodiversity

2A. Priority of vegetation assemblage based on the distribution of endemic plant communities (> 50 % of records within the Eyre Peninsula coast) (coastal dune and clifftop – species and floristic)

The state-wide coverage of the CDCS survey was used to compare the Eyre Peninsula with other coastal regions of South Australia: if more than 50% of records of a plant community were found within the Eyre Peninsula coastal boundary, it was rated, as in the table below. This rating thus reflected the degree of endemism to the coast of the Eyre Peninsula.

TABLE 2.6 Priority assigned to plant communities with more than 50% of records found within the Eyre Peninsula coastal boundary

Priority	3	5	7	9
Percentage of SA records found within Eyre Peninsula coastal boundary	50.1–60%	60.1–70%	70.1–80%	80.1+%

2B. Priority of vegetation assemblage based on the distribution of endemic habitat (> 50 % of habitat within the Eyre Peninsula coast) (saltmarsh communities)

Systematic coastal saltmarsh and mangrove habitat mapping around the state by Coastal Management Branch, DENR, provides an endemism rating for saltmarsh areas within the state.

TABLE 2.7 Priority assigned to saltmarsh communities with more than 50% of records found within the Eyre Peninsula coastal boundary

Priority	6	7	8	9
Percentage of SA records found within Eyre Peninsula coastal boundary	50.1–60%	60.1–70%	70.1–80%	80.1+%

2C. Priority of vegetation assemblage based on the distribution of endemic habitat (>50 % of habitat within the Eyre Peninsula coast) (floristic vegetation)

This layer was based on the national inventory of vegetation associations: a further reflection of the degree of endemism of associations within the Eyre Peninsula coast.

TABLE 2.8 Priority assigned to vegetation communities with more than 50% of records found within the Eyre Peninsula coastal boundary

Priority	6	7	8	9
Percentage of SA records found within Eyre Peninsula coastal boundary	50.1–60%	60.1–70%	70.1–80%	80.1+%

2D. Priority of sites based on species richness (total number of species)

This layer is based on a total number of plant and animals species recorded at any location. While the presence of threatened species is significant for conservation and management programs, so too are areas of high and representative species diversity. Priority values were assigned to all locations within the coastal boundary based on the number of species detected.

TABLE 2.9 Priority assigned to the number of flora and fauna species at any location

Priority	3	4	5	6	7	8	9
Number of species per location	8-62	63-104	105-149	150-192	193-242	243-338	339-578

2.3.3 Significant bird habitats

3A. Priority of sites as habitat for threatened bird species

This layer was created to enhance the representativeness of habitat for threatened bird species. As with other species of fauna, there is relatively little data available to accurately determine significant areas for these species. Hence, an additional theme was created to represent the value of areas as habitat for threatened bird species.

Bird lists for cells in the Eyre Peninsula coast were obtained from published records; current data, expert and local knowledge of the distribution of the species and the distribution of available habitat were used to determine the conservation value for threatened birds within each coastal cell. This improved the data coverage for determining the significance of the whole coast for threatened birds, without being limited to known survey site locations.

TABLE 2.10 Priority assigned to sites as habitat for threatened bird species

Priority	5	6	7	8	9
Number of threatened bird species habitats	1-4	5-9	10-17	18-25	26-38

3B. Priority of sites as habitat for all existing birds

As for 3A, this layer used bird lists from published records; current data, expert and local knowledge of the distribution of the species and the distribution of available habitat were used to determine the conservation value for all birds within each coastal cell. This improved the data coverage for determining the significance of the whole coast for all birds, without being limited to known survey site locations.

TABLE 2.11 Priority assigned to sites as habitat for all bird species

Priority	1	2	3	4	5	6	7	8	9
Number of bird species habitats	1-15	16-26	27-36	37-50	51-66	67-78	79-88	89-99	100-127

2.3.4 Significant reptile and amphibian habitats

4A. Priority of sites as habitat for threatened reptile and amphibian species

This layer was created by using reptile and amphibian lists from published records; current data and expert knowledge (Dr. Mark Hutchinson) of the distribution of the species and the distribution of available habitat were used to determine the conservation value for threatened reptile and amphibian species within each coastal cell. This improved the data coverage for determining the significance of the whole coast for threatened reptile and amphibian species, without being limited to known survey site locations.

TABLE 2.12 Priority assigned to sites as habitat for threatened reptile and amphibian species

Priority	5	6	7	8	9
Number of threatened reptile or amphibian species habitats	1	2	3	4	5-6

4B. Priority of sites as habitat for all existing reptile and amphibian species

This layer was created by using reptile and amphibian lists from published records; current data and expert knowledge (Dr. Mark Hutchinson) of the distribution of the species and the distribution of available habitat were used to determine the conservation value for all reptile and amphibian species within each coastal cell. This improved the data coverage for determining the significance of the whole coast for all reptile and amphibian species, without being limited to known survey site locations.

TABLE 2.13 Priority assigned to sites as habitat for all reptile and amphibian species

Priority	1	2	3	4	5	6	7	8	9
Number of reptile or amphibian species habitats	3-10	11-14	15-18	19-23	24-27	28-31	32-36	37-40	41-51

2.3.5 Significant mammal habitats

5A. Priority of sites as habitat for threatened mammal species

This layer was created by using mammal species lists from published records; current data, local and expert knowledge (Cath Kemper) of the distribution of the species and the distribution of available habitat were used to determine the conservation value for threatened mammals within each coastal cell. This improved the data coverage for determining the significance of the whole coast for threatened mammal species, without being limited to known survey site locations.

TABLE 2.14 Priority assigned to sites as habitat for threatened mammal species

Priority	5	6	7	8	9
Number of threatened mammal species habitats	1-2	3-4	5-6	7-8	9-11

5B. Priority of sites as habitat for all existing mammals

This layer was created by using mammal species lists from published records; current data, local and expert knowledge (Cath Kemper) of the distribution of the species and the distribution of available habitat were used to determine the conservation value for all mammals within each coastal cell. This improved the data coverage for determining the significance of the whole coast for all mammal species, without being limited to known survey site locations.

TABLE 2.15 Priority assigned to sites as habitat for all reptile and amphibian species

Priority	1	2	3	4	5	6	7	8	9
Number of all mammal species habitats	2-6	7-8	9-11	12-14	15-18	19-21	22-25	26-30	31-33

2.3.6 Significant butterfly habitats

6A. Priority of vegetation assemblage as habitat for butterflies

The importance of habitat for invertebrates is generally underestimated or excluded from most biodiversity and conservation assessments. Data is generally unavailable and difficult to collect.

To represent invertebrate habitat, extensive information on the butterflies of South Australia was used to establish a theme for the conservation analysis (Grund 2005). Species of butterflies, habitat requirements and host plants required for the larval stages of the butterflies' lifecycles were determined for the Eyre Peninsula coast. As host plants are required for the butterflies' persistence in an area, the diversity of host plants was used as an indicator of the butterfly species possibly located within a patch of remnant vegetation. This approach does not take into consideration of the condition of the host plants, host plant abundance and presence of other resource requirements, such as food plants (R Grund pers. comm.).

TABLE 2.16 Priority of remnant vegetation based on the number of butterfly species represented by the presence of host plants

Priority	5	6	7	8	9
Number of species per patch	1-3	4-8	9–12	13-18	19-24

2.3.7 Focal species

7A. Priority of location based on Australian Sea-lion colonies

The layer is based on the distribution of Australian Sea-lion habitats throughout the coastal boundary. This layer is the spatial representation of work has been done continuously to pinpoint the breeding and haul out sites through the state with up to date population details and locations.

TABLE 2.17 Priority of location based on distribution of Australian Sea-lion haul out and breeding sites

Priority	7	9	9
Site type	Main haul out sites with 0 – 200m buffer	Infrequent breeding site with 0 – 300m buffer	Main breeding sites with 0 – 100m buffer

7B. Priority of location based on the habitat of the Australian Pied Oystercatcher

The layer is based on the distribution of Australian Pied Oystercatcher habitat throughout the coastal boundary. Preferred habitat was determined in consultation with bird experts.

TABLE 2.18 Priority assigned location based on preferred habitat of Australian Pied Oystercatcher

Priority	0	9
	Absent	Australian Pied Oystercatcher habitat

7C. Priority of location based on Eastern Osprey nesting sites and territory

The layer is based on the distribution of Eastern Osprey territories and habitats throughout the coastal boundary. This layer is the spatial representation of work that has been done to identify the nest sites of Eastern Osprey around the state by Terry Dennis with up to date details and locations.

TABLE 2.19 Priority of location based on distribution of Eastern Osprey nest sites and territories

Priority	5	5	9
Site type	10km foraging area around all primary nests	Abandoned nests with 2km buffer	Primary & alternate nests with 2km buffer

7D. Priority of location based on White-bellied Sea-Eagle nesting sites and territory

The layer is based on the distribution of White-bellied Sea-Eagle territories and habitats throughout the coastal boundary. This layer is the spatial representation of work that has been done to identify the nest sites of White-bellied Sea-Eagle around the state by Terry Dennis with up to date details and locations.

TABLE 2.20 Priority of location based on distribution of White-bellied Sea-Eagle nest sites and territories

Priority	5	5	9
Site type	15km foraging area around all primary nests	Abandoned nests with 2km buffer	Primary & alternate nests with 4km buffer

7E. Priority of location based on the habitat of the Beach Slider

The layer is based on the preferred habitat of Beach Slider throughout the coastal boundary. Preferred habitat was derived in consultation with reptile/amphibian expert Mark Hutchinson.

TABLE 2.21 Priority of location based on preferred habitat of Beach Slider

Priority	0	9
	Absent	Beach Slider habitat

7F. Priority of location based on the habitat of the Bight Coast Skink

The layer is based on the preferred habitat of Bight Coast Skink throughout the coastal boundary. Preferred habitat was derived in consultation with reptile/amphibian expert Mark Hutchinson.

TABLE 2.22 Priority of location based on preferred habitat of Bight Coast Skink

Priority	0	9
	Absent	Bight Coast Skink habitat

2.3.8 Visual amenity

8A. Viewshed analysis (sea views from the land)

Topographic data and digital map technology have been used to define areas which have a view of the sea. This layer is used to highlight the increased appeal of areas of land which have sea views.

TABLE 2.23 Priority assigned to areas based on if land has a sea view

Priority	0	9
Sea view	No sea view	Sea view

8B. Viewscape analysis (perceived visual appeal of coastal landscape)

This layer uses the Andrew Lothian (2005) state-wide study to rank coastal areas for a sense of scenic value. Areas with a higher scenic value will contribute to a higher conservation priority as the public view these areas as increasingly important to conserve.

TABLE 2.24 Priority assigned to areas based on their scenic amenity

Priority	0	4	5	6	7	8	9
Viewscape value*	No value	3–3.9	4–4.9	5–5.9	6–6.9	7–7.9	8–8.9

* The higher the viewscape number, the more aesthetically pleasing an area of coast is seen to be (Lothian 2005)

2.3.9 Vegetation patch metrics

Vegetation patch metrics in this section are derived from current mapping of remnant vegetation. The methodology was developed by Nerissa Haby and Matthew Royal for the conservation priorities study of Northern and Yorke Natural Resources Management region (Caton et al. 2007a).

9A. Priority of remnant vegetation based on patch size

Available state vegetation mapping layers were used to calculate the area of each remnant patch in the Eyre Peninsula coast. Ecologically relevant ranges, previously identified for the Northern and Yorke coastal conservation assessment, were used to categorise each patch size (Caton et al. 2007a). Each patch was then assigned a priority value to reflect increasing habitat value and rarity of the larger patches.

TABLE 2.25 Priority assigned to patches of remnant vegetation based on size

Priority	0	4	5	6	7	8	9
Patch size (ha)	< 1	1–5	5–30	30–100	100–500	500–1500	> 1500

9B. Priority of vegetation assemblage based on connectivity (minimum distance to nearest patch)

A variety of methods may be used to calculate the degree of connectivity between patches, including the average distance along the edges of two neighbouring patches and whether patches are continuous or not (e.g. Lindenmayer et al. 1999; Hargis et al. 1998).

For ease of calculation, the minimum distance between a patch and its nearest neighbour was used to indicate connectivity (Bender et al. 2003). Patches greater than 100 m away from the coast were considered to be reasonably isolated for many species dependent on remnant vegetation and with limited mobility.

A series of categories were determined to portray priority value of a patch based on the minimum distance between patches. Available literature identified a range of dispersal abilities by a variety of species (Table 2.27). Fragmentation and how this impacts populations of species depends on a number of factors, such as the species (e.g. Haas 1995), the animal's sex, age and reproductive status (e.g. Andreassen and Ims 2001; Marchesan 2002; Brooker and Brooker 2002). However, the categories selected were believed to be representative of wildlife, based on the dispersal ability of a selection of terrestrial fauna.

It should be noted that this nearest neighbour analysis does not take into account block size: thus two small adjacent blocks may score 9 if less than 100 metres apart, but may be effectively isolated if separated by great distance from other blocks.

TABLE 2.26 Priority assigned to vegetation patches based on connectivity (distance to nearest patch)

Priority	1	2	3	4	5	6	7	8	9
Distance to nearest patch	> 10km	5–10km	2–5km	1–2km	751–1000m	501–750m	251–500m	101–250m	0–100m

TABLE 2.27 Dispersal ability of selected species identified from a variety of sources

Class	Dispersal ability	Sources
Insecta	50–100 m, up to 5 km	Haddad 1999
Insecta	< 50 m, up to 130–165 m	Rudd and McEvoy 1996, Haddad 1999
Insecta	150 m	Haddad 2000
Insecta	> 2 km	Schultz 1998
Mammalia	< 15 m	Andreassen and Ims 2001
Mammalia	< 20 m	Diffendorfer et al. 1995
Mammalia	> 50 m (dispersal btn patches rare)	Dooley and Bowers 1998
Mammalia	< 100 m, up to 760 m	Bowne et al. 1999
Mammalia	> 100 m, < 6 km	Bright 1998
Mammalia	< 1 km	Lindenmayer et al. 2000
Mammalia	< 100 m	Marchesan 2002
Reptilia	almost none	Sarre et al. 1995
Amphibia	> 500 m	Bulger et al. 2003
Aves	< 200 m, < 1000 m, up to 6 km	Haas 1995
Aves	60 m, < 9 km	Brooker and Brooker 2002

9C. Priority of vegetation assemblage based on the presence of remnant vegetation (< 1 ha)

This layer provides the opportunity to value patches of remnant vegetation of less than 1 ha, which were excluded from other themes used in this analysis. This layer was created to include the refuge and resources value that small patches of vegetation provide throughout the landscape into the analysis.

TABLE 2.28 Priority assigned to patches of vegetation less than 1 ha in size

Priority	0	9
Vegetation patch < 1 ha	Absent	Present

9D. Priority of vegetation assemblage based on patch shape (edge to interior ratio)

The clearance of vegetation for agriculture and development has led to a variety of oddly shaped remnant patches. Clearance along the Eyre Peninsula coast has been very varied, some areas have been cleared right to the waterline and in other areas vegetated dunes and associated vegetation communities remain reasonably intact. However, the linear nature of many vegetation patches exposes them to increased risk of invasion by introduced predators and competitors and reduces the cover of suitable habitat for a number of species. Vegetation patch shapes with large rounded (less degraded) habitat will withstand invasion and further degradation better than elongated or irregular patches, where more edge perimeter will allow easier invasion etc. Some animals prefer areas away from patch edges, and thus shape is relevant to habitat.

A simple method used to express the degree of edge effect was applied to each vegetation patch within the Eyre Peninsula coastal boundary:

Relative edge effect (REE) = Perimeter (m)/area (ha)

Ideally, patches containing a high proportion of interior habitat will have a small perimeter and large area. Using this analysis, the REE would have a small value and a larger priority value. Alternatively, a linear patch with a large perimeter and relatively small area would have a large REE value.

Categories used to express the value of decreasing REE were assigned in 100 unit increments, to give a roughly even spread of patches across each category.

TABLE 2.29 Priority assigned to vegetation patches based on patch shape (edge effect)

Priority	3	4	5	6	7	8	9
REE	> 600	501–600	401–500	301–400	201–300	101–200	0.1–100

2.3.10 Heritage

10A. Aboriginal/ Indigenous heritage sites

Locations of registered sites were obtained from the Department of the Premier and Cabinet, Aboriginal Affairs and Reconciliation Division. These sites were given the highest priority and are buffered by the extent of the coastal cell (i.e. the site may be anywhere within the coastal cell).

TABLE 2.30 Priority assigned to areas of Aboriginal/ Indigenous significance

Priority	0	9
Aboriginal heritage	No recorded site	Recorded significant sites

10B. European/ non-indigenous heritage sites

This layer identifies sites designated as 'European heritage' on the State Heritage Register or the Register of the National Estate and has been supplemented with additional information gathered from the Department of Environment and Natural Resources Heritage Branch databases.

Shipwreck sites have been buffered by 500m to highlight protection status of that wreck. A 500m buffer was chosen to directly align with the *SA Historic Shipwrecks Act* 1981 which discusses "protected zones" that the Minister may declare for a shipwreck at s.7 of the Act: Where: ***"Protected zones 7.*** *(1) The Minister may, by notice published in the Gazette, declare an area (not exceeding 100 hectares) consisting of water or partly of water and partly of land within which a historic shipwreck is, or a historic relic is or historic relics are, situated to be a protected zone."*. A 500m buffer is the approximate equivalent of the maximum 100ha area allowable.

TABLE 2.31 Priority assigned to non-indigenous heritage sites

Priority	Heritage description
0	No recognised heritage value
5	Contributory Place State Heritage Place (Nominated) State recommended in Heritage Surveys Locals recommended in Heritage Surveys National Trust RNE (not Commonwealth) Shipwreck (Not Found – Any Jurisdiction)
6	Local Heritage Place (Authorised) Local Heritage Place (Interim)
7	State Heritage Area State Heritage Place (Registered) State Heritage Place (Provisional) Shipwreck (Found – State Protected)
8	National Heritage Place Commonwealth Heritage Place Shipwreck (Found – Commonwealth Protected)
9	World Heritage Place

10C. Geological heritage (significant geological features)

Significant geological features (formally known as geological monuments) are defined and considered significant by the Geological Society of Australia, South Australian Branch. Information on geological monuments is stored at Primary Industries and Resources South Australia and at the South Australian Museum.

TABLE 2.32 Priority assigned to significant geological features (geological monuments)

Priority	0	9
Significant geological feature	No recorded sites	Recorded sites

2.3.11 Wetlands

11A. Priority of location based on the significance of wetland

This layer is used to prioritise the wetland areas with the Eyre Peninsula coastal boundary to acknowledge the importance of these environments being significant habitats. This is particularly important as much of the Eyre coastal boundary contains estuaries and coastal lakes (in many cases linked to marine influence) possibly missing prioritisation within other vegetation dominated themes above. The prioritisation has been used to reflect significance (national importance) and condition, in the absence of a more complete prioritisation assessment being undertaken on the Eyre Peninsula as part of the South Australian Wetland Inventory Database (SAWID) reporting process.

The wetland condition assessment refers to an aggregation of numerous assessments that have been undertaken on the Eyre Peninsula under the guise of SAWID project by Paul Wainwright etc. For a more detailed description of how the condition assessment was obtained please refer to the specific reports.

Additional estuaries assessment carried out by Kym Rumbelow in 2009 covering the estuaries throughout the state has also been used to expand the information of coastal wetlands through newly mapped areas not covered by the earlier wetland mapping.

TABLE 2.33 Priority assigned to wetlands

Priority	Wetland description
0	No prioritisation
1	SAWID wetland condition – completely degraded
2	SAWID wetland condition – no assessment Estuaries assessment rating– no assessment SAWID wetland condition – severely degraded
3	SAWID wetland condition – degraded Estuaries assessment rating– degraded/ moderate
5	SAWID wetland condition – moderate Estuaries assessment rating - moderate
7	SAWID wetland condition – intact
8	SAWID wetland condition – pristine
9	Wetland of National Importance

2.4 Layers used in the threats analysis

2.4.1 Recreation / visitation impacts

1A. Campsites and day use areas

This layer was created using local knowledge, aerial photography and land use data. Campsites and day use areas (such as car parks and lookouts) were classified as formal or informal to distinguish between the higher potential for informal sites to impact on the surrounding environment due to having unrestricted access and no facilities. The formal camping and day use areas include formalised car parks, Council camping and caravan sites and campsites within National Park reserves. Informal sites are those areas outside the formal sites that are used for camping or day use.

These sites have been buffered by 50m to include the immediate surrounds that are often highly impacted, eg. increased weeds, rubbish, vegetation degradation, etc.

TABLE 2.34 Threat value assigned to areas used for camping or day use

Threat	0	5	9
Type of use	No campsites or day use identified	Formal camping and/or day use	Informal camping and/or day use

1B. Off-road vehicle tracks

Existing road and sand dune databases were used, together with additional mapping work undertaken from aerial photography / GPS to map track locations. The tracks were buffered by

50m to include the impacts around the tracks themselves. Many unvegetated sand dune areas were included as tracks as they provide no restriction to movement and are quite often used by off-road vehicles. The presence of off-road vehicle tracks point to an increased threat on the environment in the areas directly adjacent. Beaches open to vehicle access were also included in the analysis.

TABLE 2.35 Threat value assigned to presence of tracks

Threat	0	9
Presence of tracks	Not present	Present

2.4.2 Development impacts

2A. Development zoning

The rationale of this threat layer is that development is a threat to habitat and hence the conservation values of this study. Development as defined in the *Development Act, 1993*, is regulated by Council and State plans, and the extent of the threat is expressed in the various zones defined within the plan maps, and described in terms of principles and objectives. The different principles and objectives for different zones constitute greater or less threat to conservation values. As a result, for example a 'Coastal Conservation' zone may allow fewer activities destructive to habitat than a 'Residential' zone.

Currently available in existing layers (DPLG development zones which is termed Developed/ Allowing further development is considered a threat; where development is not allowed there is no threat potential).

TABLE 2.36 Threat value assigned to development zoning

Threat	Development Zone Description
1	Coastal, Coastal (Coffin Bay), Coastal Conservation, Coastal Open Space, Coastal Waterfront, Conservation, Water Protection
3	Open Space, Recreation Coastal (Port Neill), Recreation Coastal (Tumby Bay), Urban Coastal
5	Parklands, Public Purposes (Arno Bay), Recreation, Recreation (Golf Course), Recreation (Port Neill), Recreation (Tumby Bay)
7	Coastal Mixed Use, Coastal Settlement, Country Living, NO ZONES, Remote Areas, Rural, Rural (8), Rural (Deferred Urban), Rural Fringe
9	Airfield, Airport, Aquaculture, Aquaculture, Aquaculture Coastal, Caravan Park and Tourist Park, Caravan Park and Tourist Park, Coastal (Settlement), Coastal Marina, Coastal Tourist Accommodation (Arno Bay), Commercial, Commercial (Bulk Handling), Commercial (Port Neill), Commercial (Tumby Bay), Commercial Industry, Community, Country Township, Defence, Deferred (Industry), Deferred Development 2 Zone, Deferred Urban, Fringe, General Farming, Home Industry (Tumby Bay), Industry, Industry Buffer, Infrastructure, Light Industry (Aquaculture), Light Industry (Aquaculture), Lincoln Cove Centre, Local Town Centre, Marine Commercial, Mixed Use (Foreshore), Mixed Use (Point Boston), Primary Industry, Primary Production, Regional Town Centre, Residential, Residential (Arno Bay), Residential (Lincoln Cove), Residential (Port Neill), Residential (Tumby Bay), Residential 1, Residential Character, Residential Coastal (Tumby Bay), Rural Living, Rural Living (Arno Bay), Rural Living (Arno Bay) Sustainable, Rural Living (Port Neill), Rural Living (Tumby Bay), Settlement, Special Industry (Hydro), Special Uses, Tourist Accommodation, Tourist Accommodation (Port Neill), Tourist Accommodation (Tumby Bay), Tourist

Threat	Development Zone Description
	Accomodation (Coastal), Town Centre, Town Centre (Port Neill), Town Centre (Tumby Bay), Waterfront Commercial (Arno Bay)

2B. Land ownership

This information was obtained from currently available existing layers. Land ownership was considered a threat to conservation. For example, a property in private ownership has the potential to allow land use and/or activities that may threaten conservation values, whereas a property proclaimed as a national park under the *National Parks and Wildlife Act 1972* has been specifically set aside for preserving and managing the conservation.

TABLE 2.37 Threat value assigned to areas based on land ownership

Threat	0	1	4	4	4	4	9
Land ownership	NPWSA reserves	Heritage Agreements	Forestry SA Reserves	SA Water Reserves	Crown land areas	Road and railway reserves	Private property

2C. Viewshed analysis (increased threat due to sea views)

This information was obtained from currently existing layers that identify areas that can be seen from the sea. This was used to highlight the increased pressure that a sea view places on that area of land.

TABLE 2.38 Threat value assigned based on if an area has a sea-view

Threat	0	9
Sea view	No sea view	Sea view

2D. Viewscape analysis (increasing threat due to aesthetics of the coastal zone)

This layer uses the Andrew Lothian state-wide study to score areas for of scenic value. Areas with a higher scenic value contribute to a higher threat value in this layer due to their increased desirability for development, recreation and the like.

TABLE 2.39 Threat value assigned based on the viewscape (scenic amenity)

Threat	4	5	6	7	8	9
Viewscape value	3–3.9	4–4.9	5–5.9	6–6.9	7–7.9	8–8.9

The higher the viewscape number, the more aesthetically pleasing the area of coast is seen to be and therefore of inherently increased desirability (Lothian, 2005).

2E. Existing development

This layer was used to address the direct impacts of development, such as vegetation clearance and landform modification, as well as activities and threats that occur in the immediate surrounds, such as weed introduction and spread, vegetation damage, feral species, etc. The information was obtained from currently existing layers and buffers were applied at various distances to prioritise the level of activity and its associated threat.

TABLE 2.40 Threat value assigned to existing development

Threat	5	5	9	9
Existing development	Individual Residencies, 200 – 500m Buffer	Mapped Built Up Areas, 500m – 1000m Buffer	Individual Residencies, 0 – 200m Buffer	Mapped Built Up Areas, 0 – 500m Buffer

2.4.3 Land use impacts

3A. Land use

Land use is derived from a Planning SA Land Use layer from 2008, which is periodically updated. Land use was rated for this project according to its threat potential to conservation values.

TABLE 2.41 Threat value assigned to areas based on land use

Threat	0	5	7	9	9
Land use	Areas not covered by Land-use codes (usually open space with no defined use)/ Areas Within NPWS Reserves / Water Features	Vacant	Road Reserves/ Rural Residential/ Recreation (Outside NPWS Land)/ Golf	Residential/ Non-Private Residential/ Education/ Public Institution/ Vacant Residential/ Livestock	Mine Quarry/ Utilities & Industry/ Commercial/ Food Industry/ Retail/ Retail Commercial/ Horticulture/ Agriculture

3B. Mining activities

This information was obtained from currently existing layers. Exploration leases and mining tenements are regulated by PIRSA Mining, and recorded publicly on the PIRSA website. Mining is rated according to its potential for impact on conservation values, without regard to rehabilitation potential.

TABLE 2.42 Threat value assigned based on mining activity

Threat	5	7	9
Mining activity	Exploration lease application	Exploration lease	Actual mining tenement or quarry

3C. Wastewater treatment plants / rubbish dumps / tailings / evaporation pans

This information was obtained from currently existing datasets, DENR topographic datasets, EPA dump datasets and Planning SA land use

TABLE 2.43 Threat value assigned based on wastewater treatment plants, rubbish dumps and evaporation pans

Threat	7	9
	Saltwater Evaporation Pans	Rubbish Dump/ Treatment Plant/ Tailing/ Stockpile/ Tailing or Effluent Ponds

2.4.4 Threats to habitat integrity

4A. Vegetation isolation (lack of connectivity between vegetation patches)

This layer was created as part of the vegetation patch layers. It is the opposite of the vegetation connectivity layer (9B); it identifies vegetation patches that are isolated from others.

TABLE 2.44 Threat value assigned to vegetation patches based on connectivity (distance to nearest patch)

Threat	1	2	3	4	5	6	7	8	9
Distance to nearest patch	0–100 m	101–250 m	251–500 m	501–750 m	750–1000 m	1–2 km	2–5 km	5–10 km	> 10 km

4B. Vegetation degradation

Clearance, fragmentation and invasion of introduced species all contribute to degradation of a vegetation patch. Factors that may be used to measure the condition of a patch include species diversity, presence and abundance of introduced species, structural diversity, habitat features, regeneration, shrub and tree health, and risk of future degrading processes (Croft et al. 2005).

The extent and distribution of data for helping to determine degradation of remnant patches is limited in the Eyre Peninsula coast. Hence, as a preliminary degradation indicator, plant species lists were used to determine the proportion of introduced to native species collected from survey data. The threat value of a patch of remnant vegetation was assigned based on the proportion of introduced species within it.

TABLE 2.45 Threat value assigned based on the proportion of introduced species within a vegetation patch

Threat	1	3	5	7	9
Percentage of introduced species within a vegetation community	< 5%	6–10%	10–15%	16–20%	> 20%

4C. Vegetation shape (shapes allowing increased invasion)

This layer was created as part of the vegetation patch layers. It is the opposite of the vegetation patch shape layer (9D). It was used as a measure of possible invasion of threatening species due to shape. Linear or irregular shaped patches are more susceptible to invasion of introduced species across the longer perimeter.

TABLE 2.46 Threat value assigned to vegetation patches based on patch shape (edge effect)

Threat	3	4	5	6	7	8	9
REE	0.1–100	101–200	201–300	301–400	401–500	501–600	> 600

4D. Vegetation patch size (smaller patches allowing increased invasion)

This layer was created as part of the vegetation patch layers. It is the opposite of the vegetation patch size layer (9A). It was used to indicate that vegetation patches with a larger size have a reduced threat of being lost or overrun with introduced species as they are more robust and likely to remain in their current ‘natural state’.

TABLE 2.47 Threat value assigned to patches of remnant vegetation based on size

Threat	1	2	3	5	6	7	9
Patch size	> 1500 ha	500–1500 ha	100–500 ha	30–100 ha	5–30 ha	1–5 ha	< 1 ha

4E. Distribution of known environmental weeds

Existing information from the Biological Database of South Australia was used, together with a vast amount of additional data on weed locations from EP NRM. The threat rating was determined by numerous sources including: NRM staff, DENR staff, Nature Conservation Society (NCS) weeds lists, National Weeds of Significance and SA Declared Weeds. The five invasive threat categories featured in the Bushland Condition Monitoring manual formed the basis for determining threat values in this study, however some adaptation was necessary.

TABLE 2.48 Threat assigned to weeds

Threat	NCS category	Category description
8–9	5	Highly invasive in either disturbed or intact remnant bushland, spreads rapidly producing very dense stands and a blanket cover. Potential to eliminate almost all native understorey species. Very difficult to control without outside help.
6–7	4	Highly invasive in either disturbed or intact remnant bushland, with the potential to spread rapidly and produce very dense stands given favourable habitat and/or vectors. High potential to reduce native species diversity and abundance. Can be controlled with sustained effort.
4–5	3	Invasive in intact bushland with moderate potential to reduce native species diversity. Rate of spread is slower than Cat 4 and 5 but once present will persist and threaten biodiversity. May produce dense stands over wide area but can be controlled with sustained effort.
2–3	2	Generally only invade disturbed bushland but may spread rapidly. However, generally only a slight potential to reduce native species diversity, unless present in high densities.
1	1	Generally only invade disturbed bushland. Often widespread and abundant but not considered a significant threat to native biodiversity, unless present in very high densities.
1	None	Species not considered a non-indigenous weed species.

4F. Feral species (rabbits)

This layer was created using the knowledge of NRM staff and other local members of current rabbit activity occurring within the Eyre Peninsula coastal area.

TABLE 2.49 Threat value assigned based on current rabbit activity

Threat	2	4	6	9
Current (2010) rabbit activity	Previously active, current activity unknown	Low	Medium	High

2.4.5 Hazards

5A. Dune stability

This layer was created from aerial photographic data (February 2005) by the Coastal Management Branch, DENR. Vegetated coastal dunes were categorised as having 'potential drift hazard' and unvegetated dunes were classed as 'actual drift hazard'.

TABLE 2.50 Threat value assigned based on dune stability

Threat	5	9
Dune stability	Potential drift hazard	Actual drift hazard

5B. Cliff stability

This layer was created for the cliffed sections along the coast, using a combination of aerial and oblique photo interpretation and data determining cliff height already available in the Shoreline Classification layer of DENR GIS databases.

TABLE 2.51 Threat value assigned based on cliff stability

Threat	0	3	5	7	9
Cliff stability	Cliff stable	< 50 m and potential instability	> 50 m and potential instability	< 50 m and actual instability	> 50 m and actual instability

5C. Acid sulfate soils

DENR's saltmarsh and mangrove habitat layer was adapted for the GIS databases by CSIRO research and Coastal Management Branch to categorise potential acid sulfate soils (ASS) based on the habitat type found within the saltmarsh and mangrove communities. The priority of saltmarsh habitats is dependent on the potential for that area to create ASS conditions; based on the classification developed by the CSIRO and the CPB, (see Coast Protection Board, 2003).

TABLE 2.52 Threat value assigned based on acid sulfate soils

Threat	1	3	5	5	7	9
Acid sulfate soil (ASS)	Marine / sand	Potential ASS (supratidal in subsoil below 50cm)	Potential ASS (intertidal and in subsoil below 20 cm – moderate risk)	Potential ASS (under tidal streams – moderate risk)	Potential ASS (mainly in mangrove with high risk)	Actual ASS

2.5 GIS datasets

GIS datasets used in the Eyre Peninsula Coastal Conservation Assessment are shown below.

TABLE 2.53 Existing GIS datasets used within the Eyre Peninsula Coastal Action Plan

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description

Themes and Databases – GIS datasets

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Natural Features					
Coastal Hazard Mapping	1:50000	0 - 50m	DENR - Coastal Management Unit	Jul-07	Coastal hazard mapping - mapping of sand dunes & storm surge areas.
Floristic Vegetation	Varied	0 - 250m	DENR - Client Services	Nov-08	Location of Floristic Vegetation types.
Geological Monuments	Varied	0 - 150m	PIRSA	Feb-07	Location of Geological Monuments registered with the Geological Society of Australia.
National Estate Register - Natural	Varied	0 - 150m	Australian Heritage Commission	Feb-05	Natural locations of significance within the Australian Heritage Commission (AHC) Statutory Register of the National Estate (RNE).
Native Vegetation - Cover	Varied	0 - 250m	DENR - Client Services	Nov-08	Mapping of the presence/ absence of native vegetation.
Planted Vegetation	Varied	0 - 250m	DENR - Client Services	Aug-03	Location of Vegetation Plantations.
Reefs	1:50000	0 - 25m	DENR - Client Services	May-07	Near-shore and offshore reefs exposed at low tide and outlined in normal Topographic mapping
SA Coastline	1:10000	0 - 25m	DENR - Client Services	Feb-08	Location of mean sea level.
Seabird Colonies	1:50000	0 - 500m	DENR - Science Resource Centre	Jul-04	Significant seabird habitat sites within SA.
Shoreline Classification	1:10000	0 - 25m	DENR - Client Services	Nov-07	Classification of the shorline based on substrate, form, exposure and biological character.
Tidal Saltmarsh and Mangrove Habitat Mapping	1:10000	0 - 50m	DENR - Coastal Management Unit	Nov-07	Tidal saltmarsh and mangrove habitat mapping.
Viewscape	1:50000	0 - 50m	DEG - Coastal Management Unit	Jun-05	Viewscape polygon covering the EPCAP Coastal Boundary, highlighting the visual aesthetics of the area.
Viewshed Raster	25x25m Grid	0 - 50m	DENR - Coastal Management Unit	Jun-05	Viewshed grid covering the EPCAP Coastal Boundary, highlighting areas with sea-views.
Waterbodies	1:50000	0 - 25m	DENR - Client Services	May-07	Location of waterbodies as defined by DENR topographic mapping.
Watercourses	1:50000	0 - 25m	DENR - Client Services	May-07	Location of water course lines and polygons as defined by DENR topographic mapping.
Wetlands	1:50000	0 - 50m	DENR - Coastal Management Unit	Mar-09	Location of coastal wetlands as identified in the Australian Wetlands Database.
Administrative/ Regional Features & Boundaries					
Aquatic Reserves	1:50000	0 - 100m	PIRSA - SARDI	Feb-08	Aquatic Reserves (*Fisheries Act 1982*).
Buildings	1:50000	0 - 50m	DENR - Client Services	May-07	Build structure point locations (polygons where possible)
Built - Up Areas	1:50000	0 - 25m	DENR - Client Services	Feb-08	Location of Built-up areas.
Council/ LGA Boundaries	Various	0 - 30m	DETI - Land Service Group	Jun-10	Location of Local Government Areas/ Councils extents.
Digital Cadastre Database Land Parcels	Varied	0 - 30m	DETI - Land Service Group	Jun-10	Legal land parcel boundaries within the state.
EPA Licence Sites	Cadastre Based	0 - 30m	EPA	May-05	Location of EPA licence sites.
Geomorphic Regions	1:50000	0 - 50m	DENR - Coastal Management Unit	Jun-10	Coastal Protection Branch Geomorphic Region boundaries.
Herbarium Regions	1:50000	0 - 500m	DENR - Science Resource Centre	Aug-09	Regions of South Australia adopted by the State Herbarium
IBRA Subregions	1:100000	Varied	DENR - Client Services	Dec-04	Bio Regional Landscape scale boundaries within SA for the protection of biological diversity (Ver 6.2)
Land Development Zones	Cadastre Based	0 - 30m	DPLG	Jun-10	Planning zones and policy areas derived from council development plans.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Land Use Boundaries	Cadastre Based	0 - 30m	DPLG	Jun-10	Land use descriptions by Planning SA as based on the property valuation database.
Mineral Exploration Licence Applications	Varied	0 - 150m	PIRSA	Jun-10	Location of Mineral Exploration Licence Applications (*Mining Act 197*1).
Mineral Exploration Licences	Varied	0 - 150m	PIRSA	Jun-10	Location of Mineral Exploration Licences (*Mining Act 197*1).
Mining Tenements	Varied	0 - 150m	PIRSA	Jun-10	Location of Mineral Production Tenements (*Mining Act 1971*).
National Estate Register - Aboriginal	Varied	0 - 150m	Australian Heritage Commission	Feb-05	Aboriginal locations of significance in the Australian Heritage Commission (AHC) Statutory Register of the National Estate (RNE).
National Estate Register - European	Varied	0 - 150m	Australian Heritage Commission	Feb-05	European locations of significance in the Australian Heritage Commission (AHC) Statutory Register of the National Estate (RNE).
Native Vegetation Heritage Agreements	Cadastre Based	0 - 30m	DENR - Client Services	Mar-09	Native vegetation Heritage Agreement area boundaries (*Native Vegetation Act 1991*).
Natural Resource Management Regions	Cadastre Based	0 - 30m	DLWBC	Nov-06	Natural Resource Management Region boundaries (NRM Act 2004).
Navigation Marks and Channels	1:50000	0 - 50m	DTEI - Information Management Services	Jun-10	The location of Navigation Marks and Channels from Transport SA's Navigation Marks database.
Petroleum Exploration Licence Applications	Varied	0 - 150m	PIRSA	Jun-10	Location of Petroleum Exploration Licence/ Permit Applications (Petroleum Act 2000, Petroleum (Submerged Lands) Act, 1982, or Petroleum (Submerged Lands) Act, 1967).
Petroleum Exploration Licences	Varied	0 - 150m	PIRSA	Jun-10	Location of Petroleum Exploration Licences/ Permits (Petroleum Act 2000, Petroleum (Submerged Lands) Act, 1982, or Petroleum (Submerged Lands) Act, 1967).
Petroleum Production Tenements	Varied	0 - 150m	PIRSA	Jun-10	Location of Petroleum Production Licences (Petroleum Act 2000, Petroleum (Submerged Lands) Act, 1982, or Petroleum (Submerged Lands) Act, 1967).
Placenames	1:50000	0 - 50m	DENR - Client Services	May-07	Location of Gazzetted Cities, towns & places inc.other notable non-gazzetted locations and features.
Protected Areas - NPWSA and Conservation Reserve Boundaries	Cadastre Based	0 - 30m	DENR - Science Resource Centre	Jun-10	NPWSA Reserve boundaries (*NPW Act 1972*) & NPWSA conservation reserve boundaries (*Crown Lands Act 1929*).
Rock Lobster Sanctuaries	1:50000	0 - 100m	DENR - Coast & Marine Conservation	Jun-05	Rock lobster sanctuaries as outlined in the *Fisheries Act 1982*.
SA Marine Parks Network	1:50000	0 - 100m	DENR - Coast & Marine Conservation	Jul-09	Identifying the areas of both land and water dedicated to conservation under the Marine Parks Act 2002
State Heritage Sites	Cadastre Based	0 - 30m	DENR - State Heritage Unit	Jun-10	DCDB Sites of State, Local or Contributory heritage as defined by *Heritage Places Act 1993* and *Development Act 1993*.
Quarries	1:50000	0 - 50m	DENR - Client Services	May-07	Location of Quarries.
Roads	1:50000	0 - 50m	DENR - Client Services	Aug-08	Location of road centrelines. Included Major, unsealed and ORV track information from DENR CFS mapping.
Railways	1:50000	0 - 50m	DENR - Client Services	May-08	Location of railways.
SA Water Land	Cadastre Based	0 - 30m	SA Water	Jul-07	Location of SA Water lands.
Salt Evaporation Pans	1:50000	0 - 25m	DENR - Client Services	May-07	Location of salt evaporation pans from the water construction polygon layer from the DENR topographic mapping.
Statewide Crown Land	Cadastre Based	0 - 30m	DENR - Crownland SA	Jun-10	Legal land parcel boundaries within the state held under the control of the Crown.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Waste Disposal layer	1:50000	0 - 25m	DENR - Client Services	May-07	Location of waste disposal areas e.g. sewerage filtration and effluent ponds areas from the DENR topographic mapping.
Survey Records					
Australian Sea-lion Colonies	Varied	0 - 500m	DENR - Science Resource Centre	Nov-08	Sea-Lion Colony locations including breeding & population information.
Biological Survey Database - Vegetation	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	Vegetation survey sites completed by the Biological Survey of SA.
Biological Survey Database - Vertebrates	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	Vertebrate fauna survey sites completed by the Biological Survey of SA.
Bird Atlas: Birds Australia	Varied	0 - 5000m	Birds Australia	Oct-01	Opportunistic bird survey sites collected by field ecologists associated with Birds Australia.
Coastal Dune and Clifftop Vegetation Survey Sites (CDCS Survey Sites)	Varied	0 - 1000m	DENR - Coastal Management Unit	Feb-08	Vegetation survey sites taken from the biological databases highlighting Coastal Dune and Clifftop specific communities from Oppermann's 1999 Coastal Dune and Clifftop Vegetation Survey (CDCS).
Feral Data	Varied	0 - 50km	EP NRM	Dec-09	Feral data concerning rabbits and deer obtained from the EP NRM
Opportunistic Survey Database - Vegetation	Varied	0 - 5000m	DENR - Science Resource Centre	Mar-10	Opportunistically collected vegetation data - collected by various sources.
Opportunistic Survey Database - Vertebrates	Varied	0 - 5000m	DENR - Science Resource Centre	Mar-10	Opportunistically collected vertebrate fauna data - collected by various sources.
Rare and Threatened Plant Populations	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	Vegetation sites corresponding to the DENR's Rare and Threatened Plant Population database.
Flora & Fauna Rated Buffers	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	500m buffers around threatened flora and fauna records from the biological survey databases.
Reserve Survey Database - Vegetation	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	Vegetation data collected within reserves by various sources.
Reserve Survey Database - Vertebrates	Varied	0 - 1000m	DENR - Science Resource Centre	Mar-10	Vertebrate fauna data collected within reserves by various sources.
SA Museum Fauna Data	Varied	0 - 1000m	SA Museum	Mar-10	Vertebrate fauna data collected by the SA Museum
Shipwrecks	Varied	0 - 50km	DENR - State Heritage Unit	Jun-10	Location of shipwrecks from the SA Shipwrecks database defining wrecks covered by (Commonwealth) *Historic Shipwrecks Act 1976* and the (South Australian) *Historic Shipwrecks Act 1981* in addition to others with not protection status.

TABLE 2.54 GIS datasets created for the Eyre Peninsula Coastal Action Plan

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Natural/ Administrative/ Regional Features & Boundaries					
Beaches	1:50000	0 - 50m	DENR - Coastal Management Unit	Jun-10	Mapping of areas of sand beach found within the coastal boundary
Bird Habitats	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	Significant butterfly locations within the coastal boundary obtained from various experts inc. Graham Carpenter
Butterfly Habitats	1:50000	0 - 250m	Rodger Grund	Jun-10	Significant butterfly locations within the coastal boundary obtained from DENR butterfly expert Rodger Grund
Campsites	1:10000	0 - 50m	DENR - Coastal Management Unit	Jun-10	Location of known sites used for camping within the EPCAP Coastal Boundary.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Carparks	1:10000	0 - 50m	DENR - Coastal Management Unit	Jun-10	Location of known sites used for carparking within the EPCAP Coastal Boundary.
Cliff Hazard Mapping	1:50000	0 - 50m	DENR - Coastal Management Unit	Jun-10	Cliff hazard mapping - Location of various erosional states of the metropolitan area cliffs.
Coastal Boundary	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	The study area used within the EPCAP project to determine the coastal region. An area outlined by the mean sea-level and the furthest landward edge of either saltmarsh & mangrove habitats, sand dune complexes, native vegetation blocks considered coastal or a 500m buffer from the coastline.
Coastal Cell Boundaries	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	Using the Coastal Boundary as a basis it was divided into 'Cells' of similar coastal features, wave/ fetch exposure & type.
Focal Species	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	Focal species habitat locations as described by numerous experts as outlined within report.
ORV Areas	1:10000	0 - 25m	DENR - Coastal Management Unit	Jun-10	Areas of extensive ORV tracking throughout the area including beach sections allowing 4WD vehicles.
ORV Tracks	1:10000	0 - 25m	DENR - Coastal Management Unit	Jun-10	ORV tracking throughout the EPCAP Coastal Boundary.
State Heritage Register	Varied	0 - 250m	DENR - State Heritage Unit SA	Jun-10	Locations of Coastal Use, Natural, European & Aboriginal Heritage noted in the State Heritage Register Database.
Study Vegetation Blocks	Varied	0 - 250m	DENR - Coastal Management Unit	Jun-10	Uniquely identifies all the native vegetation blocks within the coastal boundary.
Survey Records (Points created from tables)					
Additional Flora Points	Varied	0 - 500m	EP NRM	Jun-10	Additional Flora records obtained from the EP NRM Board inc. feral species & weeds.

TABLE 2.55 Raster analysis layers created from GIS datasets listed above

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Conservation Priority Raster Layers					
1A - CDCS Threatened Communities conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the status of the Coastal Dune and Clifftop vegetation communities (threatened status).
1B - EPCAP CDCS rare plant communities conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the rarity of Coastal Dune and Clifftop vegetation communities (Those with <20 records within the state).
1C - Threatened flora conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of sites with threatened Flora (threatened status).
1D - Threatened fauna conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of sites with threatened Fauna (threatened status).
1E - Total threatened species conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of sites based on total number of threatened species (total no. threatened species).
2A - EPCAP CDCS endemic plant communities conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the distribution of endemic Coastal Dune and Clifftop vegetation communities (> 50% of SA records within EPCAP area of interest).

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
2B - Endemic Saltmarsh and Mangrove Habitat communities conservation priority layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the distribution of endemic Saltmarsh and Mangrove Habitat communities (> 50% SA of records within EPCAP area of interest).
2C - Endemic Floristic communities conservation priority layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the distribution of endemic Saltmarsh and Mangrove Habitat communities (> 50% of SA records within EPCAP area of interest).
2D - Species richness conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of sites based on species richness (total no. species).
3A - Priority of Habitat for threatened birds species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for threatened bird species.
3B - Priority of Habitat for all existing birds species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for existing bird species.
4A - Priority of Habitat for threatened reptile and amphibian species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for threatened reptile and amphibian species.
4B - Priority of Habitat for all existing reptile and amphibian species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for existing reptile and amphibian species.
5A - Priority of Habitat for threatened mammal species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for threatened mammal species.
5B - Priority of Habitat for all existing mammal species	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages as habitat for existing mammal species.
6 - Significant butterfly habitats conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblage as habitat for butterflies.
7A - Austalian Sea- lion (focal species) habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(colony locations) based on the distribution of the Austalian Sea- lion (Focal species).
7B - Austalian Pied Oystercatcher (focal species) habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(beaches, estuaries & saltmarsh) based on the distribution of the Austalian Pied Oystercatcher (Focal species).
7C - Eastern Osprey (focal species) nesting sites & habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(nest sites) based on the nesting sites & distribution of the Eastern Osprey (Focal species).
7D - White- bellied Sea Eagle (focal species) nesting sites & habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(nest sites) based on the nesting sites & distribution of the White- bellied Sea Eagle (Focal species).
7E - Beach Slider (focal species) habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(beach & coastal dunes) based on the distribution of the Beach Slider (Focal species).

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
7F - Bight Coast Skink (focal species) habitat conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of location(coastal dunes) based on the distribution of Bight Coast Skink host plants (Focal species).
8A - Viewshed priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of locations based on the area having a favourable outlook of the sea.
8B - Viewscape priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of locations based on the increased aesthetics of coastal areas - based on previous work carried out by DENR.
9A - Vegetation patch size conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of remnant vegetation based on patch size.
9B - Vegetation patch connectivity conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of remnant vegetation based on connectivity (Minimum distance to nearest patch).
9C - Presence of vegetation patch <1ha conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on the presence of remnant vegetation <1ha.
9D - Vegetation patch shape conservation priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of vegetation assemblages based on patch Edge to Interior Ratio or Relative Edge Effect (REE). Where REE = Perimeter (m) / Area (ha).
10A - Indigenous Heritage Sites conservation priority layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of significant Indigenous Heritage Sites.
10B - European Heritage Sites conservation priority layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of significant European Heritage Sites.
10C - Geological Monuments conservation priority layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of significant geological monuments.
11 - Wetland priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Conservation priority of wetland based on the significance of the location from SAWID studies.
Detailed 25 x 25m Conservation Priority Analysis Layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	The final combined conservation priority analysis layer - created by summing all the individual conservation priority layers(listed above) together into one layer. The highest priority areas being the result of numerous conservation priorities having an influence on that location.
Threatening Processes Raster Layers					
1A - Campsite threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the increased activity associated with campgrounds of an informal (high threat) or formal (medium threat) type.
1B - ORV Tracks	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from Off Road Vehicles. This threat may be of the form of distinct linear tracking and areas of numerous tracks.
2A - Development Zoning threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the ability through zoning regulations to develop the land.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
2B - Land ownership threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the type of land ownership present and the threat that that type of ownership creates.
2C - Viewshed threat layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from that area having a favourable outlook on the sea and an ability to develop on that area.
2D - Viewscape threat layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat due to increased aesthetics of coastal areas - based on previous work carried out by DENR.
2E - Existing Development threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from existing development.
3A - Land use threat layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the type of land use present and the threat that that land use creates.
3B - Mining activity threat layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the level of mining activity possible(from no activity, through possible exploration to extractive processes) and the threat that that activity creates.
3C - Dump & Wastewater Treatment Plant threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the presence of waste dumps/ infills/ storage facilities and treatment plants.
4A - Vegetation Isolation threat layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the a lack of connectivity between vegetation patches.
4B - Vegetation degradation threat layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the degradation level of the vegetation patches.
4C - Vegetation patch shape threat layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the shape of the vegetation patches.
4D - Vegetation patch size threat layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the size of the vegetation patches
4E - Weed threat layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from weed species within the vegetation patches.
4F - Feral Species (Rabbit) layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from theferal species Rabbit.
3A - Dune Stability threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the presence of dunes and their likelihood to shift when disturbed.
3B - Cliff Stability threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the presence of cliff and their vulnerability to erosion.
3C - Acid Sulphate Soils threat layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Priority of locations based on the threat from the presence of Acid Sulphate soils.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Detailed 25 x 25m Threatening Processes Analysis Layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	The final combined threat analysis layer - created by summing all the individual threatening processes layers listed above into one layers. The highest priority areas being the result of numerous threatening processes having an influence on that location.

TABLE 2.56 Analysis of coastal cell summary layers

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Summarised Coastal Cell Conservation Priority Layers					
1A - CDCS Threatened Communities conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on the status of the Coastal Dune and Clifftop vegetation communities (threatened status).
1B - EPCAP CDCS rare plant communities conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summariased conservation priority of vegetation assemblages based on the rarity of Coastal Dune and Clifftop vegetation communities (Those with <20 records within the state).
1C - Threatened flora conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of sites with threatened Flora (threatened status).
1D - Threatened fauna conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of sites with threatened Fauna (threatened status).
1E - Total threatened species conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of sites based on total number of threatened species (total no. threatened species).
2A - EPCAP CDCS endemic plant communities conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on the distribution of endemic Coastal Dune and Clifftop vegetation communities (> 50% of SA records within EPCAP area of interest).
2B - Endemic Saltmarsh and Mangrove Habitat communities conservation priority coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on the distribution of endemic Saltmarsh and Mangrove Habitat communities (> 50% SA of records within EPCAP area of interest).
2C - Endemic Floristic communities conservation priority coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on the distribution of endemic Saltmarsh and Mangrove Habitat communities (> 50% of SA records within EPCAP area of interest).
2D - Species richness conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of sites based on species richness (total no. species).
3A - Priority of Habitat for threatened birds species coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for threatened bird species.
3B - Priority of Habitat for all existing	25 x 25m Grid	Up to 10 Grid Cells	DENR - Coastal	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for existing

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
birds species coastal cell summary layer		(0 - 250m)	Management Unit		bird species.
4A - Priority of Habitat for threatened reptile and amphibian species coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for threatened reptile and amphibian species.
4B - Priority of Habitat for all existing reptile and amphibian species coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for existing reptile and amphibian species.
5A - Priority of Habitat for threatened mammal species coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for threatened mammal species.
5B - Priority of Habitat for all existing mammal species coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages as habitat for existing mammal species.
6 - Significant butterfly habitats conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblage as habitat for butterflies.
7A - Austalian Sea-lion (focal species) habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(colony locations) based on the distribution of the Austalian Sea- lion (Focal species).
7B - Austalian Pied Oystercatcher (focal species) habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(beaches, estuaries & saltmarsh) based on the distribution of the Austalian Pied Oystercatcher (Focal species).
7C - Eastern Osprey (focal species) nesting sites & habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(nest sites) based on the nesting sites & distribution of the Eastern Osprey (Focal species).
7D - White- bellied Sea Eagle (focal species) nesting sites & habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(nest sites) based on the nesting sites & distribution of the White- bellied Sea Eagle (Focal species).
7E - Beach Slider (focal species) habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(beaches & coastal dunes) based on the distribution of the Beach Slider (Focal species).
7F - Bight Coast Skink (focal species) habitat conservation Summarised priority layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations(coastal dunes) based on the distribution of Bight Coast Skink host plants (Focal species).
8A - Viewshed priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations based on the area having a favourable outlook of the sea.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
8B - Viewscape priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of locations based on the increased aesthetics of coastal areas - based on previous work carried out by DENR.
9A - Vegetation patch size conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of remnant vegetation based on patch size.
9B - Vegetation patch connectivity conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of remnant vegetation based on connectivity (Minimum distance to nearest patch).
9C - Presence of vegetation patch <1ha conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on the presence of remnant vegetation <1ha.
9D - Vegetation patch shape conservation priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of vegetation assemblages based on patch Edge to Interior Ratio or Relative Edge Effect (REE). Where REE = Perimeter (m) / Area (ha).
10A - Indigenous Heritage Sites conservation priority coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of significant Indigenous Heritage Sites.
10B - European Heritage Sites conservation priority coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of significant European Heritage Sites.
10C - Geological Monuments conservation priority coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of significant geological monuments.
11 - Wetland priority coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised conservation priority of wetland based on the significance of the location from SAWID studies.
Summarised conservation priority coastal cell summary layer	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	The final coastal cell summary of the combined conservation priority analysis layer - created by summing all the individual conservation priority layers(listed above) together into one layer. The highest priority areas being the result of numerous conservation priorities having an influence on that location.
Summarised Coastal Cell Threatening Processes Layers					
1A - Campsite threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the increased activity associated with campgrounds of an informal (high threat) or formal (medium threat) type.
1B - ORV Tracks	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from Off Road Vehicles. This threat may be of the form of distinct linear tracking and areas of numerous tracks.
2A - Development Zoning threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the ability through zoning regulations to develop the land.
2B - Land ownership threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the type of land ownership present and the threat that that type of ownership creates.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
2C - Viewshed threat coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from that area having a favourable outlook on the sea and an ability to develop on that area.
2D - Viewscape threat coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat due to increased aesthetics of coastal areas - based on previous work carried out by DENR.
2E - Existing Development threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from existing development.
3A - Land use threat coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the type of land use present and the threat that that land use creates.
3B - Mining activity threat coastal cell summary layer	25 x 25m Grid	Up to 5 Grid Cells (0 - 150m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the level of mining activity possible(from no activity, through possible exploration to extractive processes) and the threat that that activity creates.
3C - Dump & Wastewater Treatment Plant threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the presence of waste dumps/ infills/ storage facilities and treatment plants.
4A - Vegetation Isolation threat coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the a lack of connectivity between vegetation patches.
4B - Vegetation degradation threat coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the degradation level of the vegetation patches.
4C - Vegetation patch shape threat coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the shape of the vegetation patches.
4D - Vegetation patch size threat coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the size of the vegetation patches
4E - Weed threat coastal cell summary layer	25 x 25m Grid	Up to 10 Grid Cells (0 - 250m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from weed species within the vegetation patches.
3A - Dune Stability threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the presence of dunes and their likelihood to shift when disturbed.
3B - Cliff Stability threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the presence of cliff and their vulnerability to erosion.
3C - Acid Sulphate Soils threat coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from the presence of Acid Sulphate soils.
3D - Feral Species (Deer) coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from theferal species Deer.
3E - Feral Species (Rabbit) coastal cell summary layer	25 x 25m Grid	Up to 2 Grid Cells (0 - 50m)	DENR - Coastal Management Unit	Jun-10	Summarised priority of coastal cells based on the threat from theferal species Rabbit.

GIS Dataset	Mapping Scale	Positional Accuracy	Custodian/ Source	Currency Date	Description
Detailed 25 x 25m Threatening Processes Analysis Layer	1:50000	0 - 250m	DENR - Coastal Management Unit	Jun-10	The coastal cell summary for the final combined threat analysis layer - created by summing all the individual threatening processes layers listed above into one layers. The highest priority areas being the result of numerous threatening processes being having an influence on that location.

2.6 Data limitations and variation of coverage between coastal cells

The datasets used for the conservation and threat analyses came from many different sources originally assembled for a variety of purposes. Their differing character gives variable coverage across the Eyre Peninsula coast.

Some datasets by their nature give a complete coverage within the region (e.g. development plan zoning covers the entire study area, since the *Development Act 1993* requires councils to zone all areas). Some datasets appear to give complete coverage but on examination show limitations. For example, sites of significant Aboriginal heritage (in a buffered form) are represented in all cells, as presence or absence. However, since many sites of significance are not represented on the state register, this variable may be under-represented within the analysis. The geological heritage layer raises another kind of issue. All defined Significant Geological Features are shown on this layer but some locations of great geological significance might not be included on the geological heritage list because they are covered by superficial deposits.

Other data layers are the results of differing kinds of sampling or recording methods and these various methodologies give rise to several issues. Most data within this project relates to remnant vegetation, significance or diversity of flora and fauna. Work by the state Biological Survey Group is a core part of these datasets, and is undertaken by systematic sampling and descriptive procedures (Heard and Channon 1997). However, sample points are irregularly distributed and chosen to represent the larger remnant patches. In addition to the systematic samples, there are opportunistic survey points, which, when mapped, often appear to be located by convenient access, rather than, for instance, the distribution of habitats. Figure 2.1 indicates the variation in coverage between cells for the layers that relied on these data but does not include data obtained from other sources for this study, such as expert contributions or Australian sea-lion sites.

Figures 2.1 identifies cells with no sample points but does not show the cells with several sample points. However, survey sites are shown on the electronic maps on the DVD and listed, by number per cell, in Appendix 6. A number of issues in the use of vegetation survey data in the Northern and Yorke Natural Resources Management region (Haby in Caton et al 2007a) also apply to the Eyre Peninsula coast:

- lack of fine scale mapping suitable for the interpretation of vegetation communities along the coastal zone;
- lack of habitat mapping including the diversity of vegetation communities within a remnant patch and the extent of those communities;
- possible lack of ground-truthing of smaller remnants during vegetation community mapping;
- difficulty in interpreting the extent of vegetation communities due to a lack of consistent vegetation descriptions;

- lack of habitat mapping leading to the assumption that remnant vegetation patches are homogeneous and species detected at a survey site will occur throughout the patch.

The last point is significant for this project. In the case of butterfly layer, for example, it was necessary to identify areas where the presence of various species was likely from the habitat, because direct evidence was not available. Clearly, this becomes particularly important where there are few sample points within a large vegetation block. The floristic vegetation layer was used to supplement habitat information. However, floristic vegetation maps were constructed from aerial photography and written accounts, as a desktop exercise necessarily limited by lack of fieldwork. During the Far West Coastal Action Plan project field checking of vegetation associations at 17 sites by the study team, suggested that the floristic vegetation map was broadly useful but needed refinement by field checking. The Eyre Peninsula region would benefit from similar field checking and follow-up refinement.

The available fauna and flora data also had limitations, generally reflecting issues with the design and implementation of surveys:

- the restrictive nature of surveys to larger and intact remnant patches, which, for example, biases vegetation survey sites to 'good' remnants of native vegetation and consequently under-represents introduced species;
- the inability to thoroughly survey the Eyre Peninsula coastal zone during past surveys (especially for fauna);
- the inability to determine the accurate distribution of threatened species during general biological surveys;
- collection of species localities outside of preferred habitat types.

Animals can be hard to locate and move with seasons to search for food or visit breeding grounds. For example, the White-bellied Sea-Eagle (*Haliaeetus leucogaster*) has been sighted more than 50 km away from known nesting locations (Dennis and Lashmar 1996). The distribution and abundance of species may change at known sites, for example long-term seasonal change may result in the alteration of movement patterns of some migratory species (Kendall et al. 2004). Thus a species may be identified at an uncommon locality in the databases used in this analysis.

Some capacity was available to manipulate data for the analysis. For example, data correlating with vegetation communities or coastal cells were represented at the scale of patch or cell, respectively.

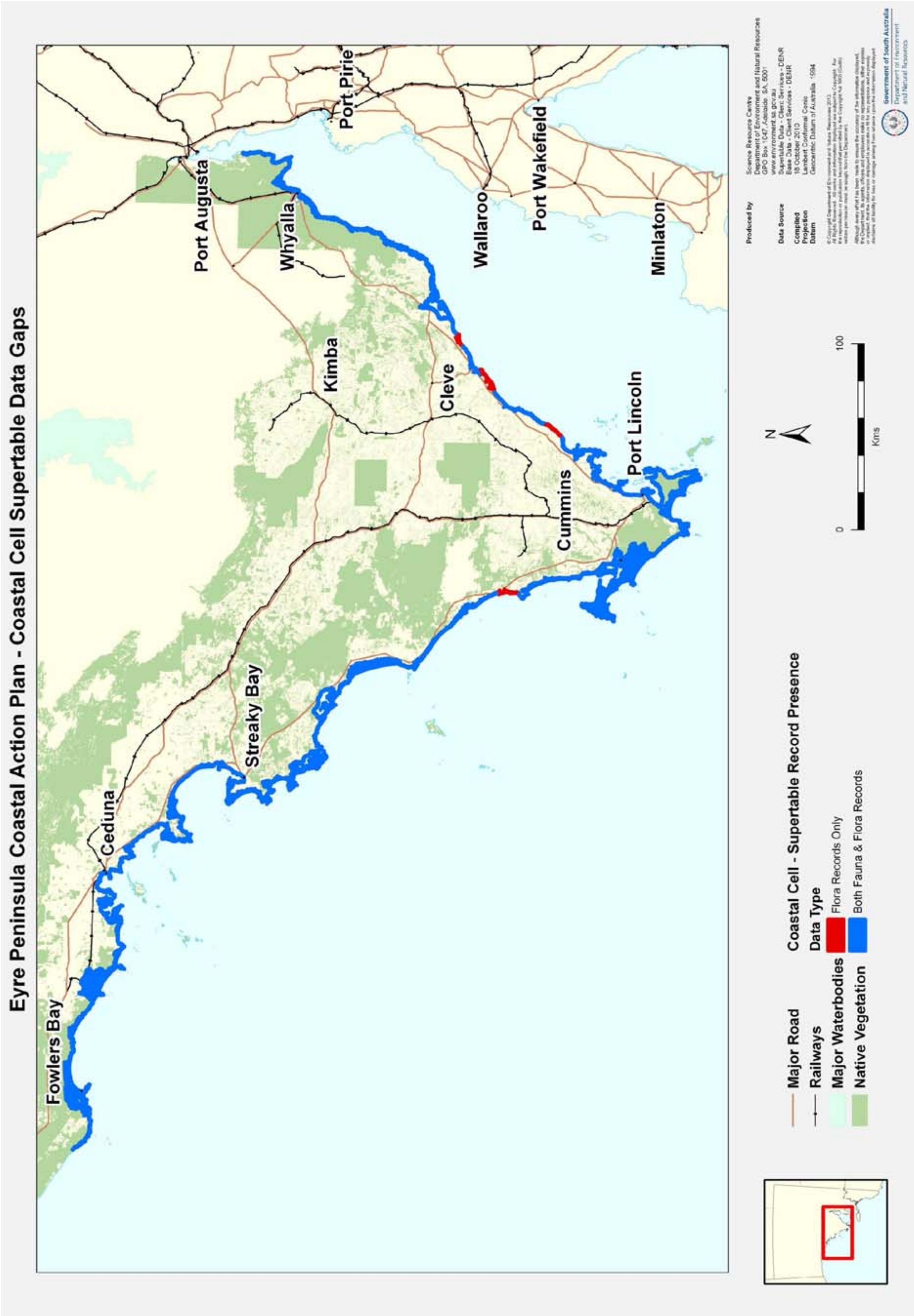


FIGURE 2.1 Variation in flora and fauna survey sites within the Eyre Peninsula coastal boundary

3 Conservation Themes

3.1 Flora

3.1.1 Native vegetation cover

A pre-European vegetation map in the Atlas of South Australia (Giffen and McCaskill 1986) shows the study area covered largely by a category called “Coastal Succession”. This category represents a variety of coastal dune and cliff-top, mangrove and salt marsh plant communities. Woodland communities are also shown on southern Eyre Peninsula and shrubland vegetation north of Whyalla. Clearance for agriculture and urban development, rabbits, stock grazing and weeds have all caused significant impacts to the native vegetation cover. The decline of Aboriginal land use may also have caused change to vegetation structure and composition.

Overall 139,101 hectares of remnant vegetation has been mapped within the Eyre coastal boundary within 657 separate vegetation blocks. This represents 72% of the study area.

3.1.2 Floristic communities

Regional floristic mapping

The Eyre coastal region is covered by floristic mapping. This forms part of the SA Vegetation Database which is managed by DENR. The mapping is available at different levels based on overstorey species, alliances, and structural formation. At the most detailed level (SAVeg_ID1) 130 plant communities have been mapped within the coastal boundary. At the broad level, Major Vegetation Sub Group (MVSB) 19 units have been mapped along the Eyre coast.

Table 3.1 lists the MVSG types mapped and shows the percentage cover within the Eyre coastal boundary and also for SA. Shrubland communities predominate comprising 76% of the vegetation cover. Less than 2% of the cover is forest or woodland. This reflects both coastal exposure to salt laden winds and also low rainfall which prevents tree cover from establishing or growing above shrub height along many parts of the Eyre coast.

TABLE 3.1 Broad vegetation classes showing % cover within the EP coastal boundary

Major Veg Sub-Group Type	Hectares Eyre coast	% cover Eyre coast	% cover SA coast
Arid and semi-arid hummock grasslands	1,554	0.5	0.02
Callitris forests and woodlands	364	0.1	0.27
Casuarina and Allocasuarina forests and woodlands	4,809	1.6	0.34
Chenopod shrublands	56,422	18.8	0.45
Eucalyptus woodlands with a grassy understorey	23	0.0	0.04
Mallee heath and shrublands	91,895	30.7	4.40
Mallee with an open shrubby understorey	6,444	2.2	0.43
Mallee with hummock grass	15,442	5.2	0.32

Major Veg Sub-Group Type	Hectares Eyre coast	% cover Eyre coast	% cover SA coast
Mangroves	4,307	1.4	26.86
Melaleuca open forests and woodlands	15	0.0	0.10
Melaleuca shrublands and open shrublands	22,937	7.7	5.61
Mixed chenopod, samphire or forblands	25,294	8.4	0.76
Other Acacia forests and woodlands	545	0.2	0.31
Other Acacia tall open shrublands and shrublands	990	0.3	0.03
Other forests and woodlands	58	0.0	0.03
Other shrublands	54,709	18.3	3.30
Other tussock grasslands	12,218	4.1	2.13
Temperate tussock grasslands	175	0.1	0.14
Wet tussock grassland, herbland, sedgeland or rushland	1,438	0.5	1.07
Total	**299,640**	**100.0**	

Coastal dune and cliff-top vegetation survey

Oppermann (1999) described the results of a statewide survey of the coastal dune and cliff-top habitats in South Australia between October 1995 and November 1997. No mapping was undertaken. The survey also used site data from previous surveys for the analysis. A major purpose of this survey was to describe and measure the structure and composition of the coastal dune and cliff-top communities. Another objective was to identify sites, plants and communities of conservation significance. Survey methodology conformed to the Biological Survey Program standards detailed by Heard and Channon 1997. Cluster analysis was used to determine meaningful floristic groupings. Floristic groupings were described using a Specht/Muir derived structural table shown in Appendix 7 (Specht 1972; Muir 1977). Table 3.2 shows the 37 floristic communities identified as occurring in the coastal dune and cliff-top habitats along the Eyre coast study area. There are 20 floristic communities where 50% or greater of the known sites are found within the study area. Nineteen communities have 20 or less records for SA. Information about each of the floristic groups has been summarised below from the information compiled by Oppermann (1999).

TABLE 3.2 Floristic groups in coastal dune and cliff-top habitats*

Structural Class	Floristic community	Sites in EP	Sites in SA	% in EP
Grassland	*Spinifex sericeus / Euphorbia paralias*	2	42	5
Herbland	*Cakile maritima* ssp. *maritima*	1	4	25
Hummock grassland	***Triodia compacta***	**13**	**13**	**100**
Mallee	***Eucalyptus diversifolia / Clematis microphylla***	**29**	**36**	**81**
Mallee	*Eucalyptus diversifolia / Gonocarpus mezianus*	4	9	44
Mallee	***Eucalyptus incrassata***	**2**	**2**	**100**
Mallee	*Eucalyptus rugosa / Melaleuca lanceolata*	10	21	48
Mallee	***Eucalyptus* spp. / *Melaleuca lanceolata / Melaleuca uncinata***	**8**	**9**	**89**
Sedgelands	*Gahnia lanigera / Lepidosperma congestum*	2	18	11

Structural Class	Floristic community	Sites in EP	Sites in SA	% in EP
Sedgelands	***Gahnia trifida***	**1**	**2**	**50**
Shrublands	*Acacia ligulata*	7	27	26
Shrublands	*Alyxia buxifolia*	4	22	18
Shrublands	***Atriplex cinerea***	**12**	**20**	**60**
Shrublands	***Atriplex vesicaria* ssp.**	**15**	**21**	**71**
Shrublands	*Beyeria lechenaultii / Acrotriche patula*	3	11	27
Shrublands	*Enchylaena tomentosa* var. *tomentosa*	1	6	17
Shrublands	***Halosarcia indica* ssp.**	**5**	**6**	**83**
Shrublands	***Leucophyta brownii***	**14**	**25**	**56**
Shrublands	*Leucopogon parviflorus / Olearia axillaris*	39	150	26
Shrublands	***Leucopogon parviflorus / Acrotriche patula***	**13**	**13**	**100**
Shrublands	*Maireana erioclada*	1	29	3
Shrublands	***Maireana oppositifolia***	**12**	**24**	**50**
Shrublands	***Melaleuca halmaturorum***	**4**	**8**	**50**
Shrublands	*Melaleuca lanceolata / Acrotriche patula / Lasiopetalum discolor*	18	37	49
Shrublands	***Melaleuca lanceolata / Atriplex paludosa* ssp.**	**25**	**26**	**96**
Shrublands	***Melaleuca lanceolata / Atriplex vesicaria* ssp.**	**15**	**17**	**88**
Shrublands	***Melaleuca lanceolata / Senecio lautus***	**28**	**29**	**97**
Shrublands	***Melaleuca lanceolata / Tetragonia implexicoma***	**28**	**39**	**72**
Shrublands	*Melaleuca uncinata*	2	5	40
Shrublands	***Nitraria billardierei***	**13**	**24**	**54**
Shrublands	*Olearia axillaris / *Lycium ferocissimum*	1	12	8
Shrublands	***Olearia axillaris / Lasiopetalum discolor***	**17**	**33**	**52**
Shrublands	*Olearia axillaris / Rhagodia candolleana* ssp.*candolleana*	7	64	11
Shrublands	***Olearia axillaris / Tetragonia implexicoma.***	**32**	**42**	**76**
Shrublands	*Threlkeldia diffusa*	2	8	25
Trees	*Allocasuarina verticillata*	4	11	36
Trees	***Meleleuca brevifolia / Gahnia filum***	**3**	**3**	**100**

* Oppermann (1999) study area

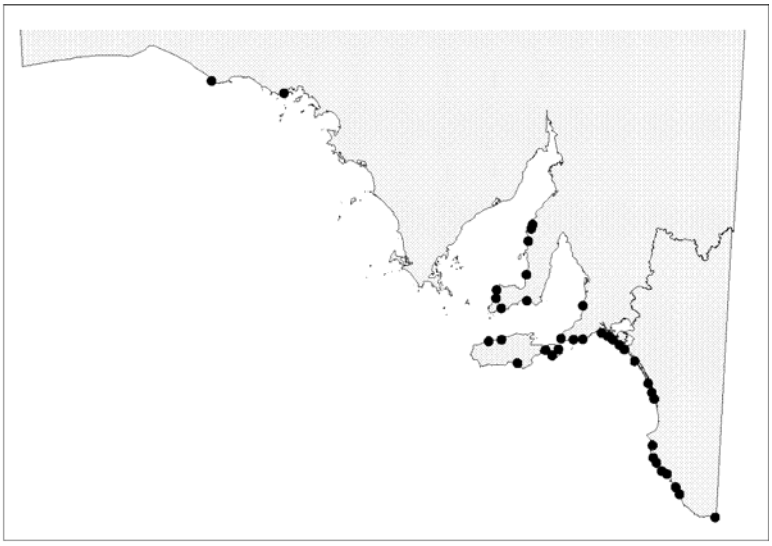
Bold = 50%+ sites found along Eyre coast

Shaded = less than 20 sites recoded along SA coast

Spinifex hirsutus / Euphorbia paralias **grasslands (shrublands)**

Description

A strong group located mainly on fore-dunes, predominantly along the sandier eastern part of the SA coastline. This group is more common on the sandy parts of the Eyre coast than the map reflects. The average number of species is moderately low with an unusually high proportion of herbs and grasses.



Number of plant species

Min	Max	Average
3	19	10.52

Dominant species

Euphorbia paralias
Spinifex hirsutus

FIGURE 3.1 ***Spinifex hirsutus/Euphorbia paralias*** **grasslands at KUR00201 (HOB14290) western Eyre Peninsula**

Cakile maritima ssp. *maritima* herbland

Description

A non native plant often found colonising the beach behind the strandline and unstable dunes. The distribution map reflects inadequate sampling of the strandline habitat as the plant is widely distributed along the SA coast. Winter storms often remove the beach communities transporting the seed along the coast.

Number of plant species

Min	Max	Average
1	9	4.50

Dominant species

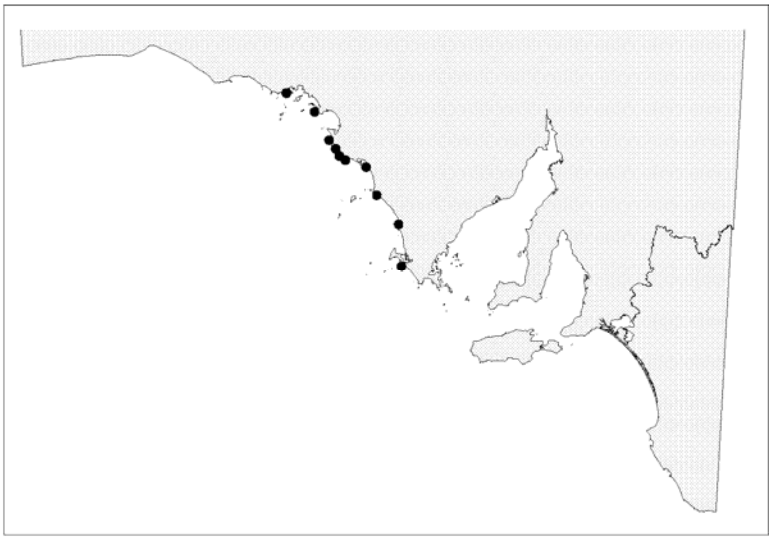
Cakile maritima ssp. *maritima*

FIGURE 3.2 ***Cakile maritima* ssp. *maritima* herbland at Lucky Bay eastern Eyre Peninsula**

Triodia compacta hummock grasslands (shrublands)

Description

A moderately strong group located in the western coast of Eyre Peninsula on both dunefields and cliffs. Associated shrubs are generally under 0.5m.



Number of plant species

Min	Max	Average
11	24	17.92

Dominant species
Triodia compacta

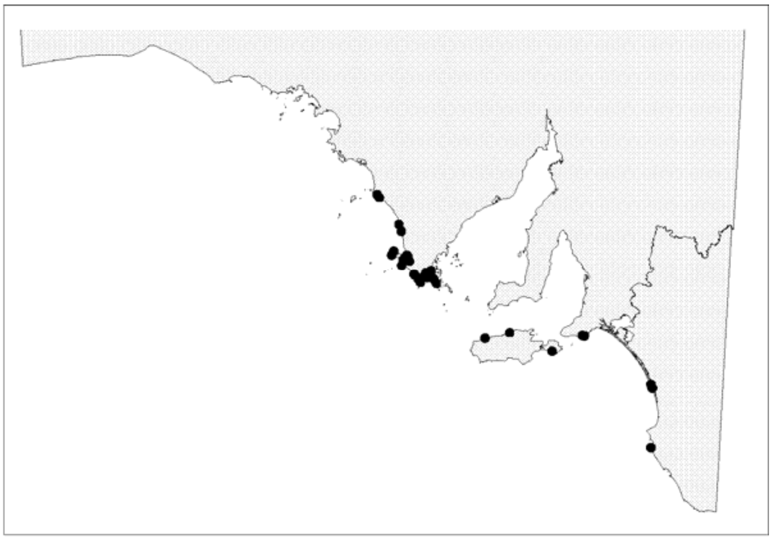
Sub-dominant species
Melaleuca lanceolata

FIGURE 3.3 *Triodia compacta* hummock grasslands (shrublands) at quadrat KIA00101 (EPW15908)

***Eucalyptus diversifolia / Clematis microphylla* mallees**

Description

Predominantly located on rocky lithified dunefields. There is a distinctive overstorey with few understorey species in common.



Number of plant species

Min	Max	Average
4	38	17.89

Dominant overstorey species
Eucalyptus diversifolia

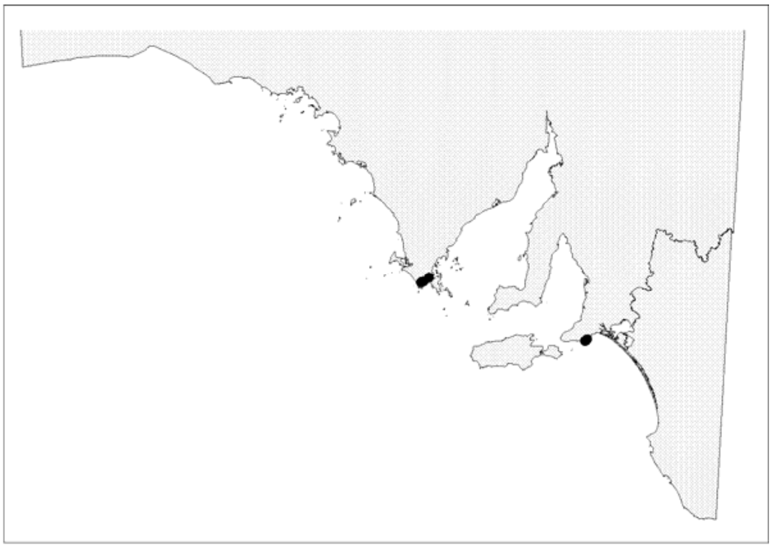
Dominant understorey species
Clematis microphylla

Sub-dominant species
Melaleuca lanceolata

FIGURE 3.4 ***Eucalyptus diversifolia / Clematis microphylla* mallees at quadrat WAN00202 (EPS15877) southern Eyre Peninsula**

Eucalyptus diversifolia / *Gonocarpus mezianus* mallee

Description
A moderately strong group located predominantly on cliffs. The connecting species is a ground stratum plant but there are high abundances of Eucalypts throughout the group with a high number of understorey plant species



Number of plant species

Min	Max	Average
21	62	41.78

Dominant overstorey species
Eucalyptus diversifolia

Dominant understorey species
Danthonia setacea var. *setacea*
Gonocarpus mezianus
Schoenus breviculmis

Sub-dominant species
Acacia pycnantha
Acrotriche cordata
Hibbertia riparia (glabriuscula)
Xanthorrhoea semiplana ssp.

FIGURE 3.5 ***Eucalyptus diversifolia / Gonocarpus mezianus* mallee at quadrat SLE01702 (EPS13428)**

Eucalyptus incrassata mallee

Description

A small but distinctive group with a combination of high abundance of the overstorey species with an understorey of the other three dominant species. Both quadrats are in one site of the Arno mapsheet.

Number of plant species

Min	Max	Average
7	11	9.00

Dominant overstorey species
Eucalyptus incrassata

Dominant understorey species
**Lycium ferocissimum*
Pittosporum phylliraeoides var. *microcarpa*

Indicator species
Rhagodia preissii ssp. *preissii*

FIGURE 3.6 ***Eucalyptus incrassata*** **mallee at quadrat ARN00103 (EPE14579)**

Eucalyptus rugosa / Melaleuca lanceolata mallees

Description

A moderately strong to strong group limited to the the central area of the SA coastline. There is a distinctive overstorey with few common species of understorey plants.

Number of plant species

Min	Max	Average
7	35	20.81

Dominant overstorey species
Eucalyptus rugosa

Dominant understorey species
Acrotriche patula
Melaleuca lanceolata

Sub-dominant overstorey species
Eucalyptus diversifolia

FIGURE 3.7 *Eucalyptus rugosa / Melaleuca lanceolata* mallees at quadrat JUS00103 (EPS15900) southern Eyre Peninsula

Eucalyptus sp. / *Melaleuca lanceolata* / *Melaleuca uncinata* low mallee

Description

A weak group located on the eastern coast of Eyre Peninsula. All groups have either or both of the sub-dominant Melaleuca species with eight quadrats having high abundances of Eucalyptus species. All quadrats are in flat to nearly flat areas with a moderately high number of perennial species.

Number of plant species

Min	Max	Average
14	38	27.22

Dominant understorey species

Tetragonia implexicoma

Sub-dominant overstorey

Melaleuca lanceolata
Melaleuca uncinata

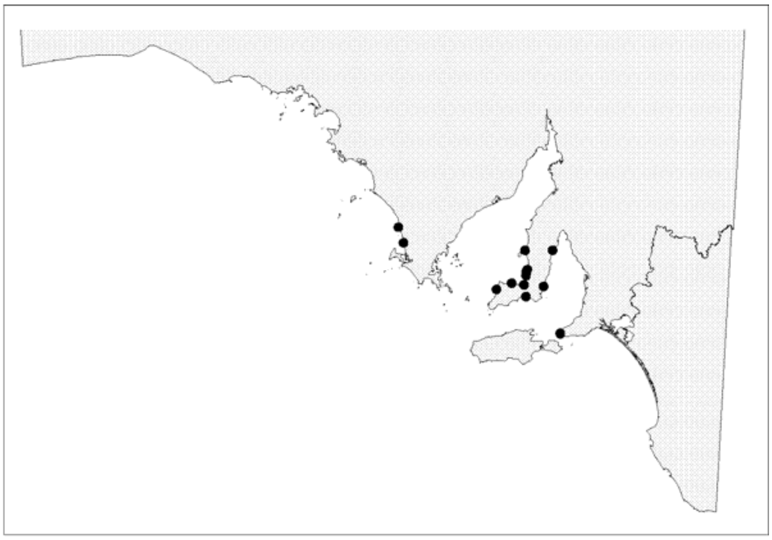
Indicator species

Leptospermum coriaceum
Triodia scariosa ssp. *scariosa*

FIGURE 3.8 ***Eucalyptus sp. / Melaleuca lanceolata / Melaleuca uncinata* low mallee at quadrat BAN00204 (EPS13235) southern Eyre Peninsula**

Gahnia lanigera / Lepidosperma congestum low sedgelands

Description
A moderately strong group located in the central part of the coastline, predominantly on rocky lithified dunefields.



Number of plant species

Min	Max	Average
15	40	26.89

Dominant species
Gahnia lanigera
Helichrysum leucopsideum
Lepidosperma congestum

Sub-dominant species
Lomandra effusa

FIGURE 3.9 *Gahnia lanigera / Lepidosperma congestum* low sedgelands at quadrat COU01101 (EPS13281) southern Eyre Peninsula

Gahnia trifida sedgeland

Description
A very small strong group located in flat, swampy areas. Mixed with sparse herbs, grasses and shrubs.

Number of plant species

Min	Max	Average
5	21	13.00

Dominant species
Gahnia trifida
Samolus repens

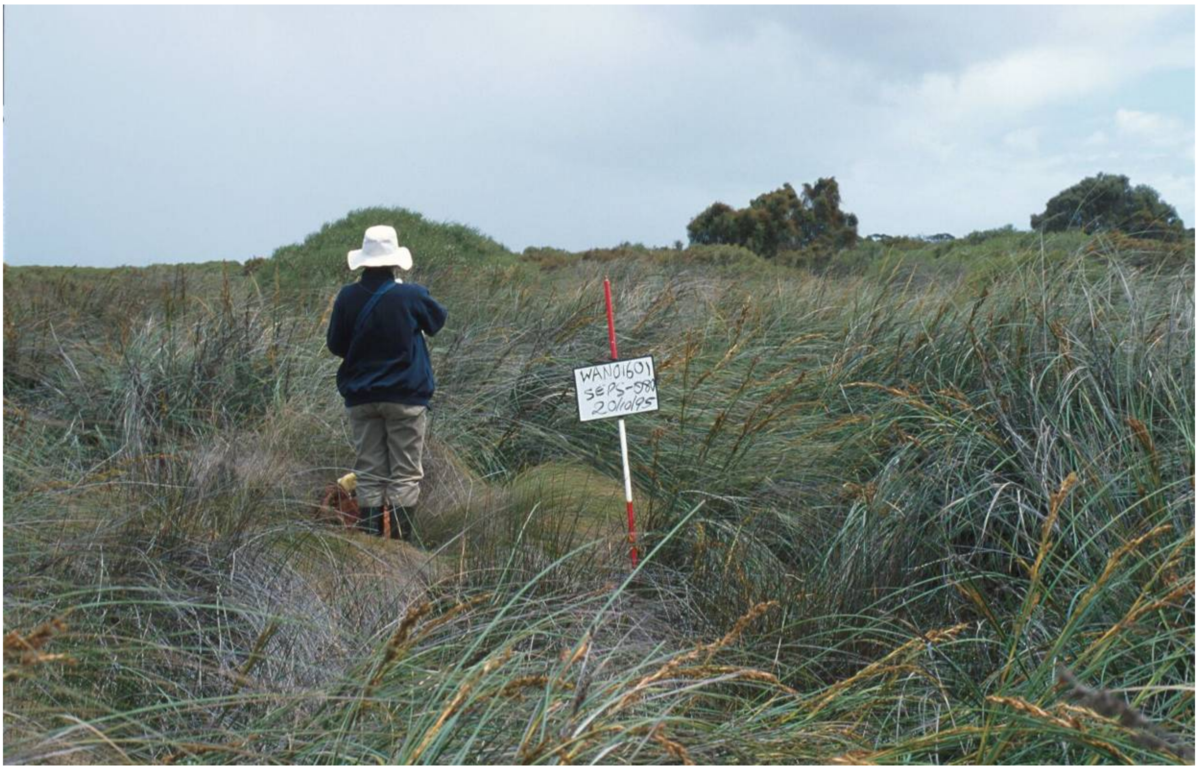
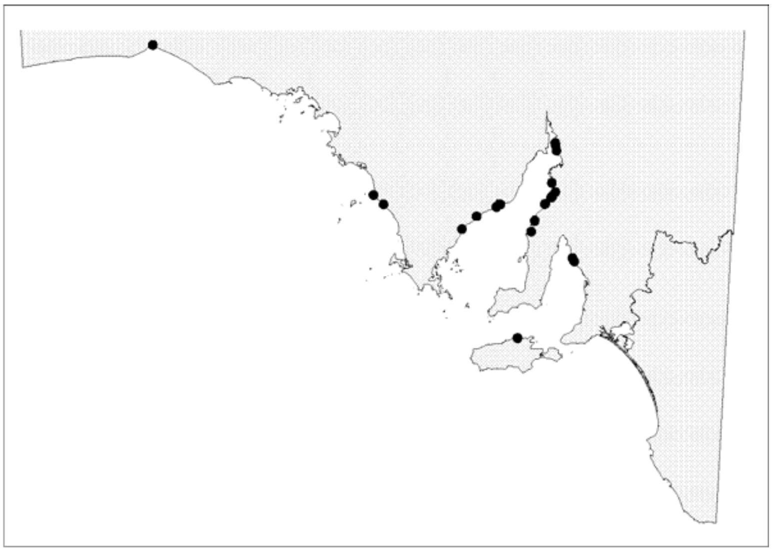


FIGURE 3.10 *Gahnia trifida* sedgeland at quadrat WANO1601 (EPS13508) southern Eyre Peninsula

Acacia ligulata shrublands

Description

A weak group located predominantly in the central part of the coast on dunefields. There is a mixture of tall (>2m) overstorey species connected by an understorey species.



Number of plant species

Min	Max	Average
4	31	18.15

Dominant understorey species

Threlkeldia diffusa

Sub-dominant overstorey species

Acacia ligulata
Myoporum insulare
Olearia axillaris

FIGURE 3.11 *Acacia ligulata* shrublands at quadrat ARN00202 (EPE14591) eastern Eyre Peninsula

Alyxia buxifolia shrublands

Description
A moderately strong group on cliffs and dunefields located across the central part of the coastline.

Number of plant species

Min	Max	Average
17	36	26.64

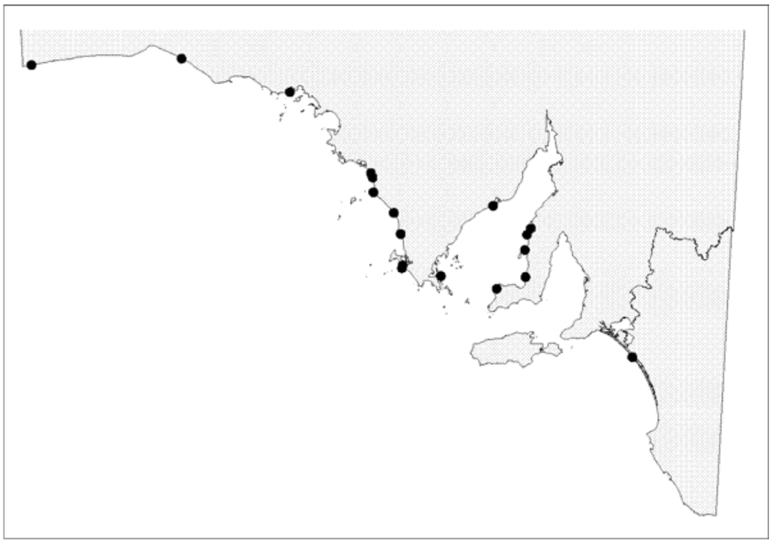
Dominant overstorey species
Alyxia buxifolia

Dominant understorey species
Acrotriche patula
**Lagurus ovatus*
Rhagodia candolleana ssp. *candolleana*

FIGURE 3.12 ***Alyxia buxifolia*** **shrublands at quadrat TAL00406 (EPW15880) western Eyre Peninsula**

Atriplex cinerea shrublands

Description
Mainly an overstorey found along the back-beach, on incipient foredunes and foredunes that are semi-stable.



Number of plant species

Min	Max	Average
4	27	14.25

Dominant overstorey species

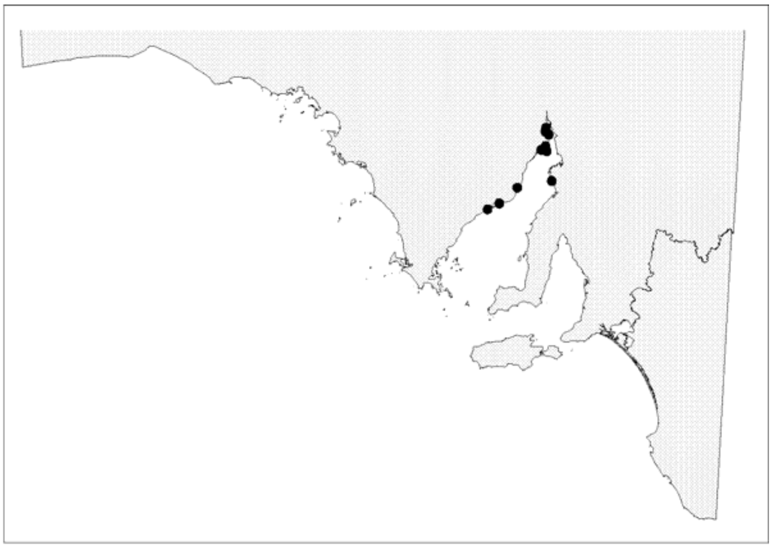
Atriplex cinerea
Olearia axillaris

FIGURE 3.13 Atriplex cinerea shrublands at WAN00206 (EPS15892) southern Eyre Peninsula

Atriplex vesicaria **ssp. low shrublands**

Description

A moderately strong group located along the coast of Spencer Gulf. The outcrop and strew data indicated a possible association with silica soils.



Number of plant species

Min	Max	Average
6	28	17.33

Dominant species
Atriplex vesicaria ssp.

Sub-dominant species
Geijera linearifolia

Indicator species
Rhagodia parabolica

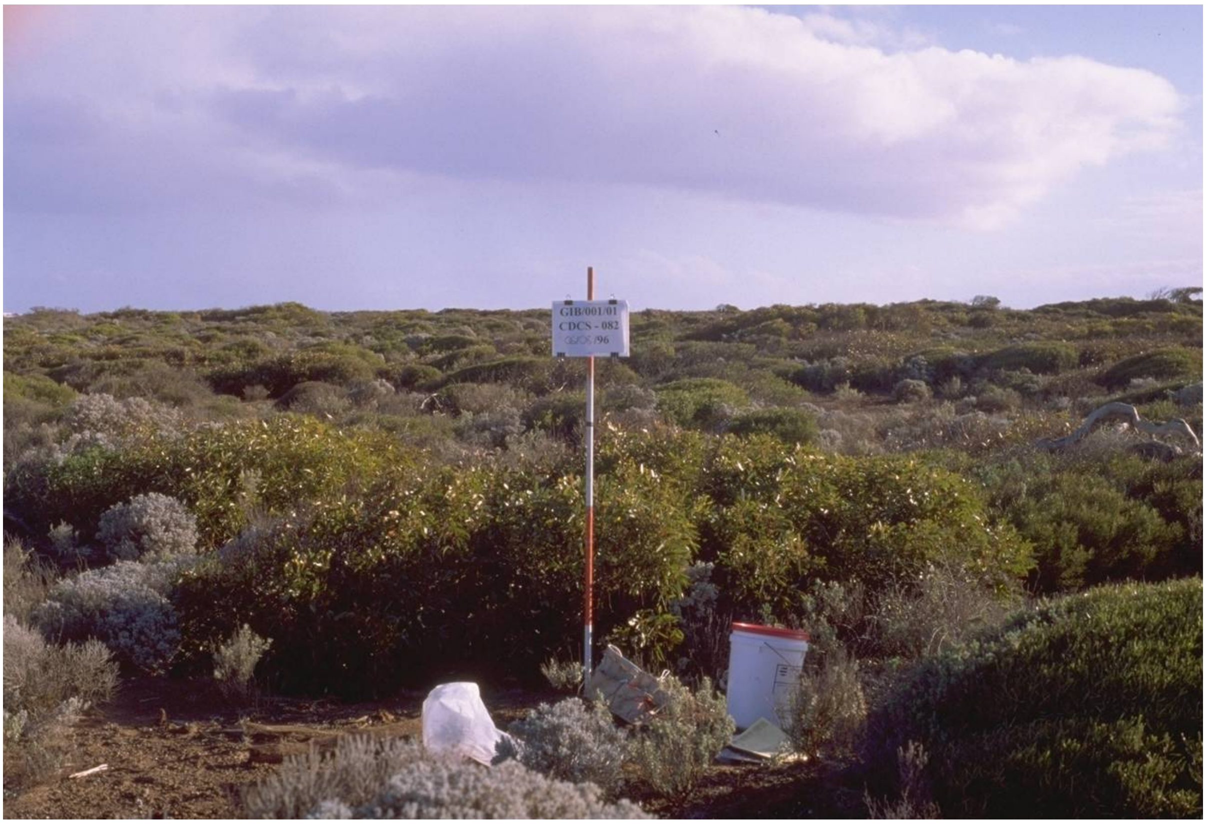


FIGURE 3.14 ***Atriplex vesicaria*** **ssp. low shrublands at quadrat GIB00101 (EPE14857)**

Beyeria lechenaultii / Acrotriche patula shrublands

Description
A moderately strong group located on the east coast of southern Eyre Peninsula. A structurally diverse plant community with a moderately high number of species.

Number of plant species

Min	Max	Average
20	42	26.82

Dominant species
Acrotriche patula
Beyeria lechenaultii
Comesperma volubile

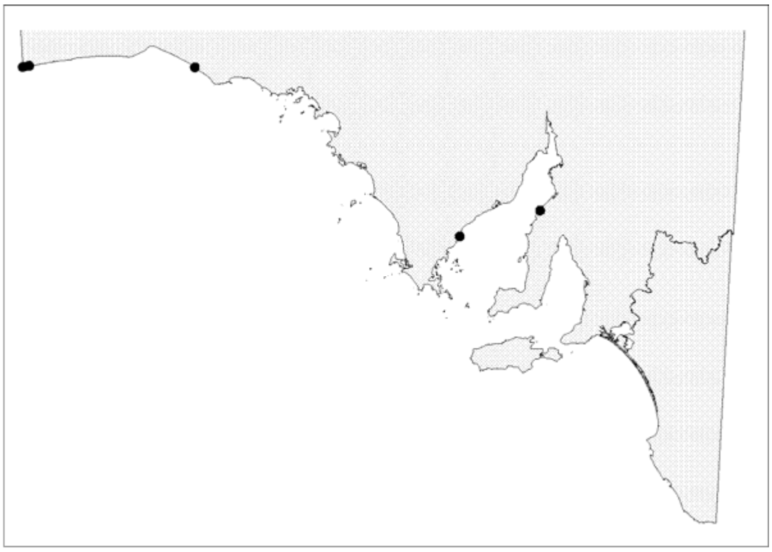
Sub-dominant species
Danthonia caespitosa
Olearia ramulosa
Pomaderris paniculosa ssp. *paniculosa*

Indicator species
Calytrix tetragona
Gahnia lanigera
Lepidosperma viscidum
Maireana enchylaenoides

FIGURE 3.15 ***Beyeria lechenaultii / Acrotriche patula*** **shrublands at quadrat JUS00403 (EPS13323) southern Eyre Peninsula**

Enchylaena tomentosa var. *tomentosa* low shrubland

Description
A very weak group connected by a low shrub with distribution in the lower rainfall areas. There is not a distinctive overstorey and all the species are in low abundances. The average species number is moderate.



Number of plant species

Min	Max	Average
4	21	12.67

Dominant species
Enchylaena tomentosa var. *tomentosa*

Sub-dominant species
Maireana erioclada

FIGURE 3.16 ***Enchylaena tomentosa var. tomentosa*** **low shrubland at quadrat NEI01301 (EPS13415) southern Eyre Peninsula**

Halosarcia indica ssp. low shrublands

Description

A moderately strong group located along the coastline on saline low lying flat. There is a very high proportion of low shrubs within the plant communities with few subdominant species in common.

Number of plant species

Min	Max	Average
5	14	8.50

Dominant species

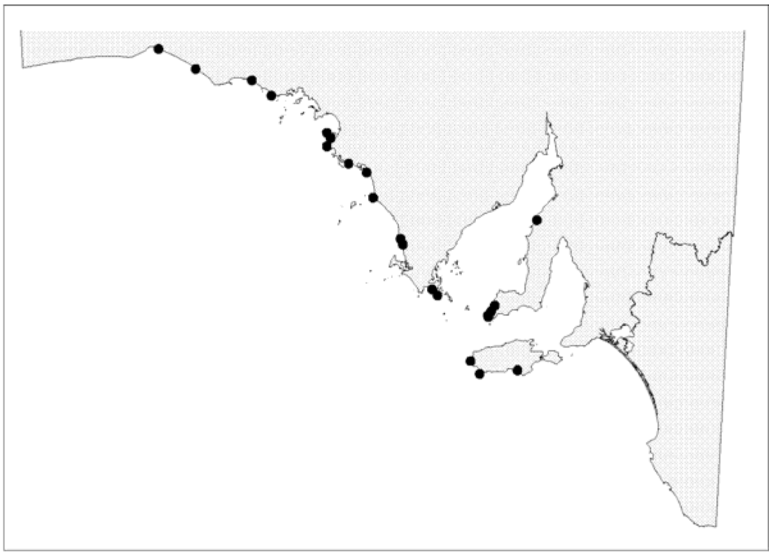
Frankenia pauciflora var. *gunnii*
Halosarcia indica ssp.

FIGURE 3.17 ***Halosarcia indica*** **ssp. low shrublands at quadrat COL00405 (EPW13743) western Eyre Peninsula.**

Leucophyta brownii low shrublands

Description

A strong group located on cliffs and dunefields, generally in exposed locations subject to wind and salt spray. A very high proportion of shrubs under 0.5m



Number of plant species

Min	Max	Average
3	26	16.16

Dominant species

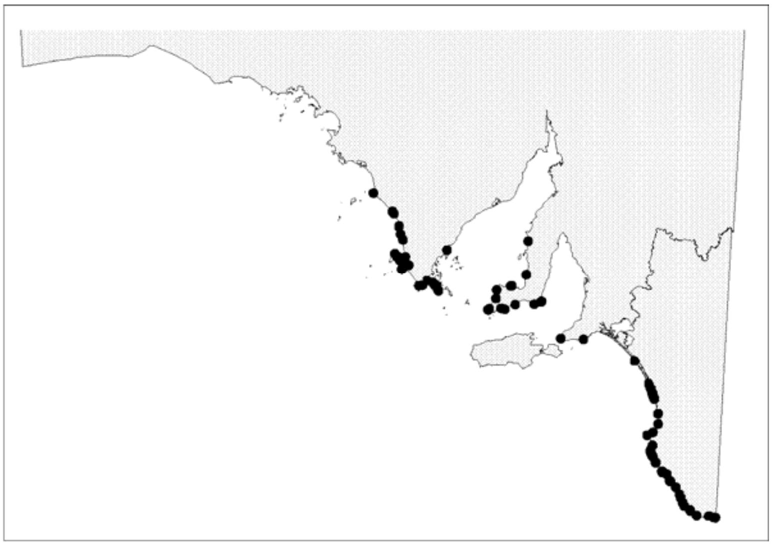
Leucophyta brownii

FIGURE 3.18 *Leucophyta brownii* low shrublands at quadrat CUN00101 (EPW13768) western Eyre Peninsula

Leucopogon parviflorus / Olearia axillaris shrublands

Description

A strong group located predominantly on dunefields in areas where average rainfall exceeds 400mm/year. . This is the largest group identified by the CDCS and includes very common coastal species. There is a distinctive overstorey with a wide distribution of lifeforms in the understorey.



Number of plant species

Min	Max	Average
8	36	20.59

Dominant overstorey species

Leucopogon parviflorus
Olearia axillaris

Dominant understorey species

Carpobrotus rossii
Clematis microphylla
Rhagodia candolleana ssp. *candolleana*

Sub-dominant species

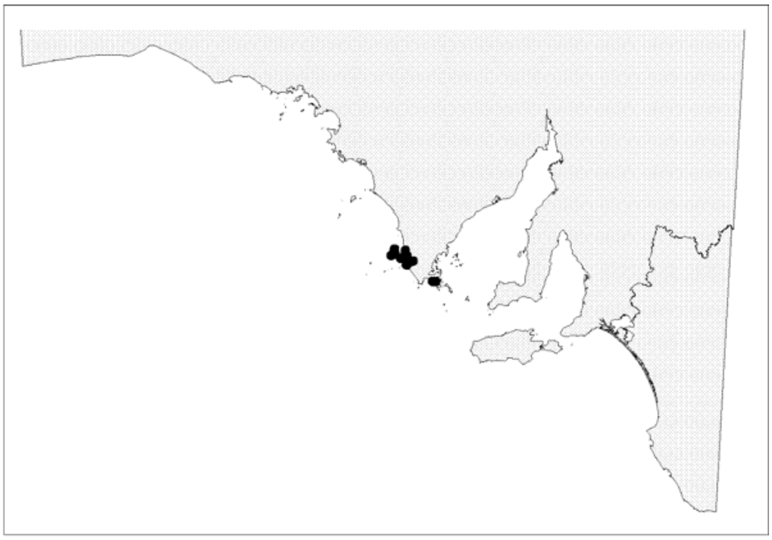
Acacia longifolia var. *sophorae*
Lepidosperma gladiatum

FIGURE 3.19 ***Leucopogon parviflorus / Olearia axillaris*** **shrublands at quadrat WAN00104 (EPS15916) southern Eyre Peninsula**

Leucopogon parviflorus / Acrotriche patula shrublands

Description

A moderately strong group located on predominantly calcareous substrates in southern Eyre Peninsula. The structure of the plant communities is variable.



Number of plant species

Min	Max	Average
10	40	22.46

Dominant overstorey species
Leucopogon parviflorus

Dominant understorey species
Acrotriche patula
Clematis microphylla
Dianella brevicaulis

Sub-dominant species
Lasiopetalum discolor
Melaleuca lanceolata
Gahnia deusta

FIGURE 3.20 ***Leucopogon parviflorus / Acrotriche patula*** **shrublands at quadrat WHI00601 (EPS13520) southern Eyre Peninsula.**

Maireana erioclada low shrublands

Description

A moderately strong group located predominantly on the Nullarbor Plain and at Merdayerrah. A very high proportion of shrubs under 1m.

Number of plant species

Min	Max	Average
3	22	13.07

Dominant understorey species
Maireana erioclada

Sub-dominant species
Melaleuca lanceolata

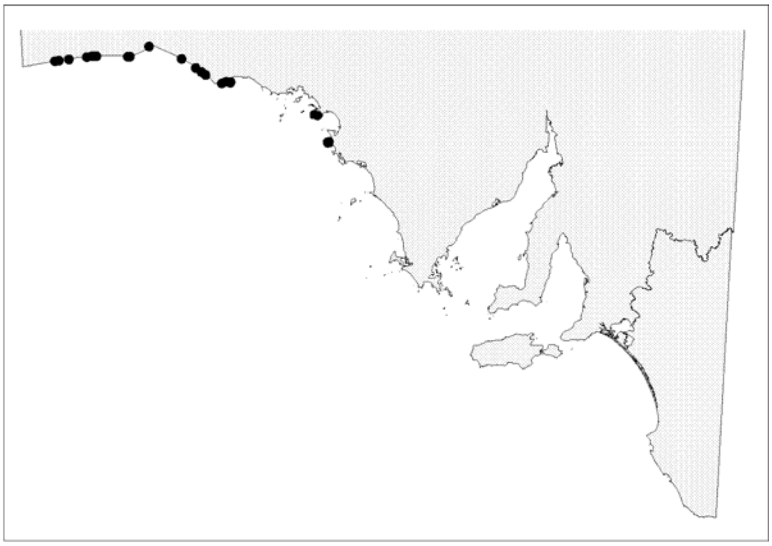
Indicator species
Frankenia sessilis

FIGURE 3.21 *Maireana erioclada* low shrublands amongst *Melaleuca lanceolata* at quadrat COO00201 (EPW13758) western Eyre Peninsula.

Maireana oppositifolia low shrublands

Description

A strong group located west of Streaky Bay located on both cliffs and dunefields. Very likely associated with saline soil conditions. There is a very high proportion of low shrubs in the plant communities.



Number of plant species

Min	Max	Average
8	24	13.79

Dominant species

Disphyma crassifolium ssp. *clavellatum*
Hemichroa diandra
Maireana oppositifolia

Sub-dominant species

Atriplex paludosa ssp.

Indicator species

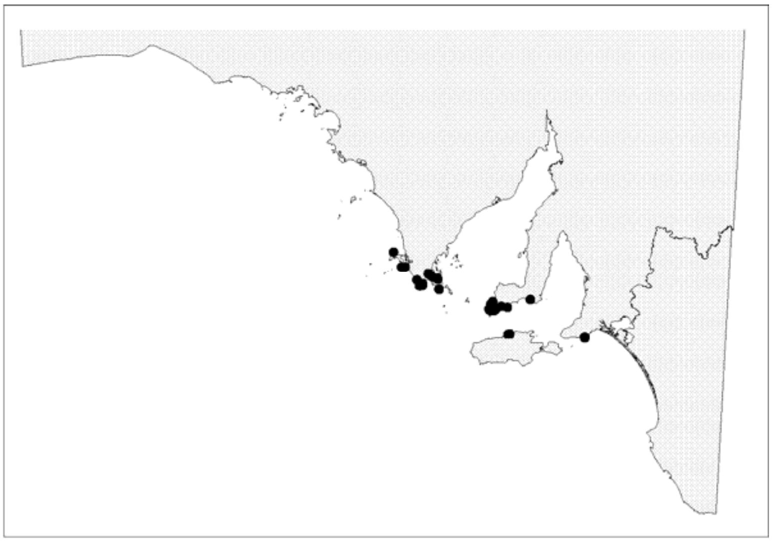
Frankenia sessilis

FIGURE 3.22 *Maireana oppositifolia* low shrublands at quadrat RUS00402 (HOB14297) western Eyre Peninsula

Melaleuca lanceolata / Acrotriche patula / Lasiopetalum discolor **shrublands/mallees**

Description

A moderately strong group located on dunefields and cliffs. There are a high number of species in a variable plant community with a predominantly low shrub understorey.



Number of plant species

Min	Max	Average
18	49	30.81

Dominant overstorey species

Melaleuca lanceolata

Dominant understorey species

Acrotriche patula
Lasiopetalum discolor

Sub-dominant species

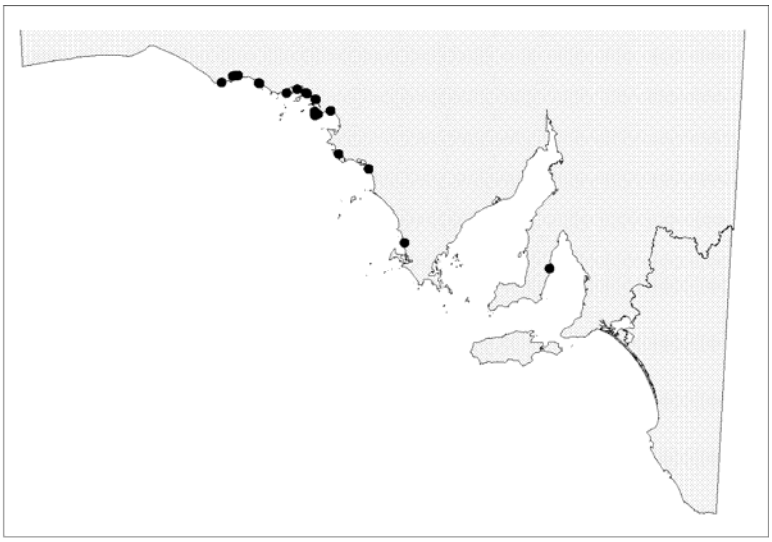
Beyeria lechenaultii
Eucalyptus diversifolia
Gahnia lanigera

FIGURE 3.23 ***Melaleuca lanceolata / Acrotriche patula / Lasiopetalum discolor*** **shrublands/mallees at quadrat JUS00102 (EPS15899) southern Eyre Peninsula**

Melaleuca lanceolata / Atriplex paludosa ssp. shrublands

Description

A strong group located predominantly in western Eyre Peninsula on dunefields. There is a distinctive overstorey with a high proportion of low (<0.5m) shrubs as understorey



Number of plant species

Min	Max	Average
8	19	14.88

Dominant overstorey species
Melaleuca lanceolata

Dominant understorey species
Atriplex paludosa ssp.

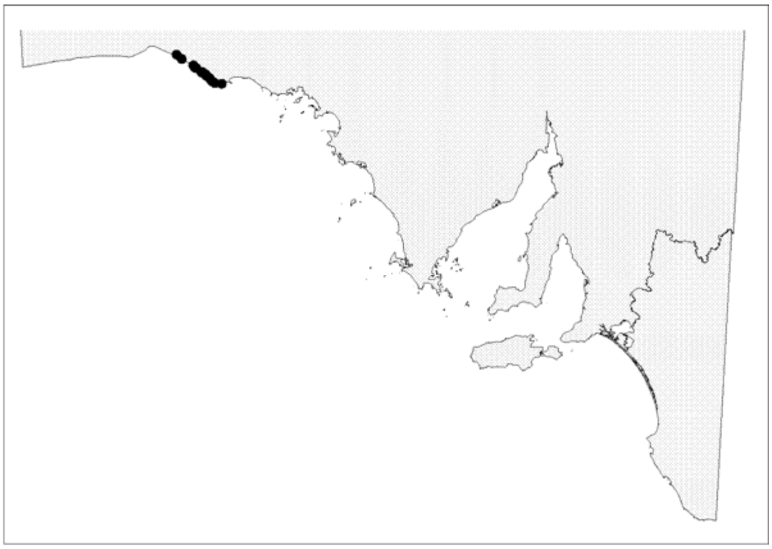
Sub-dominant species
Geijera linearifolia

FIGURE 3.24 ***Melaleuca lanceolata / Atriplex paludosa*** **ssp. shrublands at quadrat COL00102 (EPW13738)**

Melaleuca lanceolata / Atriplex vesicaria ssp. shrublands

Description

A strong group located in dunefields near the Head of the Bight. A distinctive overstorey with a high proportion of low shrubs (under 1m).



Number of plant species

Min	Max	Average
7	19	14.59

Dominant overstorey species

Melaleuca lanceolata

Dominant understorey species

Atriplex vesicaria ssp

Rhagodia crassifolia

Sub-dominant species

Beyeria lechenaultii

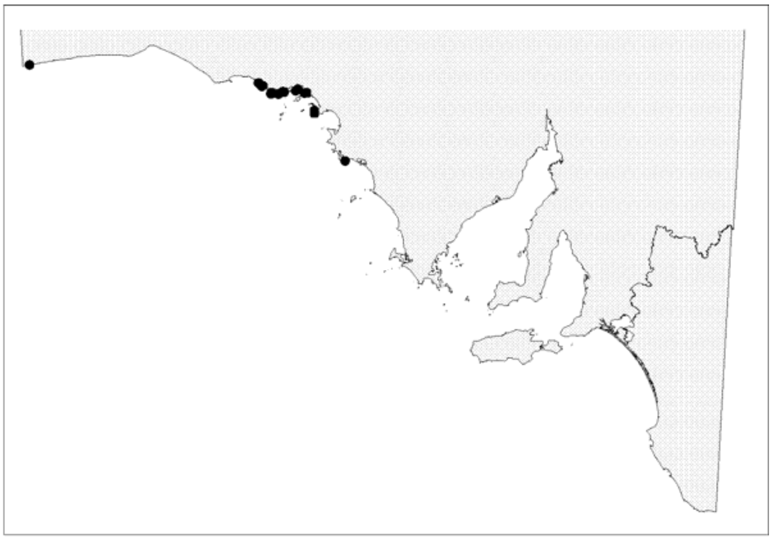
Geijera linearifolia

FIGURE 3.25 *Melaleuca lanceolata / Atriplex vesicaria* ssp. shrublands at quadrat COO00102 (EPW13755) western Eyre Peninsula.

***Melaleuca lanceolata* / *Senecio lautus* shrublands**

Description

A weak group located predominantly on the west coast of Eyre Peninsula on both dunefields and low cliffs. Plant communities are predominantly sparse with a high proportion of low shrubs.



Number of plant species

Min	Max	Average
8	24	16.31

Sub-dominant species (over 70%)

Melaleuca lanceolata
Senecio lautus

Sub-dominant species

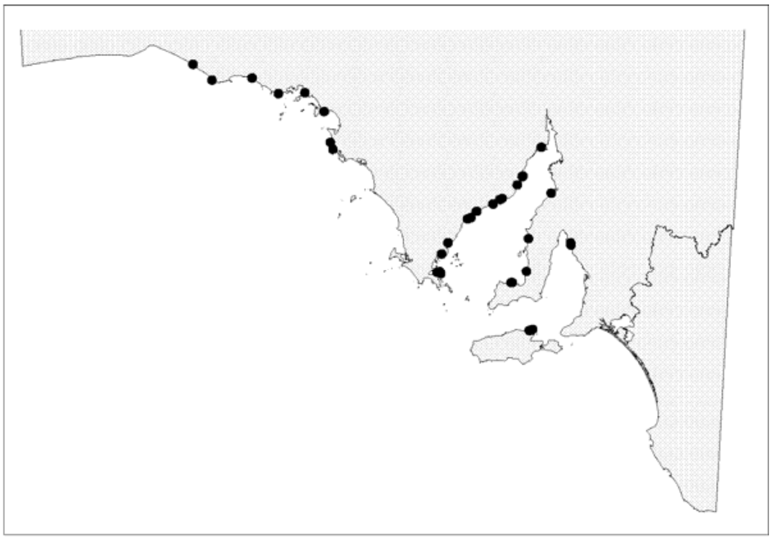
Beyeria lechenaultii
Geijera linearifolia

FIGURE 3.26 *Melaleuca lanceolata / Senecio lautus* shrublands at quadrat CHA00303 (EPW13926) western Eyre Peninsula.

Melaleuca lanceolata / Tetragonia implexicoma shrublands

Description

A very strong group located mainly on dunefields. A distinctive, predominantly tall overstorey with a wide range of lifeforms as understorey.



Number of plant species

Min	Max	Average
3	23	14.44

Dominant overstorey species

Melaleuca lanceolata

Dominant understorey species

Tetragonia implexicoma

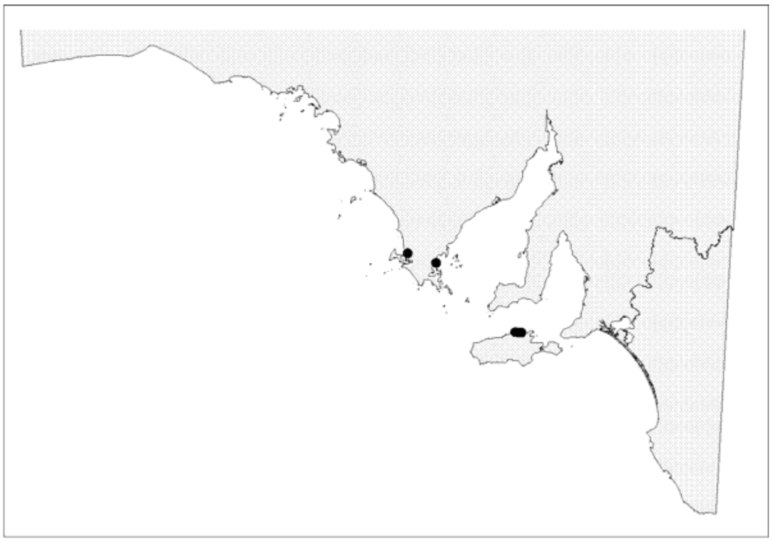
Sub-dominant species

Threlkeldia diffusa
Rhagodia candolleana ssp. *candolleana*
Exocarpos aphyllus

FIGURE 3.27 *Melaleuca lanceolata / Tetragonia implexicoma* shrublands at quadrat CUN00104 (EPW13766) western Eyre Peninsula.

Melaleuca uncinata shrubland

Description
A very strong group associated with siliceous soils. There is a distinctive dominant overstorey with many understorey species.



Number of plant species

Min	Max	Average
6	32	19.60

Dominant overstorey species
Melaleuca uncinata

Dominant understorey species
Hibbertia sericea var. *major*

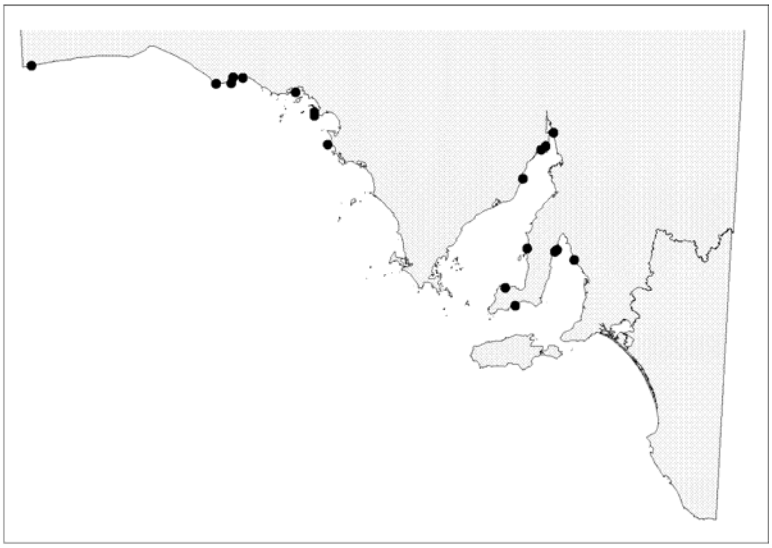
Indicator species
Astroloma conostephioides
Eucalyptus odorata
Gonocarpus mezianus
Lepidosperma viscidum

FIGURE 3.28 ***Melaleuca uncinata*** **shrubland at quadrat COU01601 (EPS13291) southern Eyre Peninsula**

Nitraria billardierei shrublands

Description

A strong group located west of Adelaide on dunefields. A distinctive overstorey which is uniformly abundant in all quadrats with an understorey of predominantly low shrubs.



Number of plant species

Min	Max	Average
4	19	11.38

Dominant overstorey species
Nitraria billardierei

Dominant understorey species
Tetragonia implexicoma

Sub-dominant and indicator species
Olearia axillaris
Threlkeldia diffusa

FIGURE 3.29 *Nitraria billardierei* shrublands at quadrat COL00101 (EPW13737) western Eyre Peninsula.

Olearia axillaris / **Lycium ferocissimum* shrublands

Description

A moderately strong group located on cliffs and dunefields along the central part of the coastline. *Lycium ferocissum* (South African Boxthorn) is an introduced weed. There is a distinctive overstorey with a broad distribution of understorey plant lifeforms.

Number of plant species

Min	Max	Average
6	26	14.75

Dominant overstorey species

**Lycium ferocissimum*
Olearia axillaris

Dominant understorey species

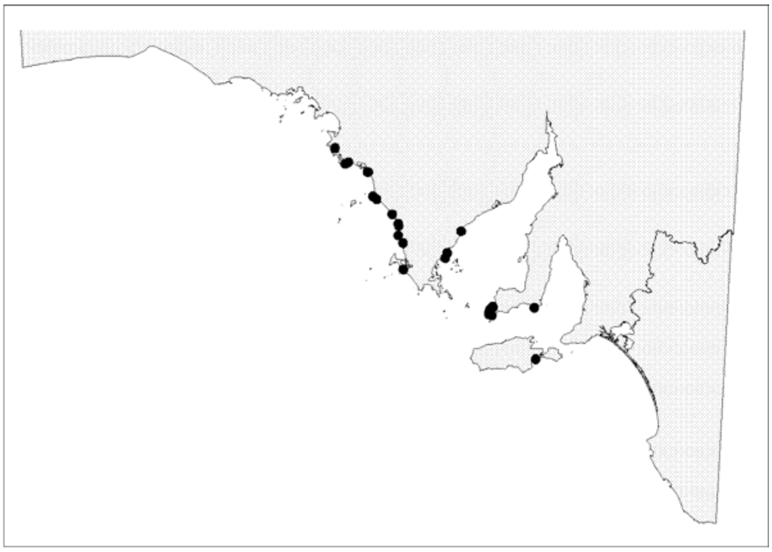
**Lagurus ovatus*

FIGURE 3.30 ***Olearia axillaris / *Lycium ferocissimum*** **shrublands at quadrat ARN00104 (EPE14580) eastern Eyre Peninsula**

Olearia axillaris / Lasiopetalum discolor shrublands

Description

A moderately strong group located along the central part of the coastline. A relatively tall overstorey with predominantly common species throughout the plant communities.



Number of plant species

Min	Max	Average
11	32	20.76

Dominant overstorey species
Olearia axillaris

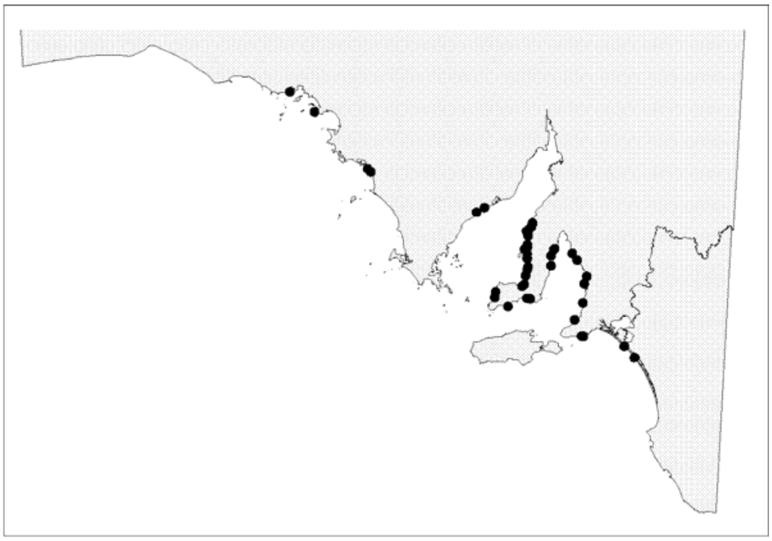
Dominant understorey species
Lasiopetalum discolor
Senecio lautus

Sub-dominant and indicator species
Leucopogon parviflorus
Melaleuca lanceolata

FIGURE 3.31 ***Olearia axillaris / Lasiopetalum discolor*** **shrublands at quadrat TAL00102 (EPW13774) western Eyre Peninsula.**

***Olearia axillaris* / *Rhagodia candolleana* ssp. *candolleana* shrublands**

Description
A large moderately strong group located along the coastline, predominantly on dunefields.



Number of plant species

Min	Max	Average
9	31	19.50

Dominant overstorey species
Olearia axillaris

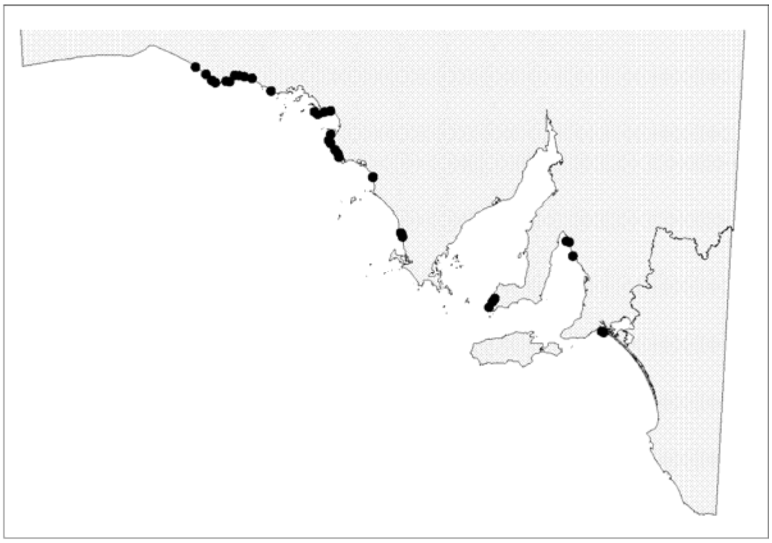
Dominant understorey species
Rhagodia candolleana ssp. *candolleana*
Tetragonia implexicoma
Threlkeldia diffusa

Sub-dominant species
**Lagurus ovatus*

FIGURE 3.32 *Olearia axillaris / Rhagodia candolleana* ssp. *candolleana* shrublands at quadrat TAL00101 (EPW13773) western Eyre Peninsula.

Olearia axillaris / Tetragonia implexicoma shrublands

Description
A strong group located in dunefields and well represented on west coast of Eyre Peninsula. Distinctive overstorey with a mix of other lifeforms.



Number of plant species

Min	Max	Average
6	22	13.50

Dominant overstorey species
Olearia axillaris

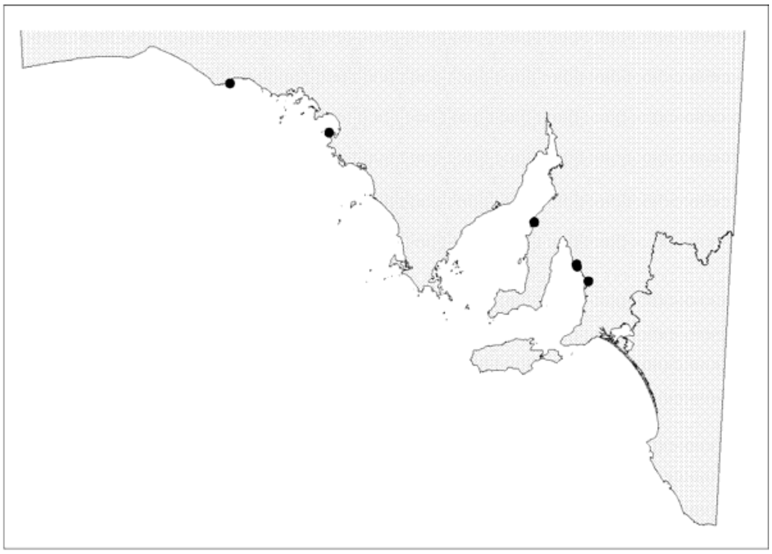
Dominant understorey species
Tetragonia implexicoma

FIGURE 3.33 ***Olearia axillaris / Tetragonia implexicoma*** **shrublands at quadrat COL00401 (EPW13744) western Eyre Peninsula.**

Threlkeldia diffusa low shrublands

Description

A moderately strong group scattered along drier parts of the coast. There is a high proportion of low shrubs.



Number of plant species

Min	Max	Average
6	20	12.75

Dominant species

Disphyma crassifolium ssp. *clavellatum*
**Mesembryanthemum crystallinum*
Threlkeldia diffusa

Sub-dominant species

Atriplex paludosa ssp.

Indicator species

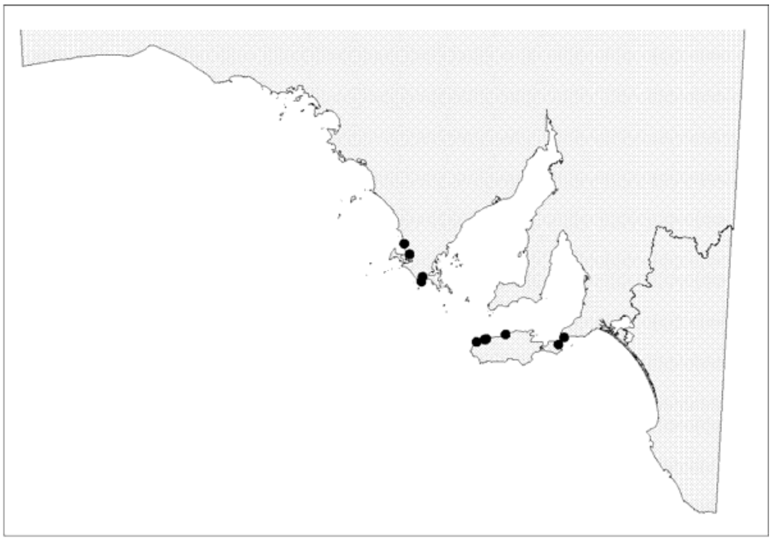
**Mesembryanthemum nodiflorum*

FIGURE 3.34 *Threlkeldia diffusa* low shrublands at quadrat HAS00501 (EPW13770) western Eyre Peninsula.

Allocasuarina verticillata forests

Description

A very strong group which is located on cliffs and hills often rocky sites across the central coastline. There is a distinctive overstorey with few common understorey species.



Number of plant species

Min	Max	Average
2	29	12.55

Dominant overstorey species

Allocasuarina verticillata

Indicator species

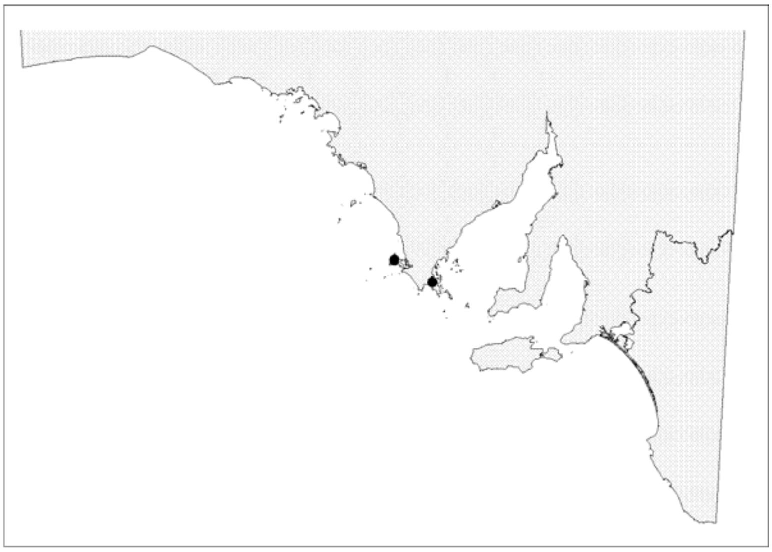
Cheilanthes austrotenuifolia

FIGURE 3.35 ***Allocasuarina verticillata*** **forests at quadrat COU01003 (EPS13280)**

Melaleuca brevifolia / Gahnia filum forest

Description

A small strong group located in swampy flats on southern Eyre Peninsula. There are high abundances of the dominant overstorey species with many other species in common between the few quadrats.



Number of plant species

Min	Max	Average
5	20	11.00

Dominant overstorey species
Melaleuca brevifolia

Dominant understorey species
Gahnia filum

Sub-dominant species
Leucopogon parviflorus

Indicator species
Samolus repens

FIGURE 3.36 ***Melaleuca brevifolia / Gahnia filum*** **forest at quadrat JUS1201 (EPS13330) southern Eyre Peninsula.**

3.1.3 Mangrove and salt marsh communities

Extensive mangrove and salt marsh communities occur within the Eyre Peninsula study area. They are found where there is sufficient shelter from wave action, within Spencer Gulf and along protected shorelines within the large bays along the Eyre coast. Individual areas range in size from very large (>100 ha) to very small (<10ha). Where the habitat is suitable multiple individual areas can be found forming a complex of large and small sat marshes. Based on locality, 21 mangrove / salt marsh complexes have been identified.

Mangrove and salt marsh habitats along the Eyre coastal study area have been mapped as part of a state-wide mapping program. The habitat classes are outlined by Canty and Hille 2002. Two levels of classification are used, detailed (long description) and broad (short description). At the detailed level 69 habitat classes are defined based on landform, tidal class, estuarine class, vegetation cover and condition. At the broader level which is used for State of Environment reporting purposes, these are combined into 10 habitat classes. Within the Eyre coastal boundary all 10 short description habitat classes have been identified. In area, these cover 17,906 hectares.

Table 3.3 shows the area and percentage of the relative abundance of the 10 short description communities within the study area.. The table also shows the representation of the habitat classes as a percent of the SA total. In total 12.5% of SA mangrove and salt marsh habitats are found within the Eyre coastal boundary. Inter tidal samphire forms the largest habitat and represents 31% of SA's total. The figures show that other habitats also have significant representation.

TABLE 3.3 Habitat classes (short description) found within the Eyre coastal boundary. Total area, relative % cover within the study area and % of the SA total

Habitat Class (short description)	Area (Ha) Eyre coast	% Eyre coast	% SA total
Intertidal cyanobacterial mat	155.5	0.9	12.31
Intertidal mangrove	3,836.7	21.4	24.53
Intertidal Melaleuca	11.1	0.1	48.10
Intertidal samphire	7,101.9	39.7	31.13
Intertidal sedges	8.7	0.0	2.04
Stranded tidal samphire	2,357.2	13.2	26.22
Supratidal cyanobacterial mat	459.6	2.6	22.27
Supratidal Melaleuca	118.1	0.7	6.87
Supratidal samphire	3,705.7	20.7	14.97
Supratidal sedges	18.3	0.1	6.79
Total	**17,906.1**	**100.0**	**12.5**

Transects have been surveyed across the salt marsh habitats at nine locations on Eyre Peninsula (see Figure 3.37) to record the plant communities. All of these fall within the study area. They form part of the Coast Protection Board's coastal monitoring program. Summary information about these is shown in table 3.4. The method used enables repeat surveys in the future to measure change. Mangrove and salt marsh communities will be impacted by sea level rise and it is important that the effects are monitored and recorded. The transects which were surveyed between 1995 and 2002 provide a baseline to compare future changes.

TABLE 3.4 Salt marsh transect information

Location	Transect Number	Date Surveyed	Length (metres)
Acraman Ck	330008	06/05/1996	3,327
Arno Bay	310005	22/10/1995	1,344
Cape Missiessy	330010	29/10/1998	1,695
Davenport Ck	330011	27/10/1998	1,881
Franklin Harbour	320005	11/01/1998	638
Laura Bay	330009	07/05/1996	870
Mt Young	440007	21/05/2002	1645
Nadia Landing	330012	28/10/1998	932
Tumby Bay	340008	24/10/1995	1,251

FIGURE 3.37 Salt marsh transect locations

Figures 3.38 to 3.58 provide habitat information for each of the 21 mangrove / salt marsh complexes found within the Eyre study area. Apart from their conservation importance, each of these complexes provides a variety of ecosystem services to their local area. They contribute to local food webs and protect marine water quality by filtering rainfall runoff. Their importance as buffers against sea water inundation during storms will only increase as sea level rises.

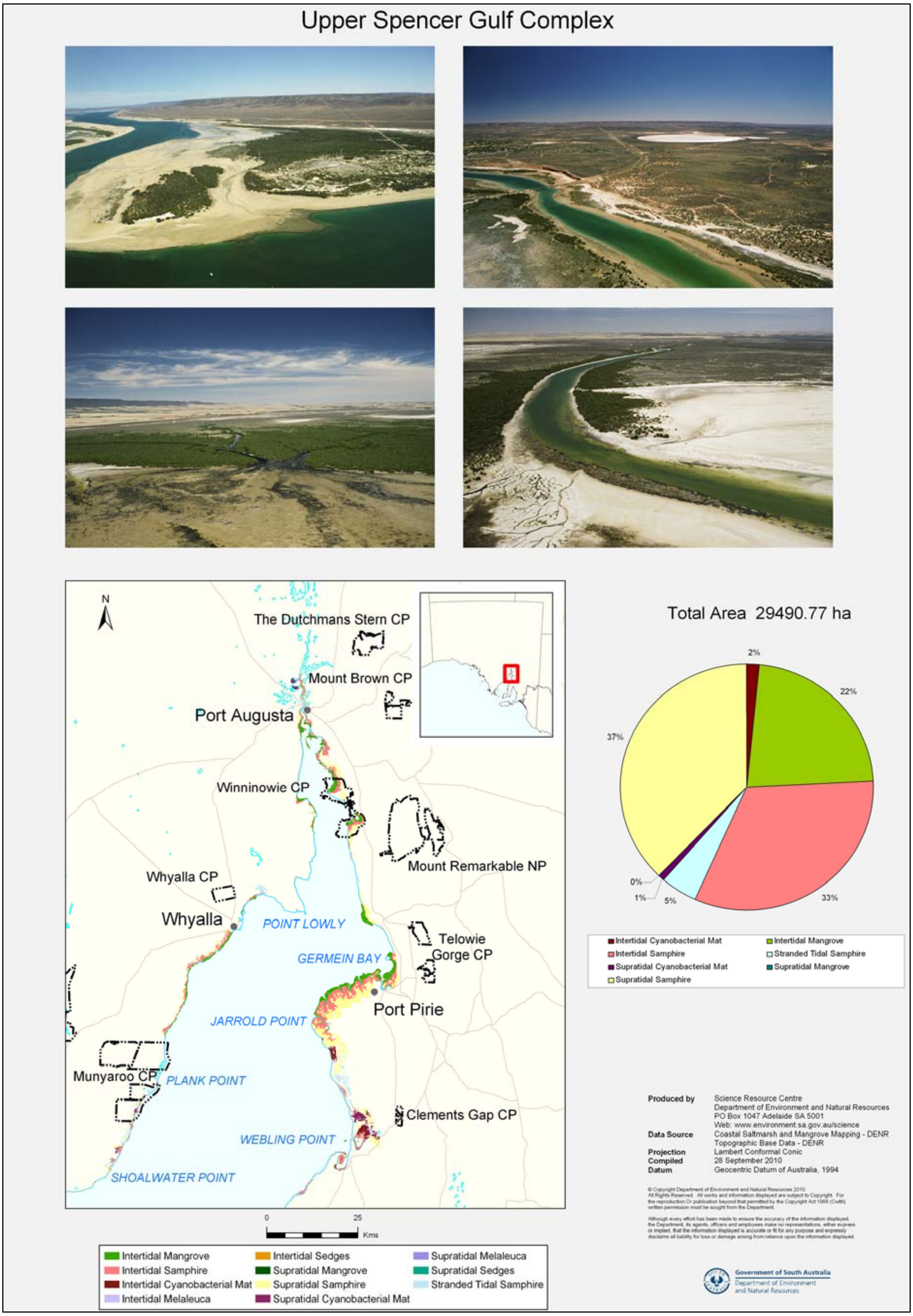


FIGURE 3.38 The Eyre study area encompasses part of the very large mangrove / salt marsh complex in upper Spencer Gulf

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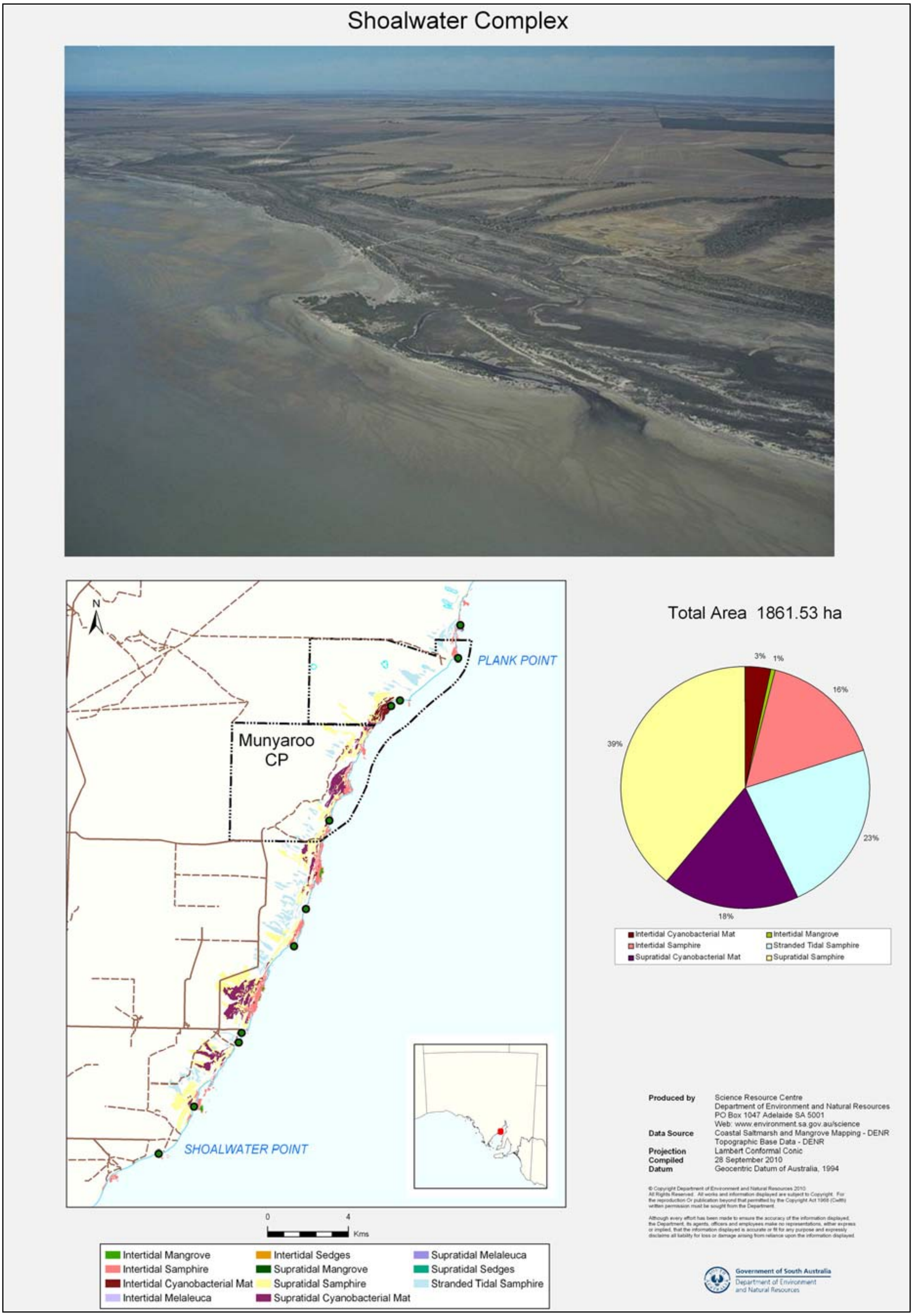

FIGURE 3.39 An extensive complex occupying sheltered gulf coast south of Whyalla

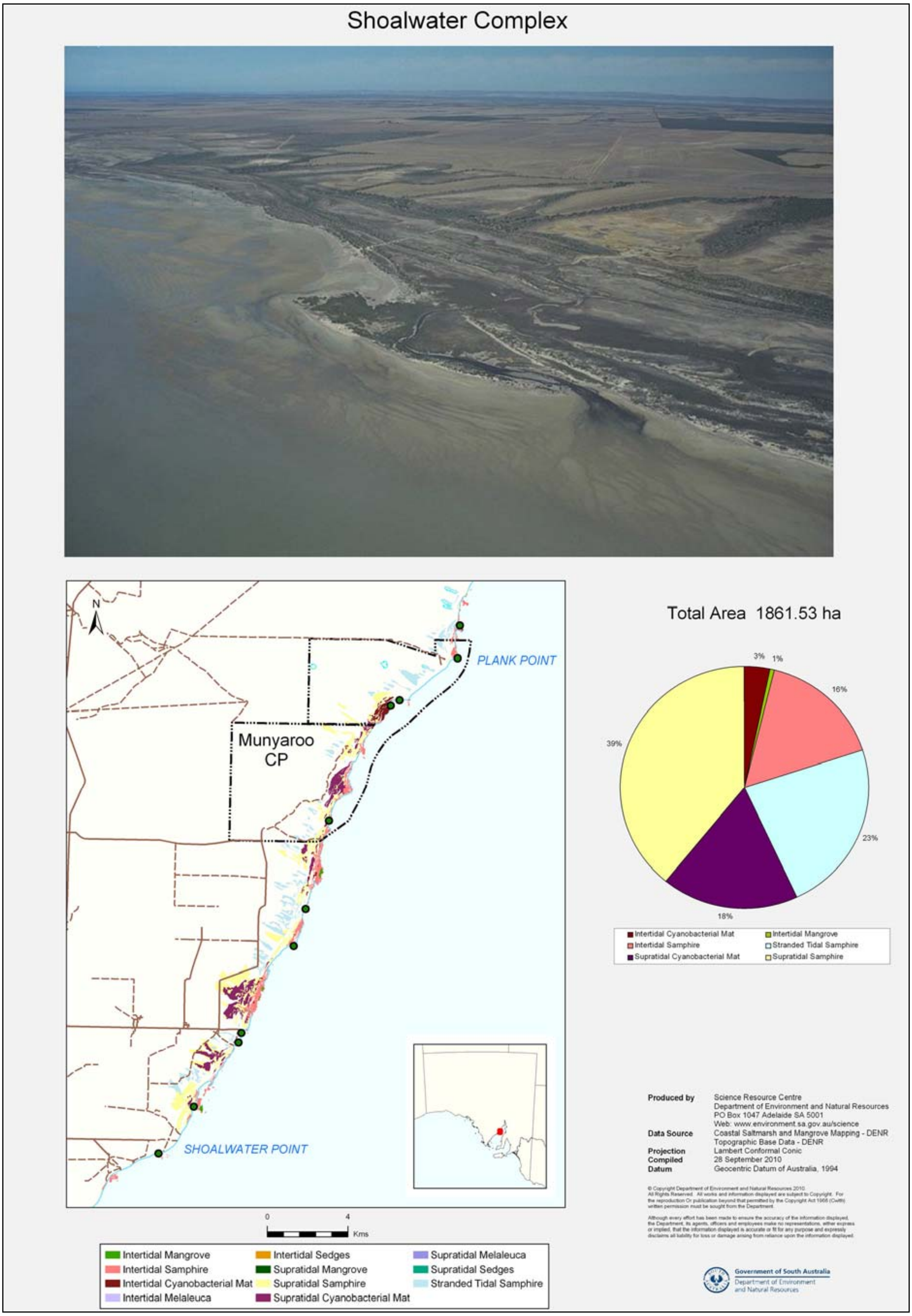

FIGURE 3.40 **Salt marsh complex north of Shoalwater Point characterised by extensive stranded salt marsh communities cut off from the sea by northward migrating sand spits**

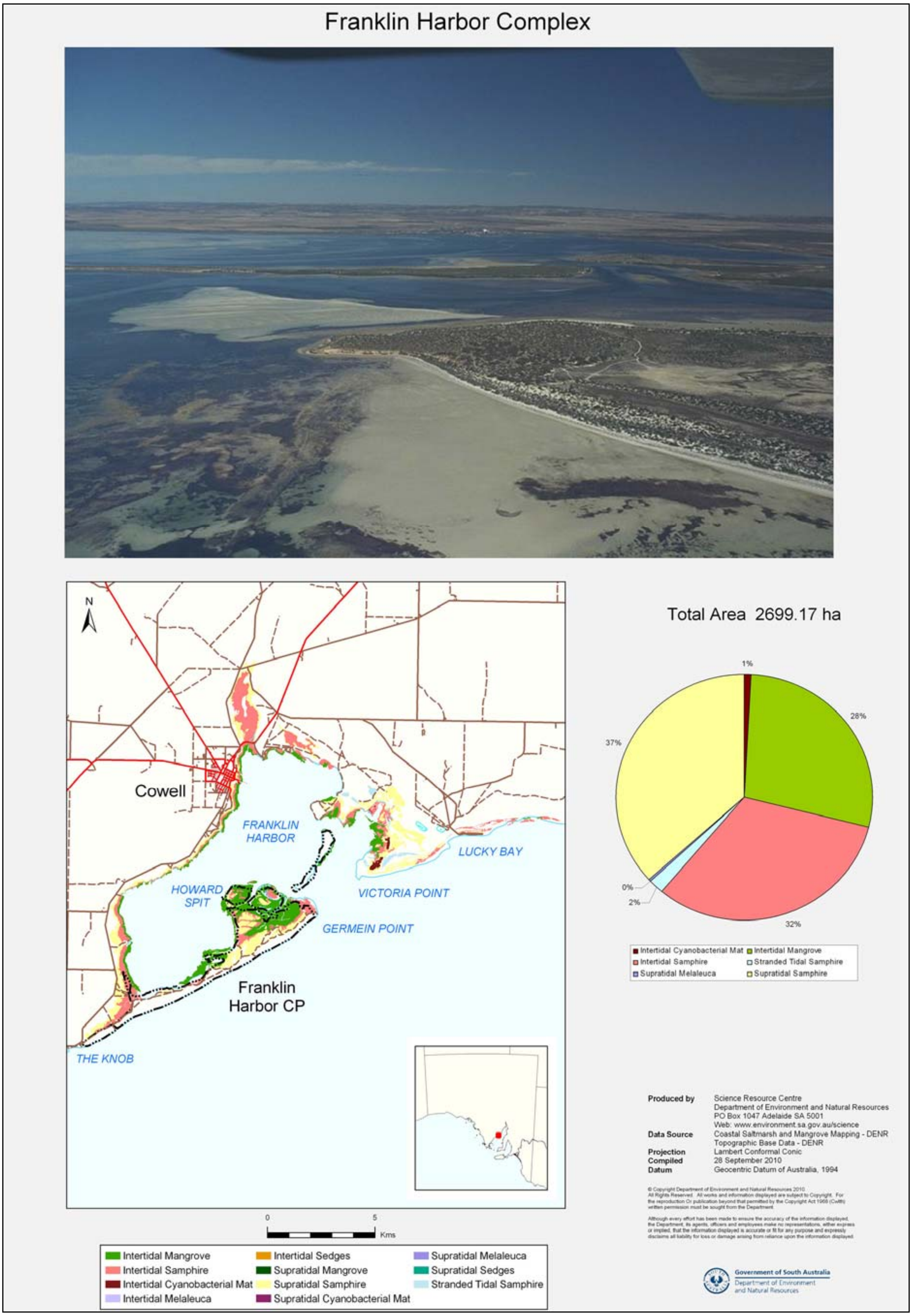

FIGURE 3.41 Extensive mangrove and intertidal salt marsh habitat within the shelter of Franklin Harbour

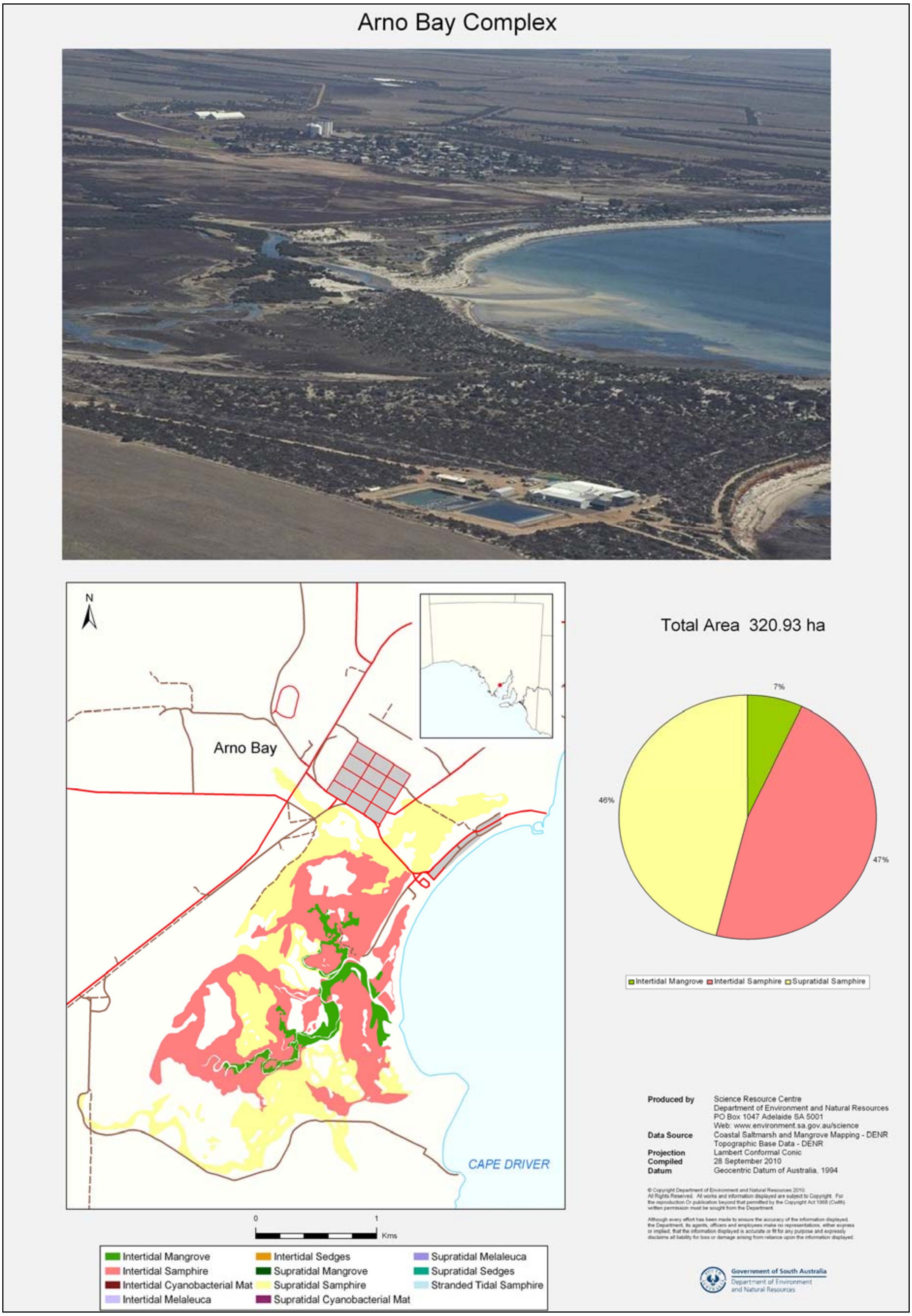

FIGURE 3.42 Shelter created by Cape Driver enabled formation of a mangrove and salt marsh complex at Arno Bay

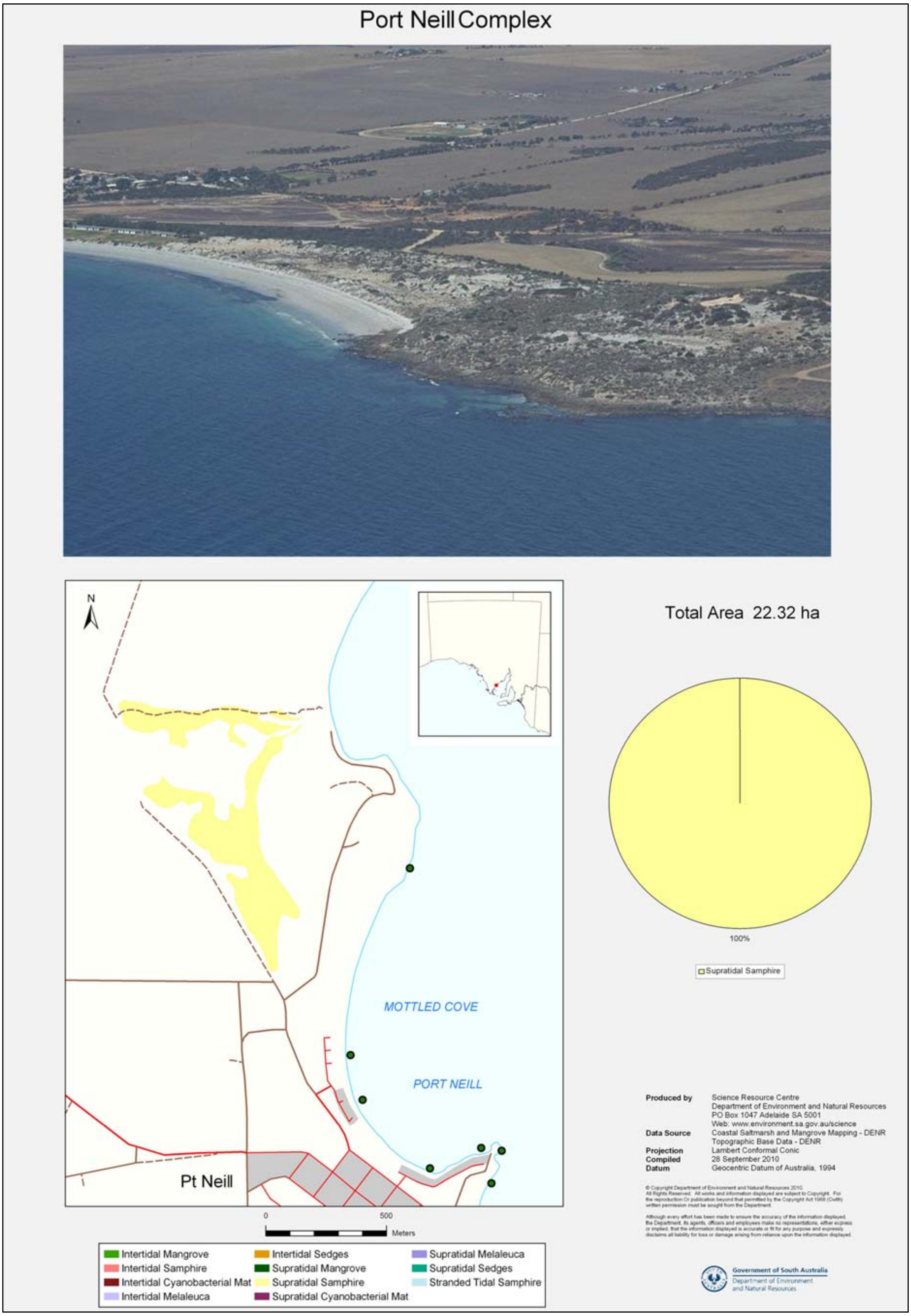

FIGURE 3.43 A small supra tidal salt marsh complex occupying a back barrier flat behind coastal dunes at Pt Neill

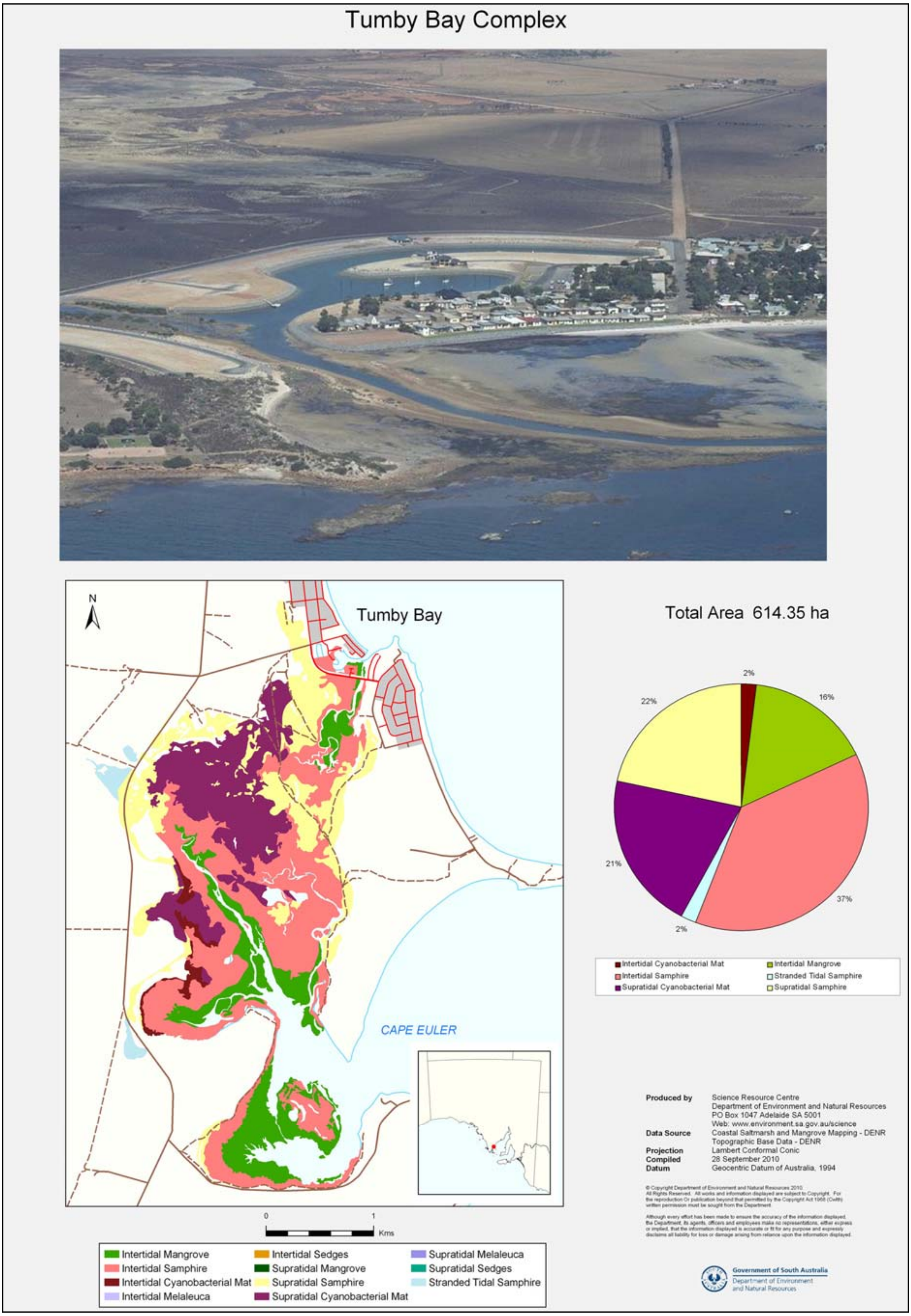

FIGURE 3.44 Extensive mangrove and salt marsh communities at Tumby Bay have been partly reduced through a marina and housing development

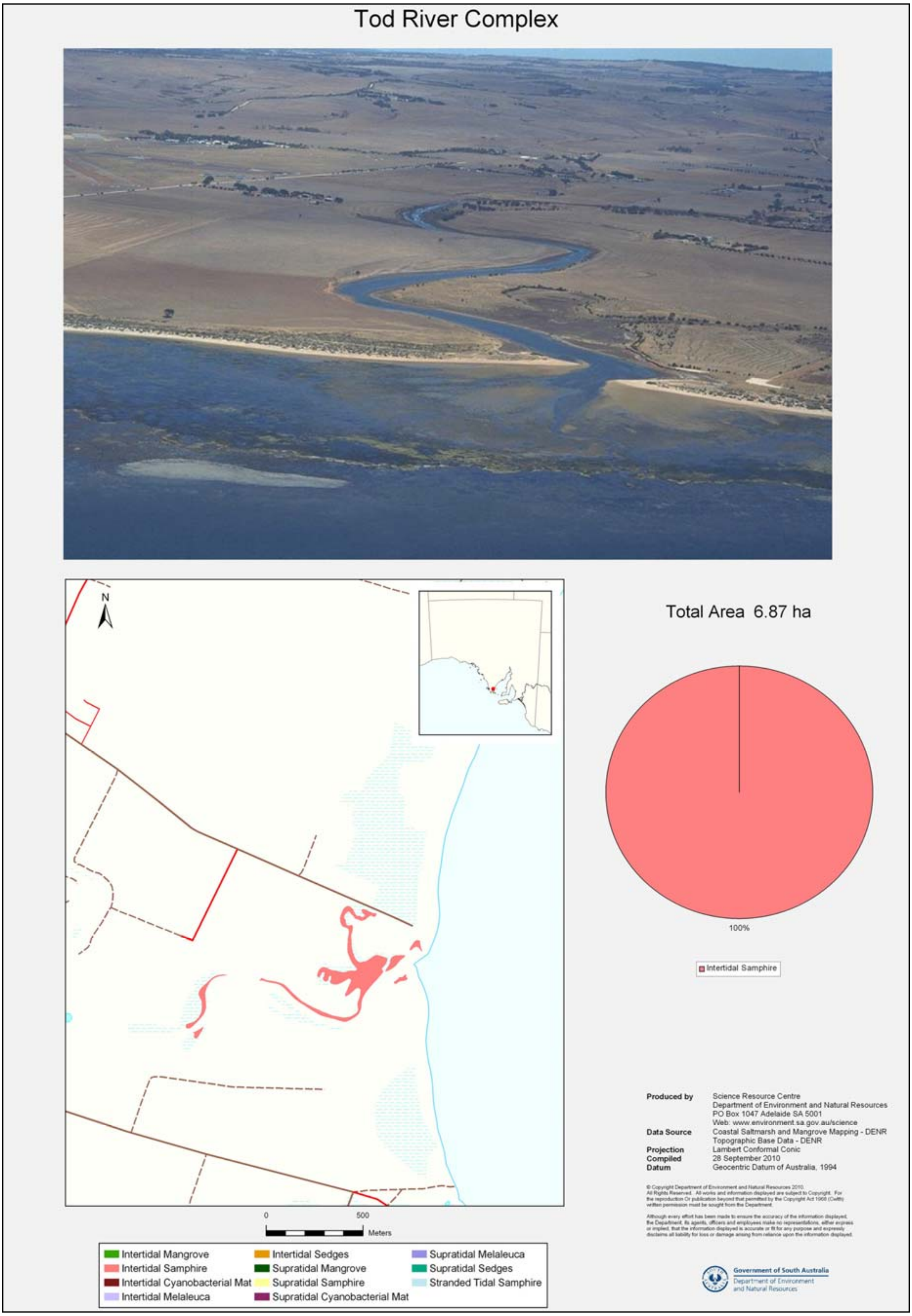

FIGURE 3.45 A small salt marsh complex located along the Todd River

FIGURE 3.46 Salt marsh habitat at Pt Lincoln has been significantly reduced due to development

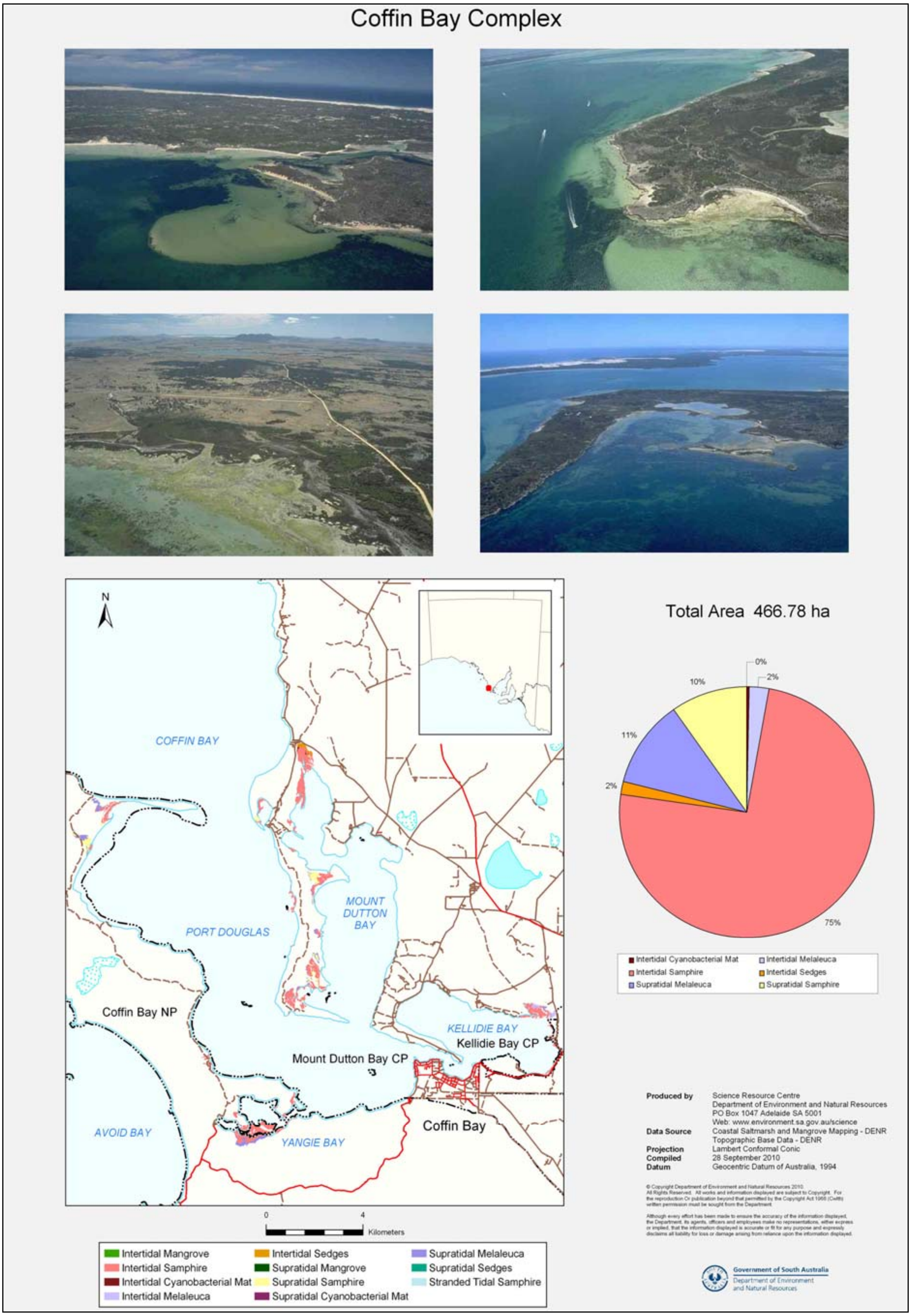

FIGURE 3.47 Numerous but scattered salt marsh habitats occur within Coffin Bay

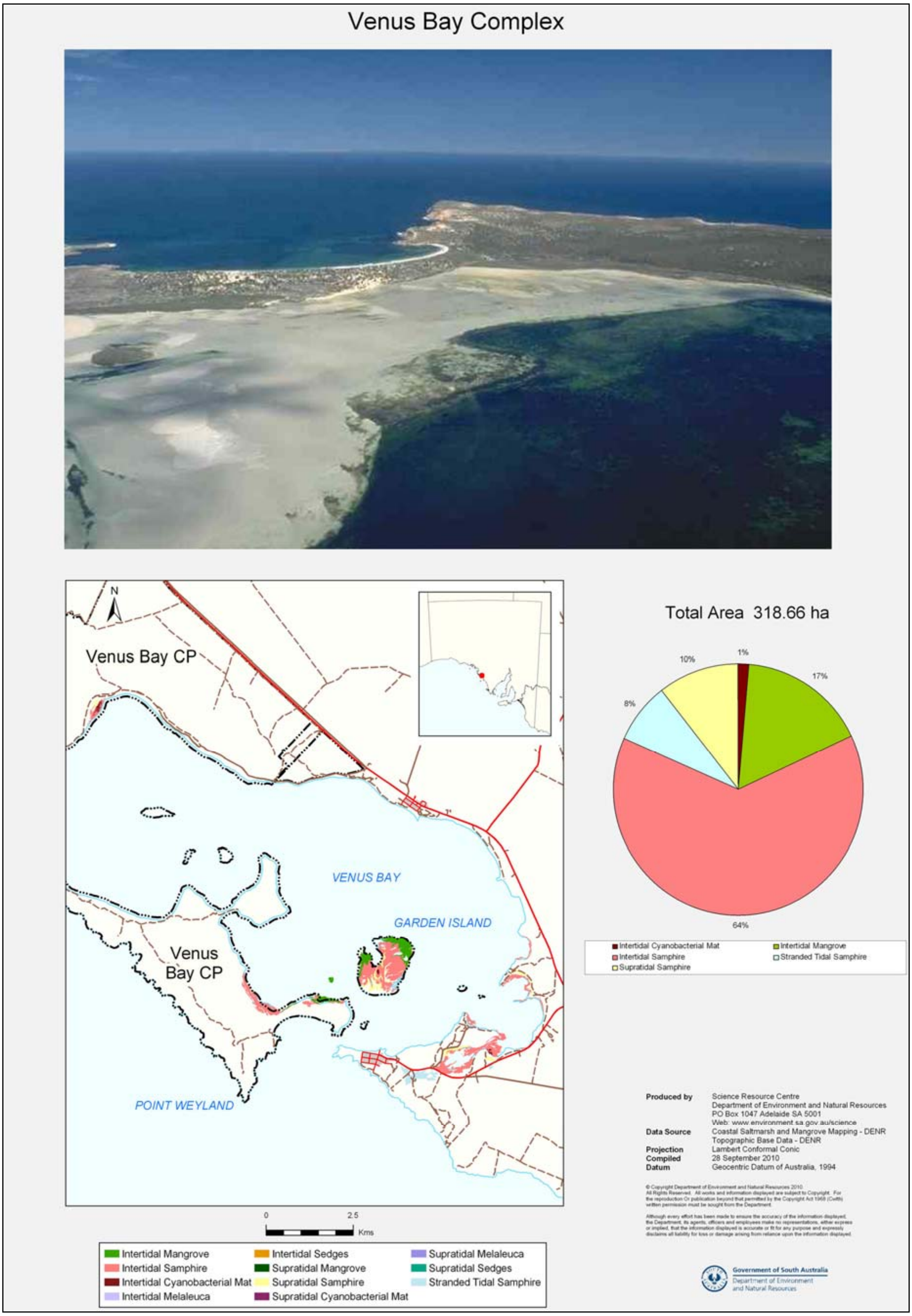

FIGURE 3.48 Mangroves and salt marshes habitats within Venus Bay

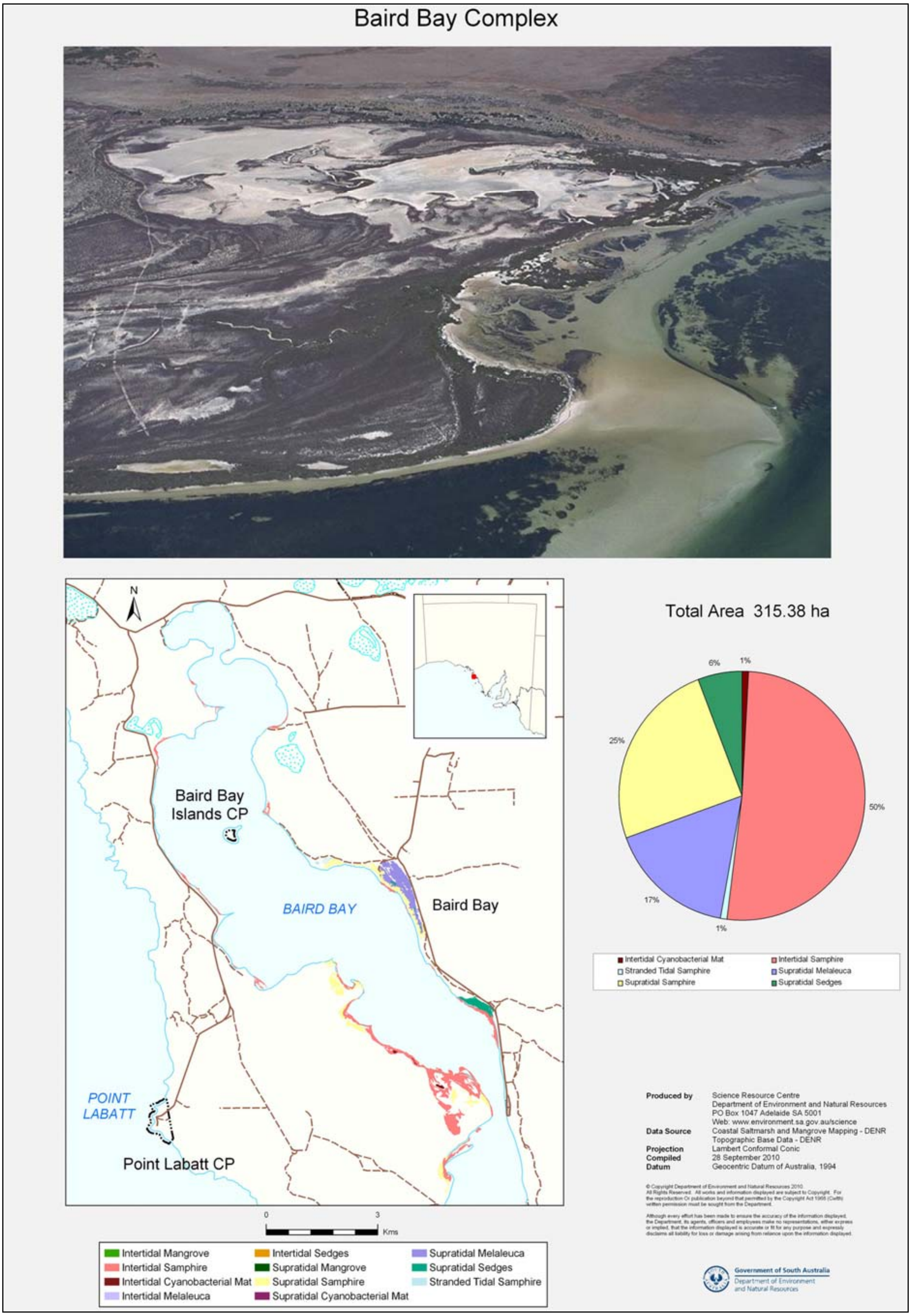

FIGURE 3.49 Melaleuca and sedge habitats occur in Baird Bay indicating groundwater seepage along the eastern shoreline of Baird Bay

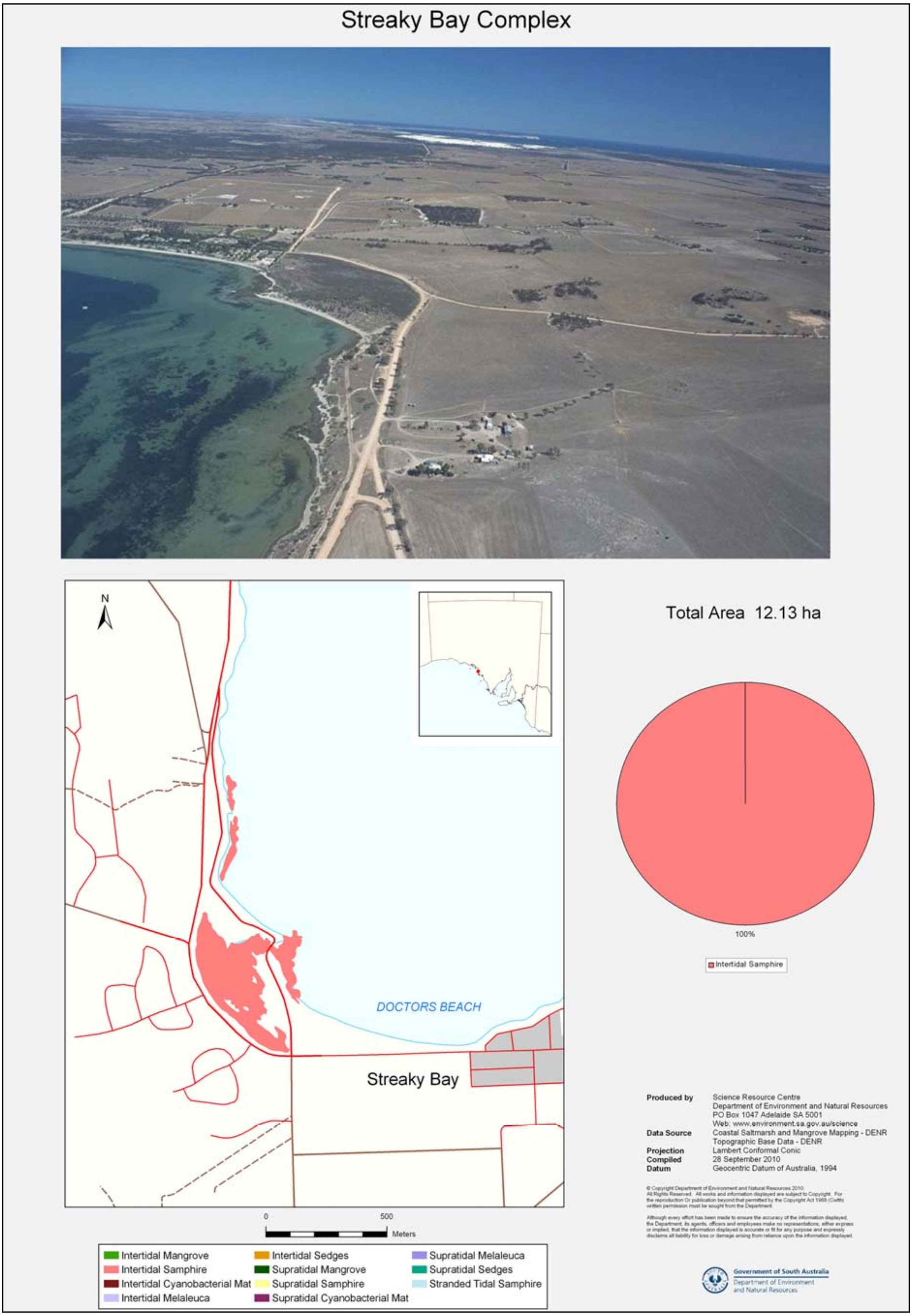

FIGURE 3.50 Although small, this salt marsh provides significant ecological value by filtering stormwater from the adjacent development and providing fish breeding and shorebird habitat. It also has educational importance due to its location on the edge of the town

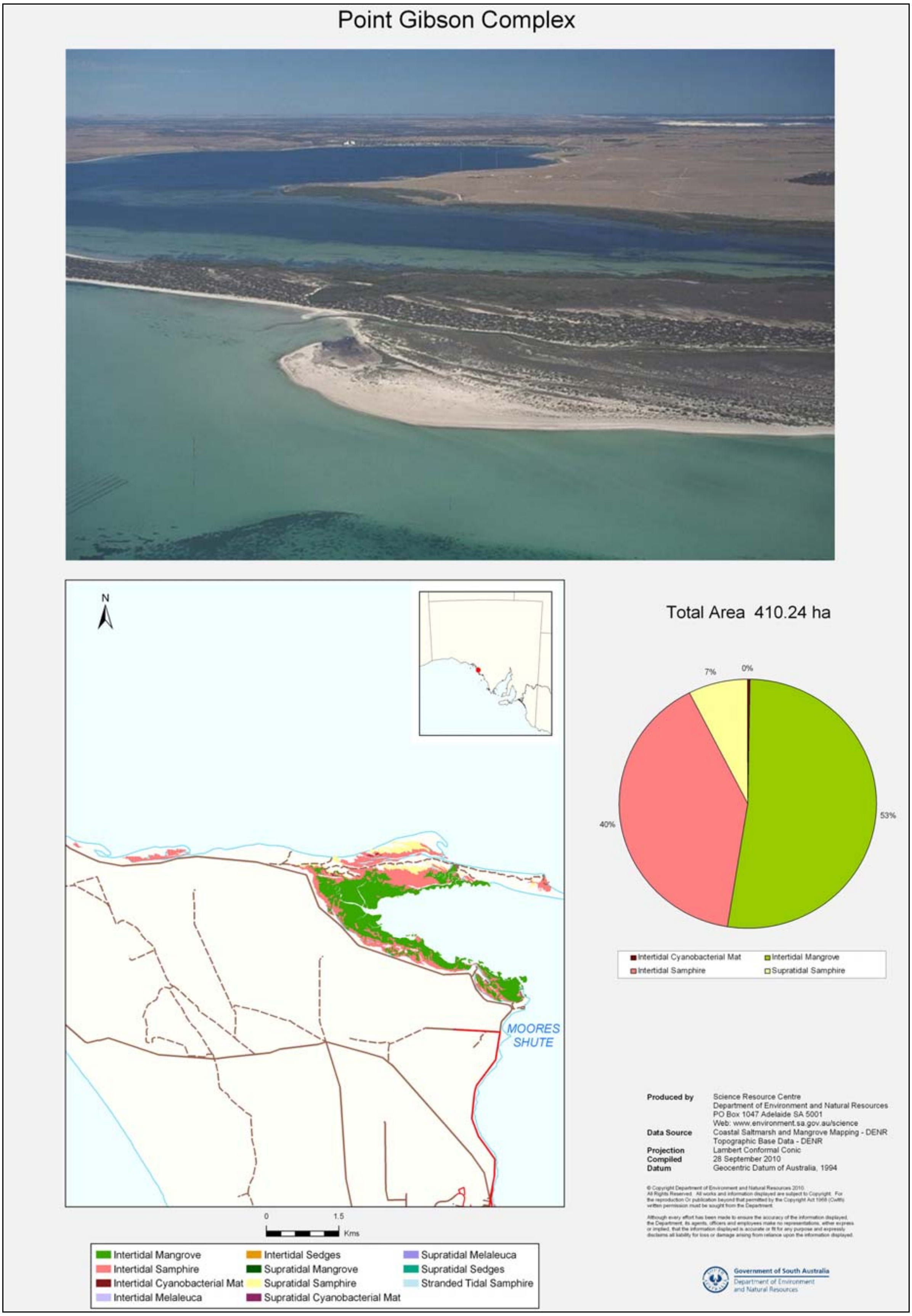

FIGURE 3.51 **A significant mangrove community has formed due to the shelter provided by Gibson Peninsula**

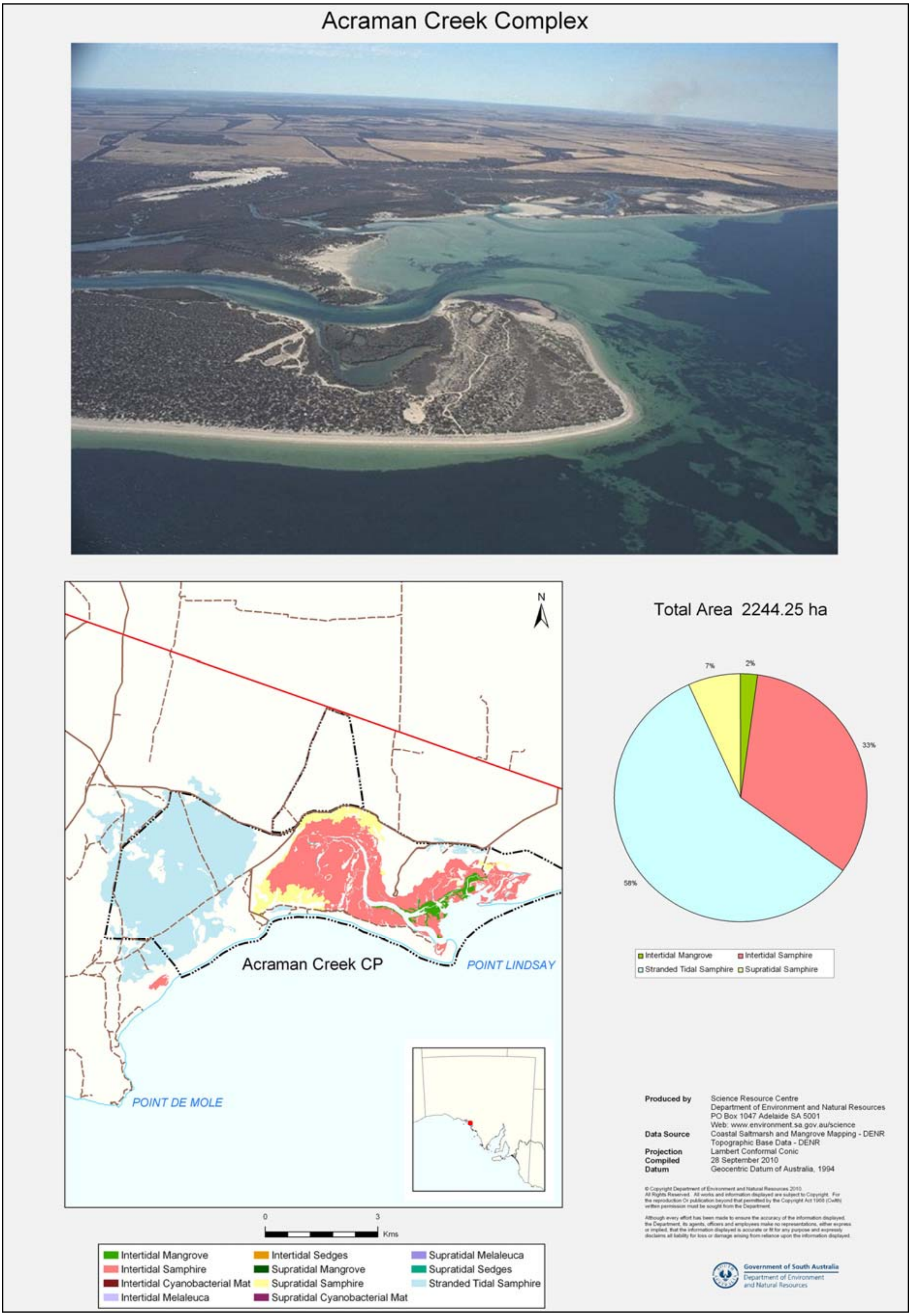

FIGURE 3.52 Progressive formation of a sand spit has created shelter for the mangrove and tidal salt marsh communities at Acraman Creek. However, more than 50% of the habitat has been blocked off from the sea by the spit, forming a large area of stranded salt marsh habitat.

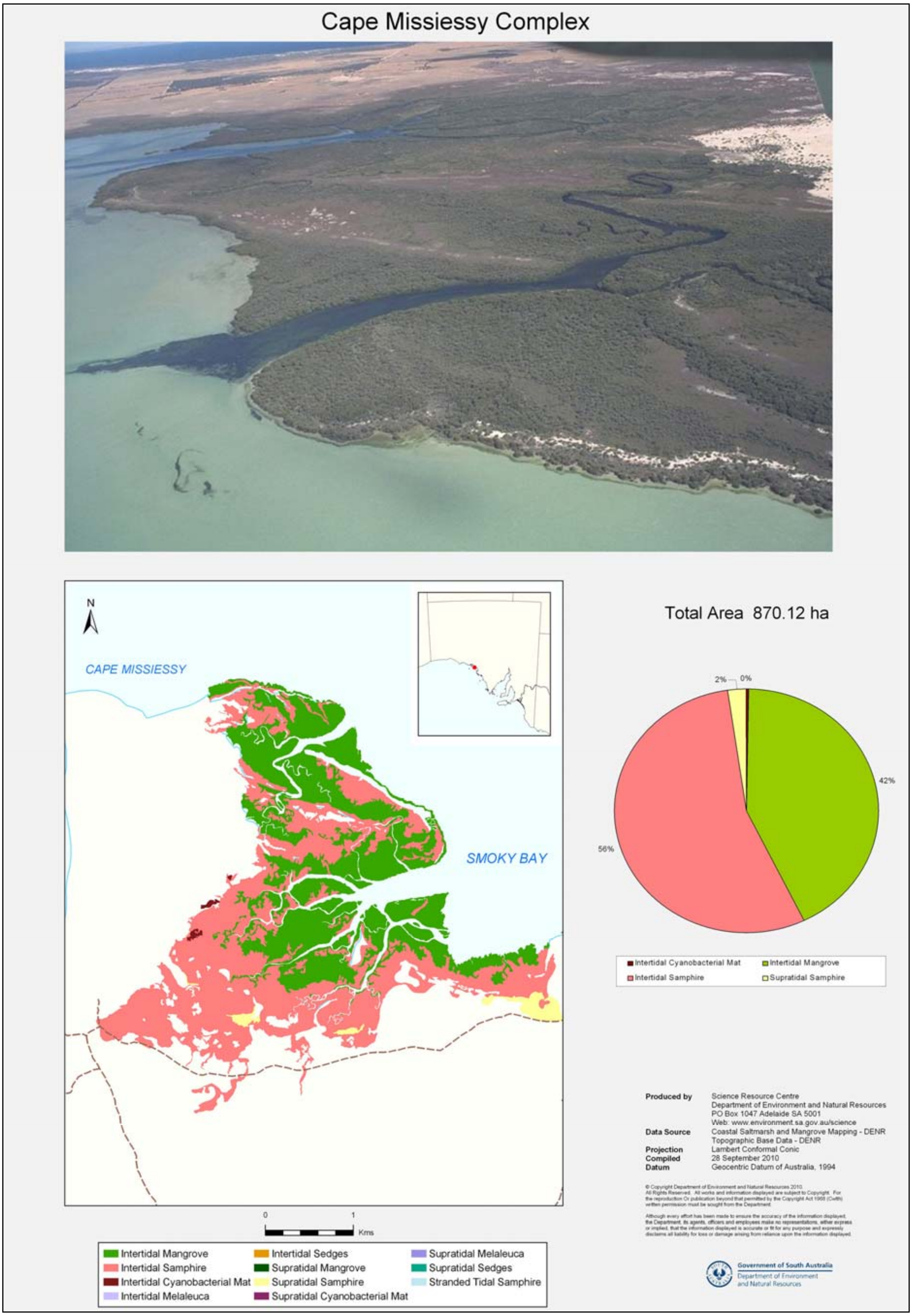

FIGURE 3.53 Large mangrove and salt marsh complex at Cape Missiessy

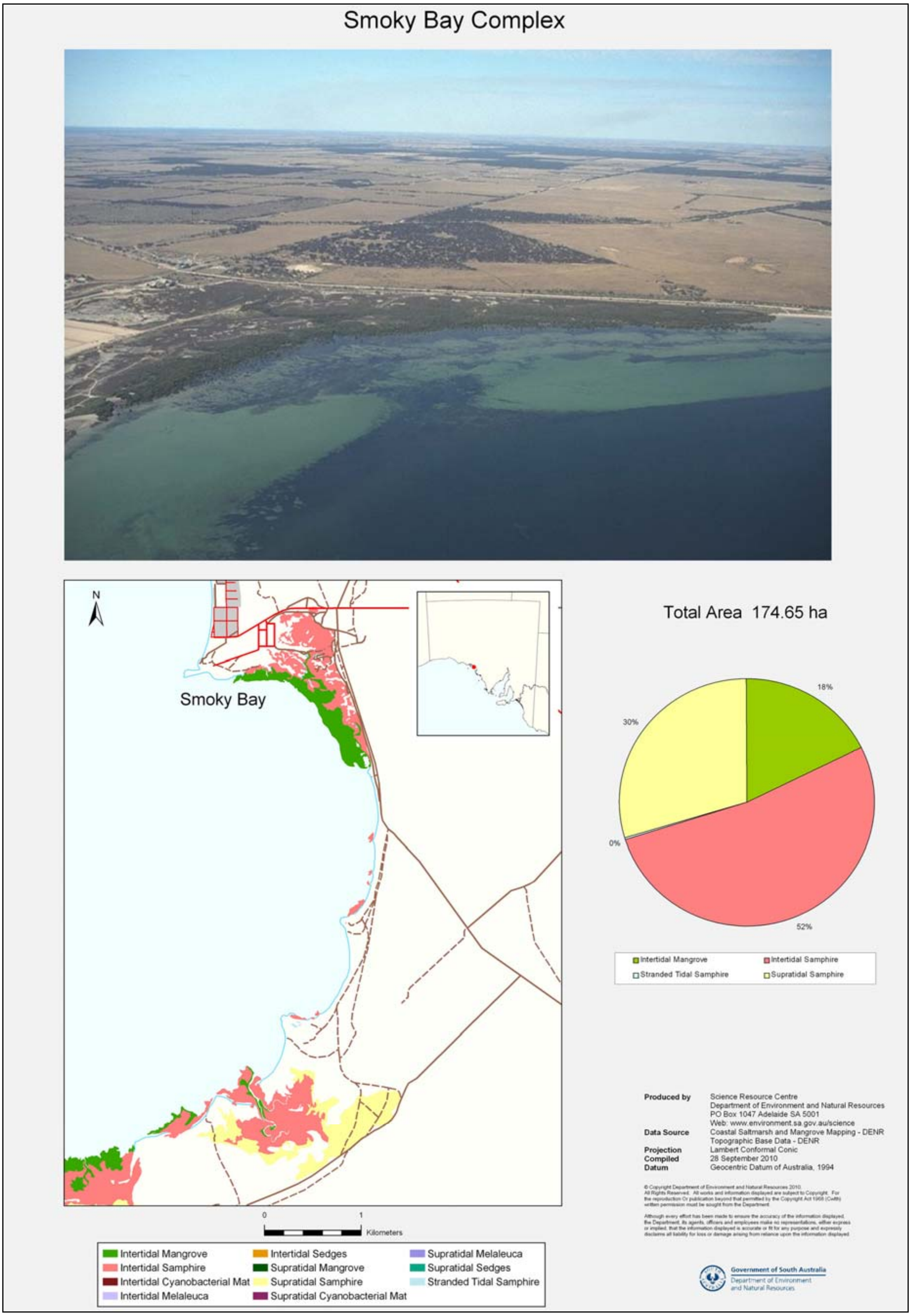

FIGURE 3.54 The Smoky Bay and Cape Missiessy mangrove and salt marsh habitats are in close proximity and could be considered a single complex

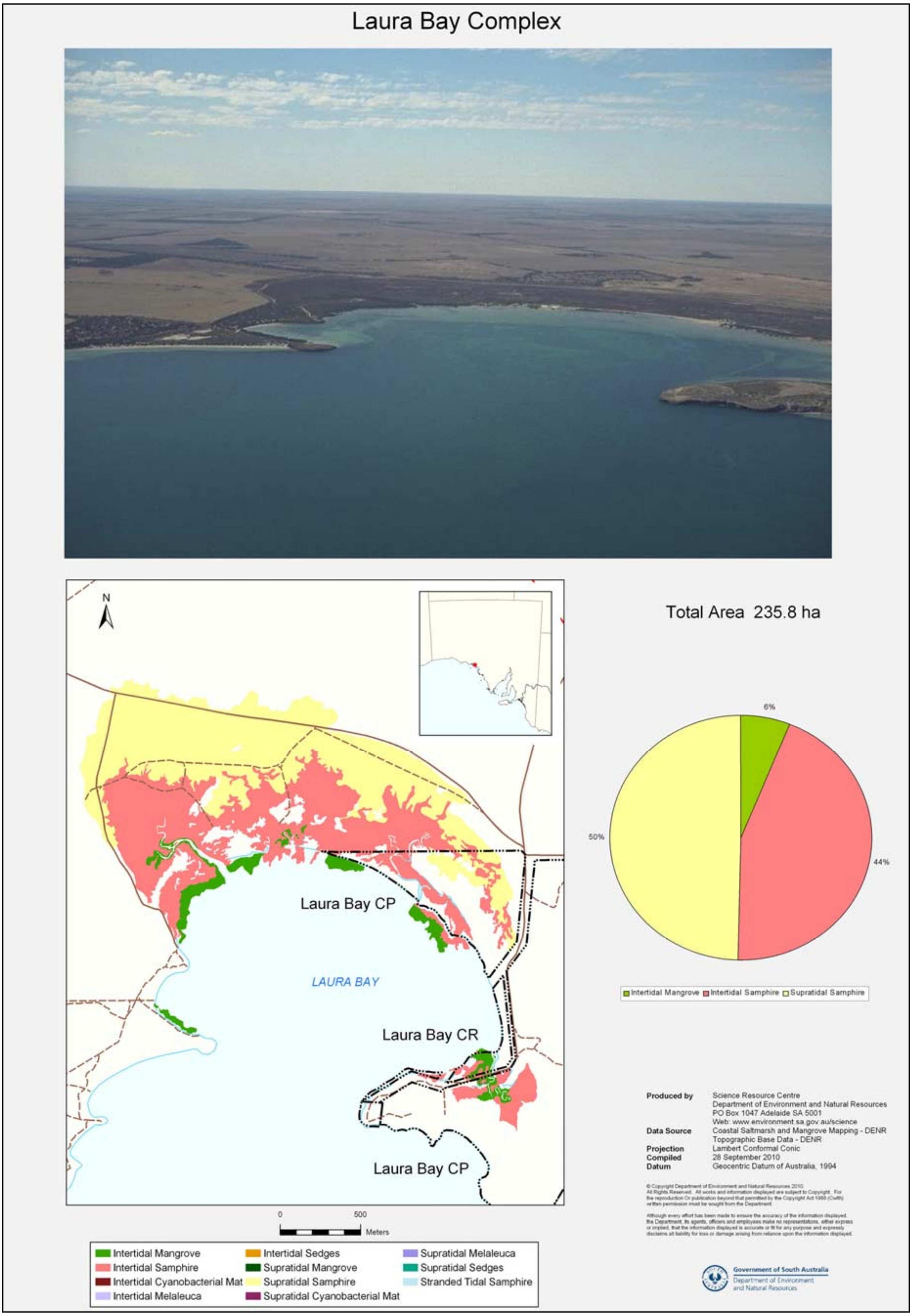

FIGURE 3.55 Mangrove and salt marsh habitat in Laura Bay

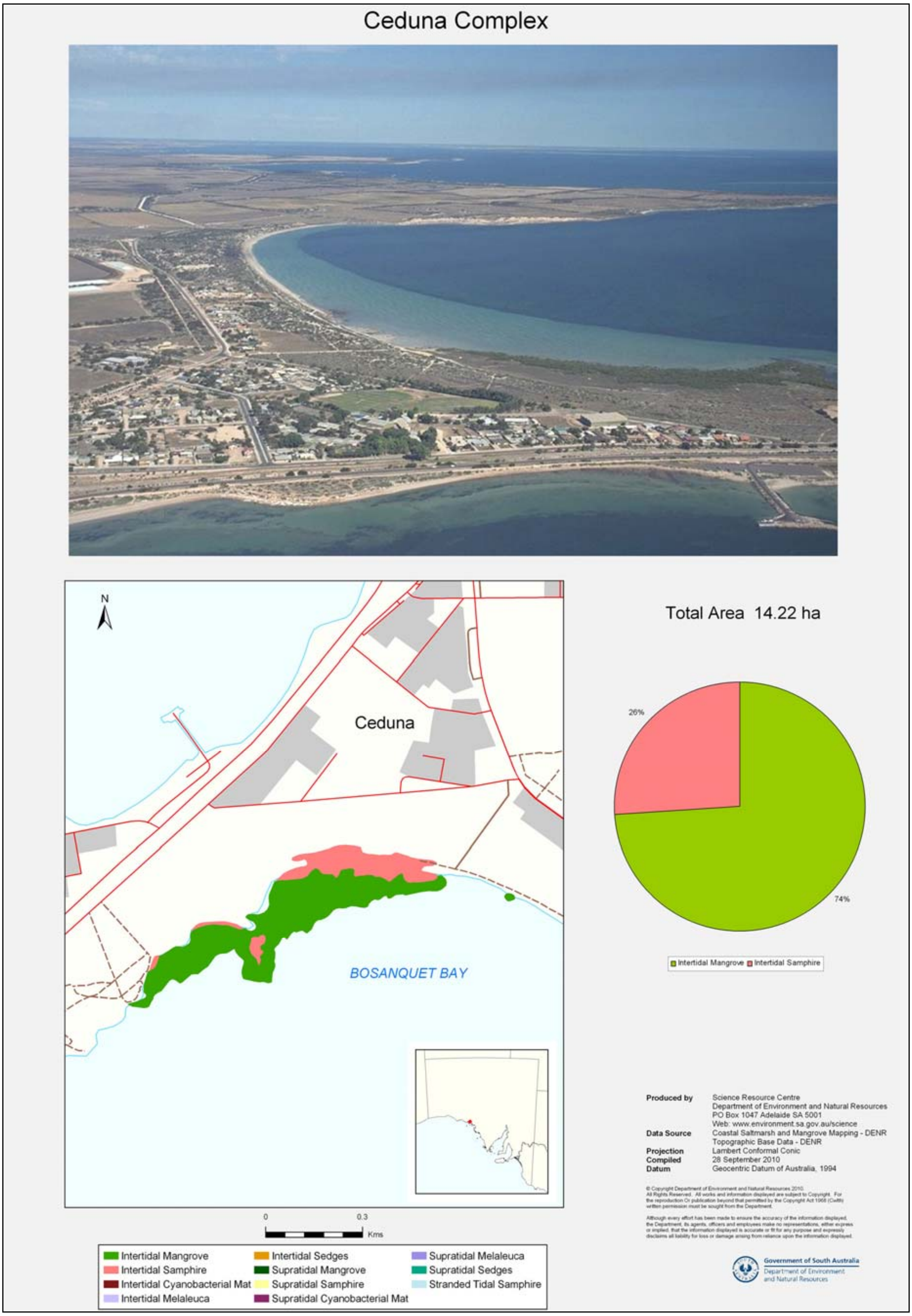

FIGURE 3.56 A small area of predominately mangrove habitat in Bosanquet Bay

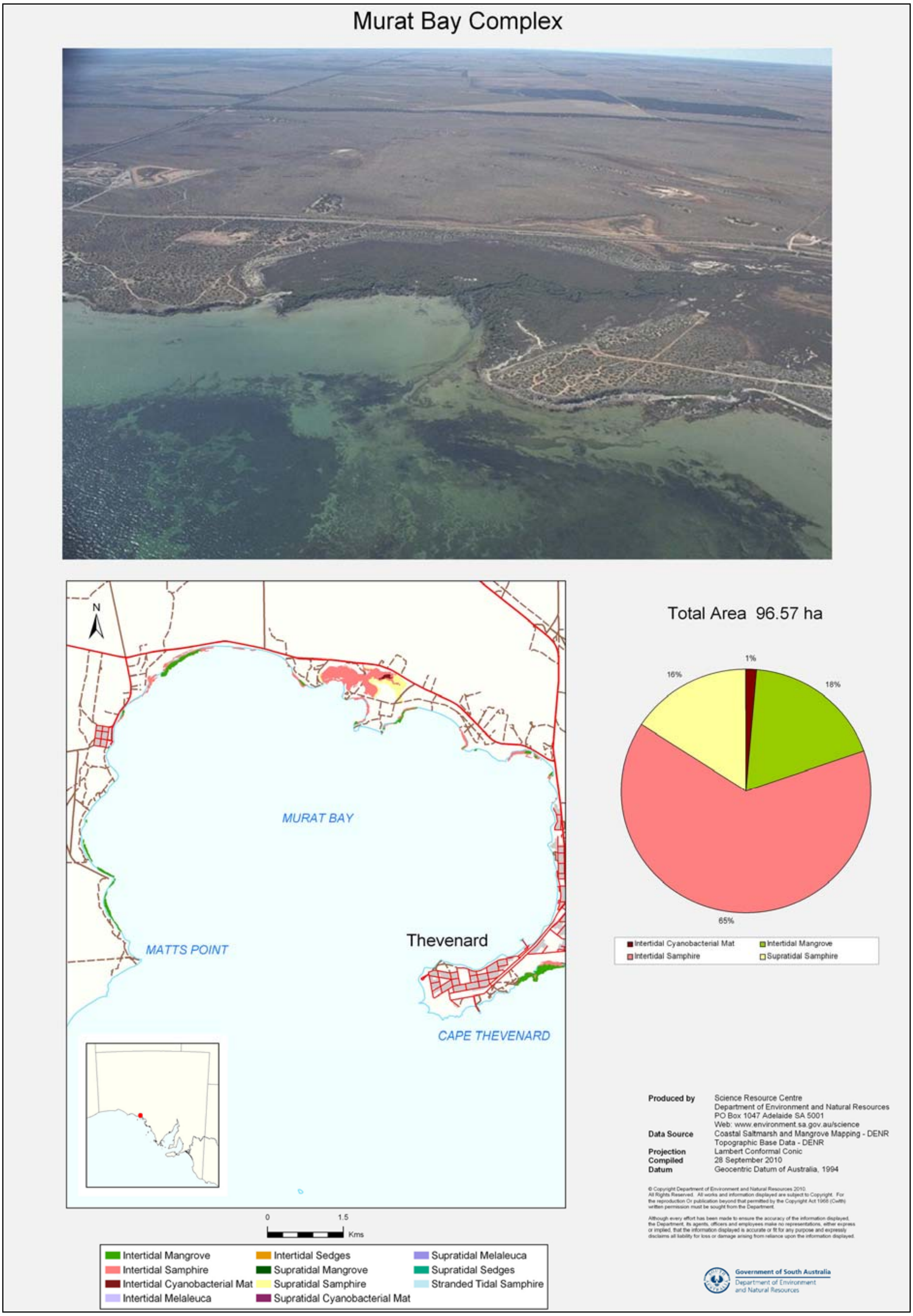

FIGURE 3.57 Mangrove and salt marsh habitats along the shoreline of Murat Bay

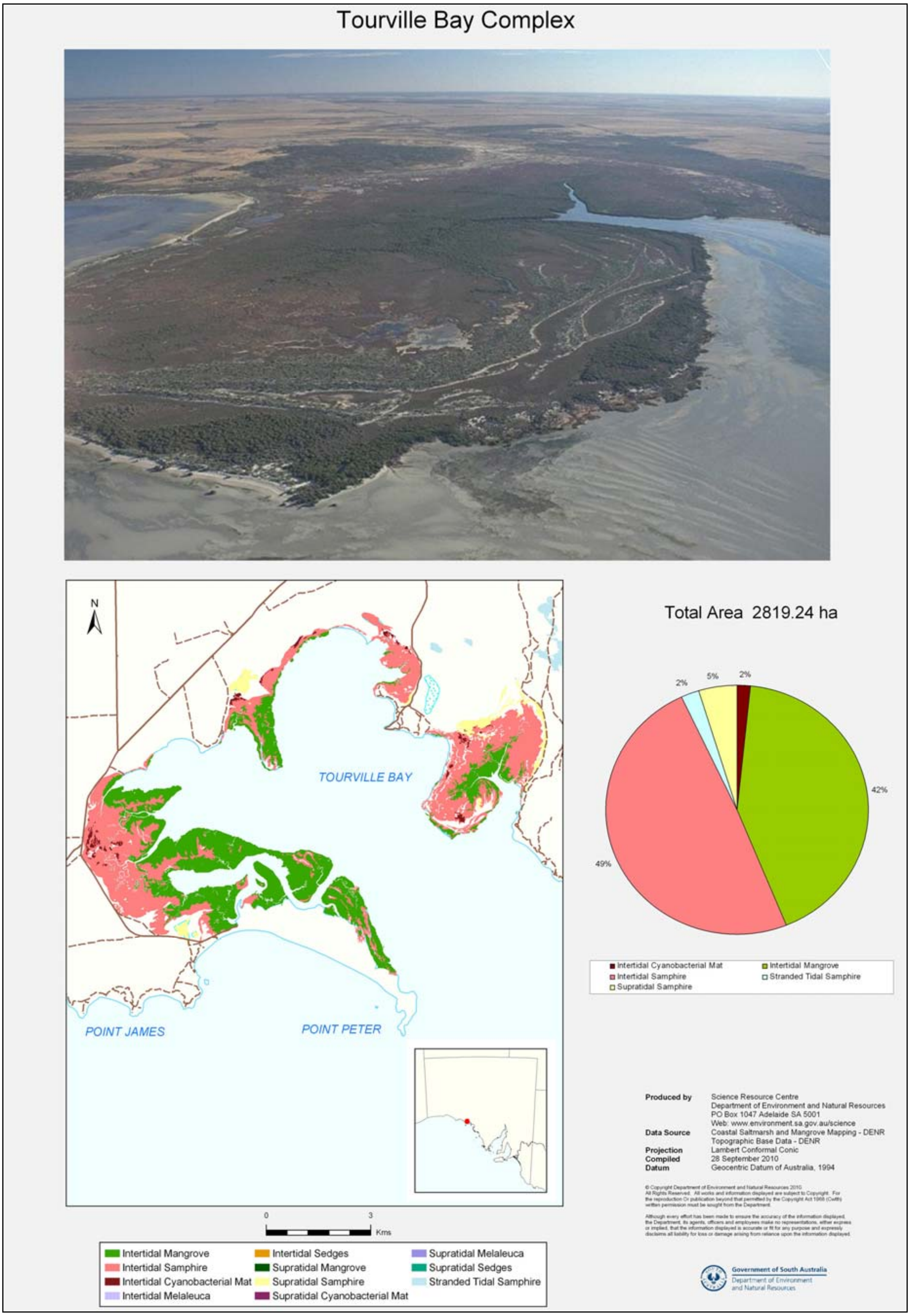

FIGURE 3.58 A large area of mangrove and salt marsh habitat in Tourville Bay. These are the most western mangroves in South Australia

3.1.4 Plant species

Coastal plant species

A list of vascular plants within the Eyre coast boundary has been compiled from the DENR plant record database, which is derived from herbarium and vegetation survey collection data including opportunistic surveys. On the Eyre coast, 1,240 vascular terrestrial plant species have been recorded, out of a total of 4,666 species known to occur in SA (Barker et al, 2005). Of the species recorded within study area 265 were non native to the Eyre region compared with 1,288 recorded for SA. Approximately 30% of SA's native species are found along the Eyre coast.

Sixty five species found within the Eyre coastal boundary have a threatened status under the *National Parks and Wildlife Act (1972)*. Nine of these are also listed under the *Environment, Protection and Biodiversity Act 1999* (Table 3.5).

TABLE 3.5 Nationally threatened plants recorded within the Eyre Peninsula study area

Species name	Common name	EPBC status	NPWS status
Acacia rhetinocarpa	Resin wattle	V	V
Acacia whibleyana	Whibley's wattle	E	E
Caladenia tensa	Inland green-comb spider-orchid	E	
Microlepidium alatum		V	V
Pleuropappus phyllocalymmeus	Silver candles	V	V
Prasophyllum goldsackii	Goldsack's leek-orchid	E	E
Prostanthera calycina	West coast mintbush	V	V
Stackhousia annua	Annual candles	V	V
Tecticornia flabelliformis	Bead samphire	V	V

R (Rare): has a low frequency of occurrence; not currently threatened but warrants monitoring and protective measures to prevent reduction of population size.

E (Endangered): Species, populations & ecosystems rare and in danger of becoming extinct in the wild.

V (Vulnerable): Species, populations & ecological communities rare & at risk from potential threats or long term threats which could cause the species to become endangered in the future.

3.2 Fauna

Whaling, sealing and fishing were the earliest industries to be established on the Eyre Peninsula, even before areas were settled; the remains of early sealers' huts and whaling stations can still be seen along the coast and on some of the surrounding islands (eg. Sleaford Bay, Fowlers Bay, Flinders Island and St Peters Island) (Twidale and Campbell 1985; Robinson et al. 2008). Today, about 65% of South Australia's seafood harvest is taken from the waters off the Eyre Peninsula (Matthews et al. 2001). Since the arrival of Europeans, the landscape has been modified through land clearance and alteration to allow for agricultural development and townships (Matthews et al. 2001). Settlements were established, significantly altering the distribution, abundance and status of various Australian native fauna. Many species have declined or become extinct due to increased pressure from loss of habitat, competition for food and habitat, poor management and direct predation by introduced species including foxes, cats and rabbits (Jones and Coman 1981; Kearney and Mirtschin 1992).

In the past Eyre Peninsula was home to more species of mammals and more individuals of small mammals than at present. Some species have reduced greatly in range and numbers and twelve terrestrial mammal species which once occurred in the coastal zone are now extinct (Table 3.6), with the cause for extinction unknown (Twidale and Campbell 1985). Many extinct species are known from subfossil records, but it is difficult to determine whether their demise occurred before or after European settlement, since, except for a collection from a sinkhole in the Venus Bay Conservation Park (CP), no other subfossil collections from Eyre Peninsula have been radiocarbon dated (G. Medlin pers. comm. 2009[1]). It is possible some species were already on their way to becoming extinct prior to European settlement, due to the gradual increase in aridity in Australia; for example the Western Mouse, *Pseudomys occidentalis* (G. Medlin pers. comm. 2009[2]).

The extensive coastline along the Eyre Peninsula has a significant variation in climatic and environmental conditions between the north, south, east and west. Variations include temperature, rainfall, evaporation, soil substrates and exposure to dominant wind conditions. These variations result in different vegetation and habitats and therefore influence the distribution of species throughout the coastal zone.

The Eyre Peninsula is the limit in distribution range for many fauna species, either from the east of Australia, or from the west. Recently, one species of skink, Bight Coast Skink *Pseudemonia baudini*, was recorded further east than previously known (it was previously known from only a couple of locations along the Great Australian Bight and locations in Western Australia). This finding highlights the gaps in knowledge and importance of biological surveys in the area to assist with conservation and management (Josephs 1999). Some species on Eyre Peninsula may be currently classified as 'regionally' rare due to lack of records. More surveys could result in the removal of this classification for some of these (D. Armstrong pers. comm. 2009[3]).

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[1] G. Medlin pers. comm. 16 November 2009
[2] G. Medlin pers. comm. 16 November 2009
[3] D. Armstrong pers. comm. 11 August 2009

TABLE 3.6 Terrestrial mammal species extinct within the Eyre Peninsula coastal zone

Scientific Name	Common name	Present at European settlement	Comments
Bettongia penicillata penicillata	Brush-tailed Bettong	Probably present	A Western Australian sub species (*B. p. ogilbyi*) was reintroduced into Venus Bay CP (1980 & 1994) and Lincoln NP (1999)
Dasyurus geoffroii	Western Quoll	Probably present	Former distribution was whole Eyre Peninsula
Isoodon obesulus	Southern Brown Bandicoot	Possibly present	Subfossils only, no whole specimens collected.
Leporillus apicalis	Lesser Stick-nest Rat	No evidence	
Leporillus conditor	Greater Stick-nest Rat	Probably present	Present only on Franklin Island as a relict population, until recent reintroductions to St Peters and Reevesby Islands and a failed attempt at Venus Bay CP
Macropus eugenii	Tammar Wallaby	Probably present	Were also present on some Eyre Peninsula islands but now extinct from the mainland and islands
Macrotis lagotis	Bilby (Greater Bilby)	Probably present	Reintroduced into Venus Bay CP & Thistle Island
Perameles bougainville	Western Barred Bandicoot	Probably present	Former distribution was whole Eyre Peninsula
Potorous platyops	Broad-faced Potoroo	No evidence	Only recorded from subfossils
Pseudomys australis	Plains Mouse (rat)	Probably not present	Only recorded from a few sub-fossil records
Pseudomys occidentalis	Western Mouse	No evidence	Recent fossils sites include along Eyre Peninsula coast
Rattus tunneyi	Pale Field Rat	Unknown	Subfossils found throughout the Eyre Peninsula

Table based on data in Watts and Ling (1985) Robinson et al. (2008) Van Dyck and Strahan (2008) and C. Kemper and G. Medlin pers. comm. (2009[4]).

Large sections of the Eyre Peninsula coast are protected by the State's reserves system, including; Franklin Harbour CP, Lincoln NP, Coffin Bay NP, Lake Newland CP, Venus Bay CP, Acraman Creek CP, Chadinga CP and Fowlers Bay CP. There are also numerous smaller parks located around the coast, including Tumby Island CP, Point Labatt CP, Eba Island CP, Laura Bay CP and Point Bell CP. These parks have generally been proclaimed to conserve significant representative ecological communities; the natural coastal landscape, flora and fauna of the area. For example, the islands of Venus Bay were proclaimed as a Conservation Park in 1976 because of their importance as breeding and feeding grounds to many native birds including oystercatchers and terns (DEH, 2006b), and areas of the mainland were added to the park in 1977, 1993 and 1995, for the conservation of native coastal landscapes and vegetation associations. Management plans have been developed for some of these reserves and include

[4] C. Kemper pers. comm. and G. Medlin pers. comm. 19 October 2009

permitted and prohibited actions that can be undertaken within the park. Prohibited actions include the clearance and removal of vegetation, recommended actions include the control of feral animals. Permitted actions vary between parks but may include certain recreational and/or commercial activities, mining and/or cultural uses. The management of these areas contributes to the conservation of fauna species present within them.

Available records from the Department of Environment and Natural Resources (DENR) Biodiversity Data Base of South Australia (BDBSA) and records from local observers show that there are currently 388 species of native fauna species found along the Eyre Peninsula coast; 227 bird, 57 mammal (including 24 marine species), 69 reptile, six amphibian and 29 butterfly species. Of these, 19 are listed as threatened under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and 74 are listed as threatened under the *National Parks and Wildlife Act 1972* (NPW Act). A total of 19 introduced species (seven bird, 11 mammal and one butterfly) have been recorded within the study area.

The dataset used includes some records dating back to the early 1900s. This is both a limitation and a benefit. Changes to the landscape over this time may have impacted on the number and type of species present, resulting in the data indicating a species is present in an area where it no longer occurs. The early data is also likely to be less spatially reliable than more recent records and may result in species being recorded in localities where they do not occur due to this limitation. However, this historical data may be extremely useful in identifying changes in environmental conditions and species distribution over time.

3.2.1 Birds

Combined records obtained from the BDBSA, Atlas of Australian Birds and Australasian Wader Studies Group show 227 bird species have been documented within the Eyre Peninsula coastal zone. Records of local bird observers and experts were also included as valuable sightings. The Eyre Peninsula coastal zone includes numerous water bodies, which provide important habitat for birds, including 47 species listed as threatened under the Commonwealth and/or state legislation.

It should be noted that for some bird species a rare classification may indicate a regular population under 3,000. This refers to some migratory species, or species with a limited or restricted area of occupancy (Gillam & Urban 2009).

State (endangered, vulnerable and rare) and Commonwealth (critically endangered, endangered and vulnerable) conservation rated species are the main focus of the next section; birds are grouped by type, then by habitat preference where appropriate. With the help of Jane Cooper (local ornithologist) and Graham Carpenter (Department of Environment and Natural Resources), some non-listed but important species were also included, such as migratory and resident shorebirds, and those birds breeding along the Eyre Peninsula coast. The various habitats for bird species are briefly discussed in each section, with only a few examples of each type of bird given. Some species were also removed from the listing, despite being recorded occasionally within the Eyre Peninsula. These were mostly seabirds and vagrant species which were only recorded on a few occasions or their usual habitat is not the coastal areas of Eyre Peninsula. They are considered to be chance sightings, or records of dead individuals washed up from the sea. Species removed include: Yellow-tailed Black-cockatoo, *Calyptorhynchus funereus*, Wandering Albatross, *Diomedea exulans*, Australian Little Bittern, *Ixobrychus dubius*, Black Kite, *Milvus migrans*, Slender-billed Prion, *Pachyptila belcheri*, Royal Spoonbill, *Platalea regia*, and Glossy Ibis, *Plegadis falcinellus*. The Southern Giant-petrel, *Macronectes giganteus* (AUS: E, SA: V), was also removed, however, it has since been identified that this species has been relatively regularly observed along the west coast during winter, these have included juvenile or immature birds that are weak but not dead. This could also be a useful species in monitoring environmental change (eg. climate change) over time (J. Cooper pers. comm. 2011).

Bush birds

<u>*Coastal shrubland / heathland*</u>

The Eyre Peninsula Southern Emu-wren, *Stipiturus malachurus parimeda* (AUS: V; SA: E) is a small threatened insectivorous bird confined to southern Eyre Peninsula in South Australia. It has been recorded at around 50 sites on lower Eyre Peninsula and has an estimated population size of < 1,000 individuals (Pickett 2002, 2003, 2004c, 2006a). Ten population groups have been identified (Pickett 2004, 2006). Within the coastal zone this species has been recorded in cells EP28 to EP41 in fragmented patches of swampy or seasonally inundated sedgeland/shrubland or dry heathy mallee/shrubland. Fragmented populations are particularly detrimental given that emu-wrens are poor flyers reluctant to cross open ground, needing areas of connective vegetation in order to move between patches. Desirable linkage habitat comprises almost any predominantly native vegetation type that can provide a corridor, preferably > 50m wide, of more or less continuous, relatively dense low-level vegetation. (Pickett 2006c). Current threats include grazing by native animals (removing and thinning vegetation), drying out or drainage of freshwater areas, fire, vegetation clearance and development. The impact of predation from cats and foxes in densely vegetated areas is unlikely to pose a major threat to this species, but this has not been fully investigated. (Pickett 2004c).

<u>*Mallee*</u>

The Major Mitchell's Cockatoo, *Lophocroa leadbeateri* (SA: R) occurs throughout drier woodlands, with the Gawler Ranges and Yalata regions being a probable stronghold in South Australia. Areas of native pines, *Callitris sp.* are often visited for food. It is an irregular summer visitor to Far West coastal cliffs and dunes to feed on ripening *Nitraria sp.* and is present in cells EP82 to EP84. It has also been recorded further south near EP69, adjacent Acraman Creek (J. Cooper pers. comm. 2011). Its distribution has contracted from the settled areas where it's preferred woodland habitat; *Callitris*, *Allocasuarina* and *Eucalyptus* has been severely fragmented (Carpenter and Cooper 2010). As a result of man-made changes to the arid interior of Australia, this cockatoo has declined in numbers. The distance between patches of vegetation is important, because Major Mitchell's Cockatoos are not strong flyers they prefer to use vegetated corridors when moving between feeding and breeding grounds. They also feed on the ground and hence are at risk of predation from foxes and cats (DES 2004). Negative impacts also occur from ongoing drought conditions and over-grazing by rabbits and kangaroos, where successful regeneration of food species is slowed or prevented (DES 2004). Loss of hollow-bearing trees and the increasing competition for hollows with other species, such as galahs and feral bees also pose a threat to the Major Mitchell's Cockatoo (DES nd).

The mainland race of the Purple-gaped Honeyeater, *Lichenostomus cratitius* (SA: ssp[5]) is widely distributed in the mallee-heathlands of the Murray Mallee, Yorke and Eyre Peninsulas. It was reported from 11.5% of survey sites during the Biological Survey of Eyre Peninsula (Brandle 2010) in predominately Ridge-fruited Mallee open scrub and Coastal White Mallee open scrub. (Carpernter & Cooper 2009). They have been recorded in cells EP27-34, EP36, EP42, EP55 and

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[5] *The mainland subspecies of Purple-gaped Honeyeater, *Lichenostomus cratitius occidentalis* is listed as rare under the NPW Act.

EP63. Purple-gaped Honeyeaters primarily feed on nectar but they also eat insects (DEC 2005a), which can be affected by the aerial distribution of pesticides and herbicides. Their main threat is the clearing of mallee vegetation which destroys habitat by removing food plants and nesting sites; fire can also have the same impact.

The Western Whipbird (eastern sub-species), *Psophodes nigrogularis leucogaster* (AUS: V; SA: E), is one of the mallee species present on the Eyre Peninsula that has a sub-species specific to the area and is listed under the EPBC Act and NPW Act. This sub-species is confined to three isolated populations, one each in the southern Eyre Peninsula, the south-western Yorke Peninsula and in the Murray-Mallee region of south-eastern South Australia (Schodde and Mason 1999).

Western Whipbird (eastern sub-species)
Photo: M. Pickett

The Western Whipbird (eastern sub-species) prefers coastal mallee vegetation, where the structure of vegetation is more important than the composition (Smith 1991). It has been recorded in cells EP28, EP30, EP34, EP35 and EP36. Fire is an important component in maintaining the preferred habitat structure, but it also poses one of the biggest threats (DEWHA 2009a). Fragmentation of the landscape and creation of vegetation patches, such as that associated with land clearance and development, increases the effect of fire; habitat fragmentation reduces the potential for populations to find refuge in unburnt areas when confronted with a wildfire, and also to recolonise burnt areas after a wildfire (DEH 2006a; Woinarski et al. 1988), especially as the Western Whipbird does not fly long distances (DEWHA 2006a). Feeding on invertebrates close to the ground also puts this species in danger of predation by cats, dogs and foxes. However, predation has not been linked to the decline of the Western Whipbird (DEWHA 2009a).

Shorebirds

Shorebirds belong to the taxonomic order *Charadriiformes* which includes sandpipers, plovers, stilts, avocets, oystercatchers snipe, pratincoles, jacanas, stone curlews and the plains-wanderer. These birds are mostly found on beaches, near intertidal habitats or inland wetlands. They usually feed in shallow water, or by probing with their bills in saturated mud or sand. Some species feed amongst the beach wrack and dry sand above the high tide line. Thirty-six species migrate annually from their northern hemisphere breeding grounds to Australia and a further 18 species reside in Australia all year-round. Eyre Peninsula shorebird areas regularly support up to 23 of the 36 international migratory species and up to 13 of the 18 resident shorebird species (Table 3.7); 7 of which are known to breed in shorebird habitat (lakes, bays, beaches and rocky shorelines) within the EP coastal zone.

Shorebirds feed in a variety of locations and substrates; sandy beaches, mudflats, salt marsh, rocky reefs and in adjacent saline lakes and lagoons. Most shorebirds are carnivorous and consume a range of food types, including: various annelids, crustaceans, fish, worms, insects, tadpoles, crabs, polychaetes, spiders, eggs, bivalve molluscs, gastropods, shrimps, sea-cucumbers, lizards, frogs and grasshoppers. Each species' bill, feeding locality, and diet varies at least slightly from all other species.

Shorebirds generally feed according to the tide; roosting at high tide and often feeding day and night. Preferred high tide roosting sites are predominantly; beaches, sand banks and spits, sand/shell bars, salt marsh and rocky reefs or platforms. These high tide roosting areas are critical to the species and require conservation and protection.

Different species of shorebird feed and live together in a non-competitive way, which reflects interspecific resource partitioning and enables flocks of thousands of birds to share the same sandflats and tidal creek systems, all within in their own particular niche.

In recent years, the "Scoping the Shoreline" project has been recording the presence and abundance of resident shorebirds along the Eyre Peninsula coast as well as assessing the disturbance impacting on their breeding, feeding and resting sites. This project, a partnership between Birds Australia, EP NRM, DENR and community, is important in providing baseline data on these birds as well as understanding their ecology, and therefore the management required to protect and conserve these species along the Eyre Peninsula coast. The Shorebirds 2020 program, a joint program between Birds Australia, The Australasian Wader Studies Group, WWF-Australia and the Australian Government, is a national shorebird population monitoring program. It aims to report on the population trends of resident and migratory shorebirds in Australia, which can then be used to assist in the conservation and management of these species and their habitats.

Migratory shorebirds

Migratory shorebirds arrive on Eyre Peninsula in August-September and regularly inhabit sheltered feeding and roosting sites around the coast until March-April when adult breeding birds prepare for the return leg of their 25,000 km round trip. Many of these species have a high site fidelity, returning to the same shorebird area every year. They spend two thirds of their annual life-cycle (the austral spring and summer) on Eyre Peninsula. Not all migratory birds return to the northern hemisphere. Non-breeding first year birds remain in Australia until the following April. Migratory shorebirds do not breed in Australia.

The 23 migratory species are listed under the Australian Government EPBC Act. Listed migratory species are a matter of national environmental significance. Under the EPBC Act an action requires approval from the federal minister if the action has, or will have, or is likely to have, a significant impact on a matter of national significance. (DEWHA 2009d). Fifteen of these are also listed as threatened under the NPW Act (Table 3.7).

Resident shorebirds

Coastal Eyre Peninsula supports 11 species of resident shorebirds. Some like the Hooded Plover and Australian Pied Oystercatcher are predominately beach-nesting birds. Sooty Oystercatchers breed on the off-shore islands (and islands within bays) but return to adjacent rocky coasts and bays to feed and rest. Black-winged Stilt, Banded Stilt (no breeding records), Red-necked Avocet, Black-fronted Dotterel and Red-kneed Dotterel rely on the ephemeral wetlands beyond the dune fields. Masked Lapwing and Red-capped Plover are not specifically beach-nesting birds. There are significant populations of breeding Red-capped Plover in the large dune blowouts and around the extensive saline lakes which characterise the coastal landscape of western Eyre Peninsula. The Bush-stone Curlew breeds on the offshore islands.

Of the 13 resident species the Hooded Plover and Banded Stilt are state and regionally rated vulnerable and the Australian Pied and Sooty Oystercatchers are state and regionally rated rare (Gillam & Urban 2009).

The Hooded Plover, *Thinornis rubricollis* (SA: V) is recorded as breeding at various sites along Eyre Peninsula with 42 breeding pairs found between Streaky Bay and Lipson, including at Anxious

Bay, Gunyah Beach, Port Neill and Sleaford Bay (Cooper 2010 in prep). The estimated South Australian population of Hooded Plovers is 600-800 birds (Cullen et al, 2008) and the estimated population between Head of Bight and Franklin Harbour is at least 300 birds (Cooper unpubl, 2010). With approximately 50 percent of the state's population, Eyre Peninsula is very important for this species. Managing and protecting the Hooded Plover habitat is crucial.

Hooded Plover. Photo: P. Wainwright, DENR

Shorebirds 2020 and Scoping the Shoreline data over the last 5-10 years suggest that the Australian Pied Oystercatcher population on Eyre Peninsula is around 1,500 birds. This is a significant population, considering the estimated South Australian population is 3,000 and the national estimate is 11,000. It breeds widely around the 2,500 km of coastline and on some offshore islands. Large non-breeding flocks can be found in some bays.

Significant shorebird areas

There are a number of areas on Eyre Peninsula that are considered nationally and/or internationally significant for shorebirds.

A shorebird area is nationally significant if it:

- Regularly supports at least 0.1% of the population of one species of shorebird migrating to Australia each year; or
- Regularly supports >2,000 shorebirds (any mix of species); or
- Supports at least 15 species of shorebirds.

There are ten nationally significant shorebird areas on coastal Eyre Peninsula: Baird Bay, Sceale Bay (including Seagull Lake), Streaky Bay (including Acraman Creek), Lake Newland CP including the ocean beach), Tourville Bay, Murat Bay, Eyre Island, St Peter Island, Coffin Bay (Point Longnose & Gunyah Beach) and Franklin Harbour. Sleaford Bay (Wanna & Tinah Beach) and Venus Bay (including the islands within the bay) are significant for breeding populations of resident shorebirds (Clemens et al., 2008, DEWHA 2009d).

A shorebird area is internationally significant if it:

- Regularly supports >1% of the population of one of the species migrating to Australia each year; or
- Regularly supports >20,000 shorebirds

Coffin Bay, Sceale Bay and Lake Newland CP beach support internationally significant populations of Sanderling *Calidris alba.* Coffin Bay, Streaky Bay, Tourville Bay, Eyre Island and St Peter Island regularly support populations of Australian Pied Oystercatchers that are greater than 1% of the Australasian population.

For current shorebird population numbers and distribution and feeding, breeding ecology, see www.shorebirds.org.au, in particular Birds Australia's Shorebirds 2020 Population Monitoring Program and Clemens et al (2008).

Ten South Australian Wetlands of National Importance are included in the Eyre Peninsula coastal boundary according to the criteria set by Environment Australia (A Directory of Important Wetlands in Australia 2001). Wetlands may be considered nationally important if they are important to the ecological community, or support 1% or more of the national populations of any plant or animal taxa, or support nationally endangered or vulnerable communities or if the wetland is of outstanding historical or cultural significance. Six of these wetlands, are listed as Nationally Important on the Eyre Peninsula (wetland reference code) because of their importance to shorebird species: Franklin Harbour (SA010); Coffin Bay Coastal Wetland System (SA008); Lake Newland (SA012); Baird Bay (SA004); Streaky Bay (SA016) and Davenport Creek (SA009) (DEWHA 2009b). The other four wetlands: Tumby Bay (SA018), Tod River Wetland System (SA017), Sleaford Mere (SA073) and Point Labatt (SA014) do not support nationally significant numbers of any one migratory or resident shorebird species (or 15 or more species), and were selected for other criteria. It should be noted that since the directory benchmarks were agreed upon in 2001, many freshwater wetlands and some coastal systems have faced ten years of drought.

In addition, there are six Important Bird Areas (IBAs) within the project area, located at Tourville Bay, Murat Bay, Seagull Lake, Venus Bay, Lake Newland and Coffin Bay. The IBAs program was developed by BirdLife International and is independent of Government process which assesses and identifies sites of international importance for bird conservation. The aim of the program is to promote the significance and assist in the conservation of those areas identified as important to birds around the world. Each site is to be managed for conservation, but species specific management can also be taken. Important Bird Areas are not designed to have legal implications, but act as a measure of conservation between areas (Dutson et al. 2009).

TABLE 3.7 Shorebird species present along the Eyre Peninsula coastal zone

Resident/ Migratory	Scientific name	Common name	Aus status	SA status
M	*Actitis hypoleucos*	Common Sandpiper	M	R
M	*Arenaria interpres*	Ruddy Turnstone	M	R
R	*Burhinus grallarius*	Bush Stone-curlew		R
M	*Calidris acuminata*	Sharp-tailed Sandpiper	M	
M	*Calidris alba*	Sanderling	M	R
M	*Calidris canutus*	Red Knot	M	
M	*Calidris ferruginea*	Curlew Sandpiper	M	
M	*Calidris melanotos**	Pectoral Sandpiper*	M	R
M	*Calidris ruficollis*	Red-necked Stint	M	
M	*Calidris tenuirostris*	Great Knot	M	R
M	*Charadrius bicinctus*	Double-banded Plover	M	
M	*Charadrius leschenaultii*	Greater Sand Plover	M	R
M	*Charadrius mongolus*	Lesser Sand Plover	M	R
R	*Charadrius ruficapillus*	Red-capped Plover		
M	*Charadrius veredus*	Oriental Plover	M	
R	*Cladorhynchus leucocephalus*	Banded Stilt		V
R	*Elseyornis melanops*	Black-fronted Dotterel		
R	*Erythrogonys cinctus*	Red-kneed Dotterel		
M	*Gallinago hardwickii**	Japanese Snipe (Latham's Snipe)*	M	

Resident/ Migratory	Scientific name	Common name	Aus status	SA status
M	*Gallinago stenura**	Pintail Snipe*	M	
R	*Haematopus fuliginosus*	Sooty Oystercatcher		R
R	*Haematopus longirostris*	Australian Pied Oystercatcher		R
R	*Himantopus himantopus*	Black-winged Stilt		
M	*Limosa lapponica*	Bar-tailed Godwit	M	R
M	*Limosa limosa***	Black-tailed Godwit**	M	R
M	*Numenius madagascariensis*	Eastern Curlew	M	V
M	*Numenius phaeopus*	Whimbrel	M	R
M	*Pluvialis fulva*	Pacific Golden Plover	M	R
M	*Pluvialis squatarola*	Grey Plover	M	
R	*Recurvirostra novaehollandiae*	Red-necked Avocet		
R	*Stiltia isabella*	Australian Pratincole		
R	*Thinornis rubricollis*	Hooded Plover		V
M	*Tringa brevipes*	Grey-tailed Tattler	M	R
M	*Tringa glareola*	Wood Sandpiper	M	R
M	*Tringa nebularia*	Common Greenshank	M	
M	*Tringa stagnatilis*	Marsh Sandpiper	M	
R	*Vanellus miles*	Masked Lapwing		
R	*Vanellus tricolor*	Banded Lapwing		
M	*Xenus cinereus*	Terek Sandpiper	M	R

R: Rare, V: Vulnerable, E: Endangered, M: Migratory

*: Unlikely to occur within study area or very uncommon.

**: No BDBSA records within study area (some records adjacent study area). Does occur within study area (J. Cooper pers. comm. 2011).

Both resident and migratory shorebirds are susceptible to a variety of threats, these include natural threats such as nest flooding from high tides or storm damage (which may increase as sea level rises), overgrowth of vegetation and predation from abundant native species (eg. Silver Gulls). Human induced threats include coastal development, vegetation clearance, vandalism, egg collecting, litter, seagrass wrack harvesting, cockle harvesting, weeds, beach walking, vehicles and dogs on beaches, pollution and oil spills. Other threats include predation from cats and foxes and disease. However, migratory species are subject to all these and additional threats resulting from management actions occurring in the northern part of their flyaway. An example is the loss and degradation of mud flats in the Yellow Sea (Australasian Wader Studies Group 2008). Global warming and the melting of the permafrost in the northern hemisphere also impacts on migratory bird numbers through impacting their feeding sites because the natural freeze and melt cycle of the tundra is altered, affecting invertebrate numbers.

The conservation of shorebird species can be assisted in many ways, including habitat protection, development control, controlling and/or restricting recreational (eg. vehicles or dogs on beaches) & commercial (eg. tourism, aquaculture) activities in areas of high sensitivity, pest animal control and ongoing monitoring programs. The monitoring of shorebirds has been occurring for many years, and should continue, to aid the understanding of populations, and help identify trends in numbers. 'A Practical guide for managing beach-nesting birds in Australia was produced by G. Maguire in 2008. This extensive document outlines the threats, management options, monitoring techniques and guidelines for the conservation and protection of beach-nesting birds. Some of the suggested management tools include signage, fencing of nesting areas, chick shelters, nest relocation and habitat management, especially weed control.

Waterbirds

Waterbirds are generally classified as those species that inhabit mainly freshwater, however, some waterbird species also inhabit saline, estuarine and marine environments, including the coastal lakes and wetlands, offshore islands, lagoons, swamps and bays of Eyre Peninsula.

The Musk Duck, *Biziura lobata* (SA: R) is present in 24 Eyre Peninsula coastal cells, while the Freckled Duck, *Stictonetta naevosa* (SA: V) is only present in one cell (EP5). The Musk Duck, which breeds on Eyre Peninsula, prefers large, deeper water including coastal embayments and lagoons, and feeds on insects, crustaceans, fish and occasionally on the seeds of aquatic plants. The most significant sites on the Eyre Peninsula for Musk Duck are Sheringa Lagoon (EP48), Baird Bay (EP58), Streaky Bay (Blancheport) (EP66), Tod Estuary (EP25), Lake Newland CP (EP51 and EP52) and Pt. Sinclair (Blue Lake) (EP80) (J. Cooper pers. comm. 2009[6]). Ducks are threatened by the destruction or modification of habitat, particularly by the drainage and clearance of wetlands and swamps. Changes to natural river flow and flood regimes can also have an impact, as can illegal shooting, as well as cropping and pesticide use in surrounding areas, which kills the aquatic invertebrates through runoff, impacting on food availability.

Australian Pelican. Photo: N. Rubbo

Usually recorded in flocks, the Cape Barren Goose, *Cereopsis novaehollandiae* (SA: R) occupies numerous sites around the Eyre Peninsula coast, in particular the Tod Estuary (EP 25), Louth Bay (EP 24), Elliston saline lakes and adjacent beaches (EP 50), Lake Newland CP (EP 51 and 52), and on the coastal properties south of Tumby Bay (EP21) (J. Cooper pers. comm. 2009[7]). These sites regularly record flocks from 80 up to 500, especially in the summer months. The Cape Barren Goose also breeds on various off-shore islands along the Eyre Peninsula coast. Other breeding waterbird species on the Eyre Peninsula include: Australian Pelican, *Pelecanus conspicillatus*, on the islands within Venus Bay CP and Baird Bay CP (EP54-EP55 and EP56 -EP57), Black Swan, *Cygnus atratus*, Eurasian Coot, *Fulica atra* and Great Crested Grebe, *Podiceps cristatus* (SA: R).

Most waterbirds have suffered from wetland modifications such as drainage, increased salinity, stock grazing, land clearing and burning. Development, especially along the coast, threatens other habitats occupied by waterbirds including estuaries and inlets. Pesticide use in surrounding areas can affect the food items of water birds, particularly the invertebrates, while the fox is a predator of many waterbirds at all life stages, preying upon eggs, chicks and adults. Waterbird conservation can be assisted by reducing pesticide use in nearby areas, improving water quality, protecting habitat and undertaking pest animal control programs.

[6] J. Cooper pers. comm. 11 November 2009
[7] J. Cooper pers. comm. 11 November 2009

Seabirds

Many of the seabird species recorded on the Eyre Peninsula coast were infrequently encountered, hence were excluded from the list. Many of these were albatross and petrel species.

Seven tern species were recorded in the Eyre Peninsula coastal boundary, but three species were removed because they were only seen on the odd occasion. The only tern species with a threatened status is the Fairy Tern, *Sternula nereis*, rated as endangered in SA and recently (3 March 2011) included in the vulnerable category under the EPBC Act. The other more common tern species include the Caspian Tern, *Hydroprogne caspia*, Crested Tern, *Thalasseus bergii* and Whiskered Tern, *Childonias hybrida,* being recorded at various sites along the coast. Large colonies of Fairy Tern, Crested Tern, and Caspian Tern nest on St Peter and Eyre Islands (which are just outside the study boundary). Terns eat mostly fish, which are caught by plunging and stabbing at the fish but they will also eat aquatic insects and crustaceans. The Fairy Tern population distribution and size in South Australia is currently under review. Breeding colonies with 30 to 60 breeding pairs have been observed over the last 5 years during the 2020 Shorebird counts at Point Gibson (EP65), Seagull Lake (EP62), Lake Hamilton (adjacent EP46-EP47), Boston Island (offshore of EP27), Nicholas Baudin Island (offshore of EP61), Horse Peninsula (EP41), Seven Mile Beach in Coffin Bay (EP38), Eyre Island (offshore of EP71-EP72) and St Peter Island (offshore of EP73-EP74) (J. Cooper pers. comm. 2011). Terns are beach nesting birds, making scrapings in the sand. Their nests are particularly vulnerable to extreme weather (strong wind, high tides) and predation of eggs and chicks by foxes, dogs, cats and raptors (DEC 2009). Adult birds are threatened by coastal development, changes to their feeding grounds and disturbance to nesting sites.

The main threats to seabirds include the destruction of their nests and habitat, through development, disturbance, recreational activities and predation by foxes, cats and dogs. Loss of prey items through fishing and pollution may also pose a threat to seabirds, as may entanglement in fishing line. Development and access control, pest animal control programs, fisheries management, improving water quality and increased public education on correct rubbish disposal, will assist in the conservation of seabird species.

Raptors

Birds of prey, known collectively as raptors, include owls, hawks, eagles and falcons, each of which are represented in the EP coastal zone. There are 15 raptor species recorded within the study area (Table 3.8), three of which have threatened status. These are the White-bellied Sea-Eagle *Haliaeetus leucogaster,* and the Eastern Osprey *Pandion cristatus* (both rated as endangered in South Australia and listed on the Marine and Migratory Species Schedules of the EPBC Act), and the Peregrine Falcon, which is rated as rare under the NPW Act. Both the sea-eagle and osprey have been identified as Focal Species for this study (see 3.2.5 for more information).

TABLE 3.8 Raptor species present along the Eyre Peninsula coastal zone

Scientific name	Common name	Aus status	SA status
Accipiter cirrocephalus	Collared Sparrowhawk		
Accipiter fasciatus	Brown Goshawk		
Aquila audax	Wedge-tailed Eagle		
Circus approximans	Swamp Harrier		
Circus assimilis	Spotted Harrier		

Scientific name	Common name	Aus status	SA status
Elanus axillaris	Black-shouldered Kite		
Falco berigora	Brown Falcon		
Falco cenchroides	Nankeen Kestrel		
Falco longipennis	Australian Hobby		
Falco peregrinus	Peregrine Falcon		R
Haliaeetus leucogaster	White-bellied Sea-Eagle	M	E
Hieraaetus morphnoides	Little Eagle		
Ninox novaeseelandiae	Southern Boobook		
Pandion cristatus	Eastern Osprey		E
Tyto javanica	Eastern Barn Owl		

R: Rare, V: Vulnerable, E: Endangered

Of the raptor species recorded, only the Eastern Osprey and White-bellied Sea-Eagle are coastal specialists, rarely breeding far from the coast, and typical of most large raptors, both have low reproductive rates and are found in low population densities (Olsen 1998). Recent surveys in SA, estimated the sea-eagle breeding population at 70-80 pairs and the osprey population at 55-65 pairs, with the majority of the latter found in the study area (Dennis *et al.* 2011b), highlighting the importance of the region to their long-term conservation in SA. These surveys also identified three sub-regions (inclusive of adjacent off-shore islands) as retaining significant habitat for both species, one of which was centred on upper-western EP and another on southern EP.

In SA, coastal areas are generally of low relief and low rainfall, with a paucity of forested landscapes and rivers. Human settlement has concentrated in coastal regions, resulting in broad-scale clearance of native vegetation and a profound loss of biodiversity, with most coastal areas now regarded as disturbed or degraded (Nance and Speight 1986). Top-order predator species, such as raptors, are widely regarded as sentinel species by which to measure anthropogenic impacts and environmental integrity (Newton 1979; Romin and Muck 1999). Since European settlement the population status of several raptor species has changed, some have increased in population while others have decreased, these changes have occurred at the local, state and national level (Olsen 1998).

Threats to raptors and their habitat include: clearance or degradation of native bushland for agricultural development, or industries such as mining and forestry (all species); habitat or prey contamination e.g. an oil spill, upward biomagnification through prey of chemical pollutants in the environment (all species); direct exposure to pesticides e.g. broadscale poisoning during rodent plagues in agricultural areas (affecting mainly Brown Falcon, Nankeen Kestrel and Black-shouldered Kite); direct persecution (Wedge-tailed Eagle); unwitting or deliberate disturbance at nests causing desertion (particularly eagle and harrier species); electrocution on poorly configured power poles (eagle species and osprey); collision with power distribution lines and windfarm turbines (particularly eagle and falcon species); entanglement with fishing gear (sea-eagle and osprey) or horticultural crop netting (e.g. Brown Goshawk); and inter-species spatial conflicts (eagle species – see Dennis *et al.* 2011b).

Collectively these habitat degrading processes and threats have affected the breeding refuge quality for coastal raptors on EP and elsewhere, particularly for the disturbance-intolerant White-bellied Sea-Eagle (Dennis 2004).

3.2.2 Mammals

The BDBSA records, including those of the state biological survey and South Australian Museum (SAM) show 33 terrestrial and 24 marine mammal species have been documented within, or adjacent to, the Eyre Peninsula coastal zone. Introduced species make up 33.3% (11) of the terrestrial mammal species recorded. An additional twelve extinct species have been recorded within the study area as sub-fossil records (Table 3.6), but these species are not included in current species lists nor are they discussed any further, except for species that have been reintroduced. Personal observations from locals, the expert opinion of Dr. Catherine Kemper (Vertebrates, Mammalogy, SAM) and information from management plans increased the available information on the occurrence of some mammal species along the Eyre Peninsula coast. Thirty-six Eyre Peninsula cells had no mammal records.

Many marine mammal species have been recorded off the Eyre Peninsula coast and many of these are listed as threatened under national and/or state legislation. The presence of marine mammals, except for seals and sea-lions, does not influence the conservation values of the cells as they are not contained within the study boundary. However, the presence and distribution of marine mammals recorded adjacent to the study boundary have been included, partly because of their historical connection with the coast through whaling stations and also to highlight the potential impacts they may have on the coast. Whaling operations are included as historical sites within the study area and are of conservation value. Tourism impacts are evident where people are drawn to the coast by regular sightings of marine species, such as Southern Right Whales and Humpback Whales, which frequent the waters around the Eyre Peninsula.

Twenty of the 57 recorded mammal species are listed as threatened under Commonwealth and/or state legislation. Ten of these are listed under both the EPBC Act and SA NPW Act, of these, only three are terrestrial, the remaining seven are marine mammals. Of the mammals only listed under the NPW Act, eight are marine and two are terrestrial (Table 3.9).

TABLE 3.9 Threatened mammal species recorded in, or adjacent to, the Eyre Peninsula coastal zone

Species	Common name	Aust Status	SA Status
Arctocephalus pusillus	Australian Fur-seal		R
Arctocephalus tropicalis	Subantarctic Fur-seal	V	E
Balaenoptera musculus	Blue Whale	E	E
Balaenoptera physalus	Fin Whale	V	V
Bettongia penicillata ogilbyi	Brush-tailed Bettong		R
Caperea marginata	Pygmy Right Whale		R
Eubalaena australis	Southern Right Whale	E	V
Globicephala macrorhynchus	Short-finned Pilot Whale		R
Hyperoodon planifrons	Southern Bottlenose Whale		R
Kogia breviceps	Pygmy Sperm Whale		R
Leporillus conditor	Greater Stick-nest Rat	V	V
Macrotis lagotis	Greater Bilby	V	V
Megaptera novaeangliae	Humpback Whale	V	V
Mesoplodon bowdoini	Andrew's Beaked Whale		R
Mesoplodon grayi	Gray's Beaked (Scamperdown) Whale		R

Species	Common name	Aust Status	SA Status
Mirounga leonina	Southern Elephant Seal	V	R
Neophoca cinerea	Australian Sea-lion	V	V
Nyctophilus timoriensis	Greater Long-eared Bat	ssp	ssp
Physeter macrocephalus	Sperm Whale		R
Trichosurus vulpecula	Common Brushtail Possum		R

R: Rare, V: Vulnerable, E: Endangered

Terrestrial species

The preferred habitat of the nationally listed sub species of Greater Long-eared Bat, *Nyctophilus timoriensis,* is tall mallee with open understorey like that found around Sceale Bay (DEH 2007), but they also inhabit mixed eucalypt woodlands around patches of sheoak vegetation that surround granite outcrops and old dams (Van Dyck and Strahan 2008)[8]. Loss of habitat threatens this species by removing roosts and shelter areas. The Greater Long-eared Bat has been recorded in and around Venus Bay (EP54, EP55, EP56) and near Fowlers Bay (EP81 and EP83).

Greater Bilby. Photo: J. Van Weenen, DENR

The Greater Bilby, *Macrotis lagotis*, listed as vulnerable under national and state legislation, was present in only one cell, Venus Bay CP (EP55), as a live record. This species was reintroduced into areas of Venus Bay CP in 2001 as part of a reintroduction program (see section on Venus Bay Ecological Restoration Program). Coffin Bay NP (EP38), Sceale Bay (EP62) and Venus Bay CP (EP55) contained subfossil records of the bilby, indicating the locations this species would have been found prior to, or around the time of, European settlement. Bilbies can occupy various habitat types, including hummock grasslands, Mitchell grass, cracking clays, desert sandplains and dunefields and Acacia shrublands (Van Dyck and Strahan 2008). Like many species, the bilby is threatened by the modification of habitat, introduced species and changes to fire regimes.

The Brush-tailed Bettong, *Bettongia penicillata ogilbyi* (SA: R) was translocated from Western Australia to replace the extinct South Australian sub-species *Bettongia penicillata penicillata*. It is therefore, only present in those areas where it was released; Island A in Venus Bay CP in 1980, Weyland Peninsula in Venus Bay CP in 1994 (see section on Venus Bay Ecological Restoration Program) (EP55), and Donington Peninsula in Lincoln NP (EP30 and EP31) in 1999 (DEH 2004a). The natural habitat of the Brush-tailed Bettong is forest and woodland vegetation (Van Dyck and Strahan 2008). Fox predation is considered the biggest threat to natural and translocated populations, although predation by cats is also likely to have contributed to a contraction in range (Van Dyck and Strahan 2008). Since the translocated populations on the Eyre Peninsula are situated within the Parks system, habitat alteration and the threat from foxes is less likely to be an issue compared with areas outside Park boundaries (fox baiting and control

[8] The details and differences between species and sub species of *Nyctophilus* are still being described and hence could slightly alter the names and specific locations of this species on the Eyre Peninsula.

is being undertaken in both locations). Fire is a threatening process that would impact on Brush-tailed Bettongs in these areas.

Common Brushtail Possum. Photo: G. Jackway, DENR

Although the Common Brushtail Possum, *Trichosurus vulpecular* (SA: R), is often thought to be common, it is a species generally in decline in its natural habitat and is thought to be regionally extinct in most IBRA Sub-regions of the DENR West Region (Gillam and Urban 2009). The area around the southern Koppio Hills is thought to contain the only sub-population of Common Brushtail Possums on the lower Eyre Peninsula (Ecological Associates 2006) and they are possibly present in the nearby coastal area (EP23-25 and EP27) (J. Van Weenen pers. comm. 2009[9]). This species is recorded in ten of the cells of the Eyre Peninsula; however, they are all sub-fossil records. Being one of the most widely distributed mammals in Australia, this species can occur in many habitats, but prefers dry eucalypt forests and woodlands (Van Dyck and Strahan 2008). Consuming a variety of plant material, this species is herbivorous and requires older trees for hollows, for shelter and denning (Van Dyck and Strahan 2008). Maintaining and increasing the number of trees, especially with hollows, and the connection between those habitats with trees, is necessary to ensure possums will have somewhere to inhabit.

Of the mammal species recorded, many of the most abundant are introduced species, including the Red Fox, *Vulpes vulpes*, Feral Cat, *Felis catus*, European Rabbit, *Oryctolagus cuniculus* and House Mouse, *Mus musculus*, which were all present in at least 18 cells (maximum of 33). The more common native species, present in at least 14 cells, include: the Western Grey Kangaroo, *Macropus fuliginosus*, Western Pygmy-possum, *Cercartetus concinnus*, Bush Rat, *Rattus fuscipes*, and Euro, *Macropus robustus*. It is possible the introduced species appear more widely spread throughout the area because they are more commonly recognised and identified than all but the larger native mammals. Introduced species are also generally more adaptive and likely to be present in and around those areas settled by humans, and hence more likely to be recorded opportunistically.

Western Pygmy-Possum. Photo: N. Rubbo

Koalas do not occur naturally on Eyre Peninsula. Their presence is the result of an introduction of six animals to a fenced enclosure of native bushland containing Manna Gums on Mikkira Station, south-west of Port Lincoln in 1969 (Robinson et.al. 1989). Subsequently they have escaped and formed a self sustaining and expanding population (Brandle 2010). They have been observed at low densities across the *Eucalyptus diversifolia* mallee communities of the Uley Basin and southern coastal fringe (Brandle 2010). Koala records collected in 2005 during a DENR survey of Eyre Peninsula were from just south of Wanilla Forest south to near Fishery Bay (EP33). They are also known from near

[9] J. Van Weenen pers. comm. 22 November 2009

Sleaford Mere and into neighbouring parts of Lincoln NP (EP32) (K. Pobke pers. comm. 2009).

The main threats impacting on terrestrial native mammals include vegetation clearance and habitat alteration for development and agriculture, weed invasion, predation and competition from feral animals, altered fire regimes and human disturbance. Conserving mammal species can be assisted by protecting remnant vegetation patches, improving the size and health of vegetation patches, undertaking pest animal and plant control programs, and where possible creating appropriate fire mosaics.

Venus Bay Ecological Restoration Program

European settlement has brought about changes in the environment that have contributed to loss of species on the Eyre Peninsula and other areas. Venus Bay CP has been an important site for the reintroduction of fauna that have disappeared elsewhere on the mainland of South Australia. Weyland Peninsula is a unique feature of Venus Bay, in that it is surrounded by the sea on three sides, and is only joined to the mainland by a narrow strip of land (Figure 3.59). Together with the islands within Venus Bay, these areas can provide places for animals to shelter, especially threatened species, and with correct land management and protection can help save the species from total extinction (DEH 2006b). The Venus Bay Ecological Restoration Program (VBERP) aids in threatened animal recovery, by carrying out habitat restoration and developing management techniques for the reintroduction of missing, rare or endangered wildlife species (DEH 2006b). With assistance from the Commonwealth Government, the VBERP has successfully introduced Brush-tailed Bettongs into Venus Bay CP, onto Island A in 1980 and the Weyland Peninsula in 1994, while the Greater Bilby was established in the Park in 2001. Introductions of the Greater Stick-nest Rat in 1995 and the Bush Stone-curlew in 2001 showed promising results in the early stages but were eventually determined to have failed. . The community around Venus Bay has contributed to the success of the VBERP, by integrating pest plant and animal control, adding to the effectiveness of the predator-exclusion fence (erected in 1996) and through taking a landscape-scale approach to pest management. The combined effort of Friends of Parks Groups, land-holders and the Eyre Peninsula NRM Board help improve the health and quality of surrounding native remnant vegetation, increasing the success of the restoration program (DEH 2006b; DEH 2009). An intensive and continuous baiting and trapping program also exists to aid the effectiveness of the predator-exclusion fence, by reducing the number of foxes and cats on Weyland Peninsula. Rabbit control also assists in the management of grazing pressures, especially of the nationally vulnerable West Coast mintbush, *Prostanthera calycina*, endemic to the Eyre Peninsula (DEH 2009).

Marine species

The majority of the marine mammal records are of the stranding of dead individuals, with fewer from live animal sightings (Table 3.10). Some sections of the Eyre Peninsula coast are more likely to have individuals wash-up on the beach because they are open and exposed to the Southern Ocean and dead individuals can be washed onto the beach by wave action and currents. Areas around the southern tip of the Eyre Peninsula and areas towards the far west of the coastal boundary are also known to have higher quantities of squid, plankton and/or other food resources at certain times of the year, so marine mammals, particularly whales are more likely to be seen during this time as they follow their food source closer to the mainland. Weak/sick individuals are also likely to follow the food, but due to their health, may die and consequently be washed up. The decomposing bodies of these individuals may alter the coastal environment, by releasing nutrients and debris into the area.

FIGURE 3.59 Location of Weyland Peninsula and Venus Bay CP.

Some of the recorded marine mammals are vagrant species, indicating they are visitors, and probably do not live in the area (C. Kemper pers. comm. 2009[10]). A rare species is one that is not often seen. An uncommon species is defined as being recorded more frequently than a rare species, but not enough to be a commonly sighted species. Several of the common species are seen on a more regular basis, mainly because they have haul-out sites or feeding areas nearby. Examples of common species include New Zealand Fur-seal, *Arctocephalus forsteri*, Indo-pacific Bottlenose Dolphin, *Tursiops aduncus*, Humpback Whale, *Megaptera novaeangliae,* and the mammal focal species Australian Sea-lion, *Neophoca cinerea*. The Southern Right Whale, *Eubalaena australis*, is a commonly seen species off the Eyre Peninsula coast because it undertakes a yearly migration to southern Australia to calve.

TABLE 3.10 Marine mammal species recorded along the Eyre Peninsula coast

Scientific Name	Common Name	Common/Uncommon/ Rare/Vagrant*	Type of record
Arctocephalus forsteri	New Zealand Fur-seal	C	L, D
Arctocephalus pusillus	Australian Fur-seal	V	L
Arctocephalus tropicalis	Subantarctic Fur-seal	V	L, D
Balaenoptera bonaerensis	Antarctic Minke Whale	U	L, D
Balaenoptera musculus	Blue Whale	U	D
Balaenoptera physalus	Fin Whale	V	D
Caperea marginata	Pygmy Right Whale	U	L, D
Delphinus delphis	Common Dolphin	C	L, D
Eubalaena australis	Southern Right Whale	C	L

[10] C. Kemper pers. comm. 19 October 2009

Scientific Name	Common Name	Common/Uncommon/ Rare/Vagrant*	Type of record
Globicephala macrorhynchus	Short-finned Pilot Whale	U	D
Globicephala melas	Long-finned Pilot Whale	R	D
Hyperoodon planifrons	Southern Bottlenose Whale	R	L, D
Kogia breviceps	Pygmy Sperm Whale	U	D
Lobodon carcinophaga	Crab-eater Seal	V	D
Megaptera novaeangliae	Humpback Whale	C	L, D
Mesoplodon bowdoini	Andrew's Beaked Whale	R	D
Mesoplodon grayi	Gray's Beaked (Scamperdown) Whale	R	D
Mesoplodon layardii	Strap-toothed Whale	U	D
Mirounga leonina	Southern Elephant Seal	V	L
Neophoca cinerea	Australian Sea-lion	C	L, D
Orcinus orca	Killer Whale (Orca)	C	L, D
Physeter macrocephalus	Sperm Whale	U	L, D
Tursiops aduncus	Indo-pacific Bottlenose Dolphin	C	D
Tursiops truncatus	Common Bottlenose Dolphin	C	D

* species is considered common, uncommon, rare or a vagrant species (within 10 km of the coastal zone) (C. Kemper pers. comm. 2009[11])

L: Live sighting, D: Dead when recorded

Southern Right Whales. Photo: N. Rubbo

Southern Right Whales feed in summer in the open Southern Ocean and come close to the coast in winter. In Australia, they occur from Perth, WA to Sydney, NSW, including Tasmania (Banniser et al. 1996). Sightings along the Eyre Peninsula coast occur mainly during the winter months, when females use the shallow waters around the mainland for calving (Bannister et al. 1996). Sightings have been made in the waters off 52 cells, evenly spread over the whole Eyre Peninsula coastal boundary. Southern Right Whales rarely strand in South Australia (Kemper and Ling 1991), with no stranding records along the Eyre Peninsula coast. However, the calves are susceptible to direct disturbance, such as whale watching vessels and/or low flying aircraft, around calving areas. Coastal industrial activities (seismic, drilling), fishing operations (entanglement), pollution and collisions with ships can also impact Southern Right Whales. Their population structure suggests high juvenile and low adult mortality (Bannister et al. 1996).

[11] C. Kemper pers. comm. 19 October 2009


Dead Pygmy Right Whale. Photo: N. Rubbo

Specimens (dead individuals) and sightings of the uncommon Pygmy Right Whale, *Caperea marginata* (SA: R), have been made in and around Port Lincoln proper, in increasing numbers since 1984 (total of 12 records). Four records were made in the last 10 years, including one in May 2009. All but one record was made between Kirton Point (EP28) and Cape Donington (EP31). One theory behind the recent increase in stranding, mainly of juveniles, is related to the Kangaroo Island pool upwelling that occurs between Kangaroo Island and the southern tip of Eyre Peninsula (C. Kemper pers. comm. 2009[12]). This upwelling is releasing/bringing in plankton, which attracts Pygmy Right Whales because it is their main food source (Van Dyck and Strahan 2008). Commercial whaling has had no impact on the numbers of Pygmy Right Whales as they were never subject to this type of exploitation (Gillam and Urban 2009).

Threats to marine mammals include marine pollution and litter, disturbance by water craft, aircraft, swimmers and divers, entanglements in fishing gear and shark nets, seismic activity along the coast (Bannister et al. 1996), and curious juveniles approaching commercial, recreational or tourist vessels and being injured the vessel or propeller (Gibbs et al. 2004). Habitat loss around drain outlets and coastal development threatens inshore species, especially those that come to use protected, sheltered bay waters such as the Southern Right Whale and Humpback Whale (Kemper 2008). Many of the common marine species, especially the fur-seals, sea lions and dolphins, feed on fish, squid and cuttlefish (McIntosh et al. 2006; Marlow 1975; Gales and Cheal 1992), which benefit from healthy seagrasses meadows for a breeding ground and nursery. Processes and actions that threaten seagrasses, will therefore also threaten marine mammals, through impacts on their food source. Entanglement and by-catch also threaten many species (Kemper 2008; Goldsworthy et al. 2009; Kemper et al. 2005); 34% of Cetacean specimens from the South Australian Museum (data from 1985-2000) died from known or probable entanglement; at least 29 entangled individuals were in anti-predator nets near Pt. Lincoln in 1994-2000 (Kemper and Gibbs 2001; Kemper at al. 2005). Improved water quality, further education and enforcement on correct rubbish disposal, impacts from disturbance, modifications to commercial fishing management practices and enforced minimum approach distances will help to reduce these threats to marine mammals.

3.2.3 Reptiles and amphibians

State biological survey and museum records show 69 reptile and six amphibian species have been documented within the study area. Personal observations of locals, the expert opinion of Dr. Mark Hutchinson (Senior Researcher, Herpetology, SA Museum) and information from various management plans increased the record of occurrence of some species across the Eyre Peninsula coastal zone. Eight reptile species and no amphibian species are listed as threatened under state and/or national legislation (Table 3.11).

Reptiles and amphibians are ectothermic; therefore their distribution is controlled partly by climatic factors, especially temperature, rainfall and vegetation (Cogger 2000). Species with less specific requirements will be found in more locations than those species with specific requirements.

[12] C. Kemper pers. comm. 19 October 2009

Reptiles

Variations in the coastal environment across the peninsula create conditions suitable for different species. Reptile species are generally distributed according to their position east/west of the peninsula rather than coastal and inland conditions, due to the position and relationship of the coast with Spencer Gulf (although there are exceptions of beach/coast specialist species) (M. Hutchinson pers. comm. 2009[13]).

One reptile species was listed as endangered and two were listed as vulnerable under the EPBC Act (Table 3.11). However, all three are marine turtle species. The Loggerhead Turtle, *Caretta caretta*, Green Turtle, *Chelonia mydas*, and Leathery Turtle, *Dermochelys coriacea*, are visitors to the Eyre Peninsula coast and have only been recorded on rare occasions. The Loggerhead Turtle has only been recorded once in 1950, the Leathery Turtle has also only been recorded once (date unknown) and the green turtle has three records from 1950, 1980 and 1996. These species generally occupy the tropical waters off the coasts of Western Australia, Northern Territory and Queensland and are not often seen or captured in southern Australia, although Leathery Turtles are also often seen in New South Wales (Cogger 2000). Fishing debris and rubbish may threaten all turtle species because they mistake it for food; ingesting the rubbish can cause starvation through blockage of internal organs, and or prevents turtles from obtaining food because the rubbish causes them to float (DEWHA 2009c).

TABLE 3.11 Threatened reptile species recorded in the Eyre Peninsula coastal zone

Scientific name	Common Name	Aust. Status	SA Status	Species prefer coastal conditions
Bassiana trilineata	Western Three-lined Skink		R	
Caretta caretta	Loggerhead Turtle	E	E	
Chelonia mydas	Green Turtle	V	V	
Dermochelys coriacea	Leathery Turtle	V	V	
Lerista arenicola	Beach Slider		R	Yes
Morelia spilota	Carpet Python		R	
Pseudemoia baudini	Bight Coast Skink		R	Yes
Varanus rosenbergi	Heath Goanna		V	

Beach Slider, *Lerista arenicola* (SA: R), a beach specialist restricted to nearshore habitat (DEH 2007) and Bight Coast Skink, *Pseudemoia baudini* (SA: R), prefer coastal areas of the Eyre Peninsula. Within South Australia both of these species are only found along the Eyre Peninsula and Far West coasts and have been identified as focal species for this study (see 3.2.5 for further information).

In addition to these two state listed species, 11 of the other reptile species recorded prefer coastal conditions to varying degrees. The Striped Wall Skink, *Cryptoblepharus pulcher*, prefers rocky outcrop areas. Bare sand dunes provide suitable habitat for Bight Coast Ctenotus, *Ctenotus euclae*. Coastal tea-tree and coastal limestone are the ideal locations to find South Coast Gecko, *Diplodactylus calcicolus*. Eastern Bearded Dragon, *Pogona barbata*, prefers coastal environments and is generally found in areas adjacent to the Dwarf Bearded Dragon, *Pogona minor*; not present in the Eyre Peninsula coastal zone, but found further inland. Four-toed Earless Skink, *Hemiergis peronii,* and Mallee Snake-eye, *Morethia obscura*, are generally widespread along coastal areas and are

[13] M. Hutchinson pers. comm. 28 August 2009

Four-toed Earless Skink. Photo: M. Hutchinson, SAM

expected to be found in most EP cells. Bull Skink *Liopholis multiscutata*, Master's Snake, *Drysdalia mastersii,* Common Scaly-foot, *Pygopus lepidopodus* and Prickly Dragon *Ctenophorus chapmani* also prefer coastal habitats. Some of these species, while presently only recorded in limited locations could be expected to be found in other areas around the coast where suitable habitat is present.

Listed as rare at state level, the Western Three-lined Skink, *Bassiana trilineata*, has only been found in three locations within South Australia, all on the southern tip of the Eyre Peninsula, in Lincoln NP and in Coffin Bay NP. Mark Hutchinson (SA Museum) also expects it to be found in the area between Mt Dutton (EP16) and Tumby Bay (EP20) (M. Hutchinson pers. comm. 2009[14]). Western Three-lined Skink is also present in southwest Western Australia. From the little information known of this species, it inhabits areas under *Leucophyta brownie* (Coast cushion bush) on limestone cliffs and nearby coastal dunes and also dense mallee heath on white sands (DEH 2007).

Of the 69 reptile species recorded, the most commonly recorded species (from actual records, rather than from locations where species are expected to be found) include Four-toed Earless Skink, *Hemiergis peronii*, Sleepy Lizard, *Tiliqua rugosa*, Mallee snake-eye, *Morethia obscura,* and South coast gecko, *Diplodactylus calcicolus*. Each of these species was found in at least 21 cells. Common Death Adder, *Acanthophis antarcticus*, Mallee Tree-dragon, *Amphibolurus norrisi*, Striped Wall Skink, *Cryptoblepharus pulcher*, Spotted Ctenotus, *Ctenotus orientalis*, Barred Snake-lizard, *Delma australis*, Southern Four-toed Slider, *Lerista dorsalis*, Dwarf Skink, *Menetia greyii,* and Common Scaly-foot, *Pygopus lepidopodus,* are all expected to have a wide distribution throughout coastal Eyre Peninsula, but current records do not reflect this (M. Hutchinson pers. comm. 2009[15]). Surveys in those areas with fewer records may help to expand their distribution.

Land degradation, habitat loss, change of land use and/or fragmentation through clearing or destruction of vegetation is a major threat to reptiles, as it removes important shelter material. Most small reptiles use leaf litter, ground debris and fallen logs as habitat, and hence any alterations (such as the removal of rocks and logs) to the microhabitat can impact on these species. Creating smaller and fragmented patches of vegetation could also make it harder for reptiles to move between areas. This might prevent the exchange of genetic material, and reduce the genetic fitness of individuals. Altered fire regimes, weed invasion and predation by foxes and cats also pose a threat to reptile species. Improving the health and connectivity between native vegetation patches and other areas occupied and used by reptiles, pest animal control programs and further knowledge of the biology and ecology of species will assist to conserve reptile species and help to understand their requirements.

[14] M. Hutchinson pers. comm. 28 August 2009
[15] M. Hutchinson pers. comm. 28 August 2009

Amphibians

All six species of frogs recorded in the Eyre Peninsula were recorded in less than seven EP cells. Common Froglet, *Crinia signifiera,* and Burrowing Frog, *Neobatrachus pictus,* were the most common species; recorded in seven and six cells respectively. While Spotted Marsh Frog, *Limnodynastes tasmaniensis*, and Trilling Frog, *Neobatrachus centralis* were found in no more than three cells each. The remaining amphibian species, Brown Tree Frog, *Litoria ewingii* and Banjo Frog, *Limnodynastes dumerilii*, were each recorded once in Lincoln NP during a Frog Census survey. This highlights the limited information available on the species, abundance and distribution of amphibians along the Eyre Peninsula coast.

Distributed mainly in South Australia, the Burrowing Frog, *Neobatrachus pictus,* is also found in Victoria and the south west corner of New South Wales. Burrowing Frogs have been found near North Shields (EP26), Port Lincoln (EP27 and EP28), Fishery Bay (EP33), Sheringa Lagoon (EP47), Lake Newland (EP52) and Talia (EP53). Adult frogs live in grasslands, woodlands, mallee, farmlands and cleared areas. They are often seen in and around flooded areas after rain; such as temporary roadside pools, ditches, mallee swales and farm dams (Frogs Australia Network 2005; DEC 2005b; ARC nd). Breeding occurs mainly in autumn and winter after heavy rain; where males call while floating on still water (Frogs Australia Network 2005; DEC 2005b). During dry years, the frogs burrow beneath the surface, and emerge after periods of rain to breed (DEC 2005b). Whilst above the ground, leaf litter, fallen logs and low vegetation are used as shelter (DEC 2005b). Habitat modification, including vegetation clearance and soil compaction, drainage of water sources, salinisation, altered drought and flooding regimes and pollution of water sources are the biggest threats to the Burrowing Frog (DEC 2005b; Frogs Australia Network 2005).

The Eyre Peninsula coastal zone has relatively few sources of freshwater that could support amphibians, and this is likely to contribute to few species being recorded. Vegetation around sources of water, including logs and debris, is important as it provides habitat and suitable breeding grounds for amphibians and provides refuges and shelter for tadpoles (DEC 2005b; Frog Census nd). Altering the environment around wet areas and their adjoining watercourses removes critical movement corridors and refuge areas, and may threaten amphibian populations. Threats to amphibians can occur in aquatic and/or land environments and include habitat loss, change of land use and fragmentation, habitat degradation, pollution, altered flooding regimes (Harley et al. 2005; DEC 2005b; Frog Atlas nd) and predation by feral species. Prolonged drought can also impact on frog populations, by extending the time between wet/rain periods and affect the moistness of the environment (Frog Atlas nd). Conservation of amphibian species can be helped by conserving those habitats that only occur seasonally, or with the change of rainfall, such as freshwater pools and dams. In addition, improving water quality, pest animal control programs and further knowledge into their distribution, biology and ecology will help with their protection and understanding their requirements.

3.2.4 Butterflies

The most comprehensive reports on butterflies of the Eyre Peninsula include two studies undertaken by Roger Grund; one on the southern Eyre Peninsula in 1997 and one on the north-east Eyre Peninsula in 1999. Information from these reports and current information from R. Grund was used to outline the conservation of butterflies on the Eyre Peninsula. The coast varies along the Eyre Peninsula and includes areas of high cliffs to sand dunes and estuarine ecosystems. These various environments incorporate different habitats including sedge wetlands, samphire marshes, shrubland, mallee and low coastal heath. Even in these harsh environments, butterflies are able to thrive (Grund 2007). Butterflies are important indicators of environmental damage or change, such as clearing, overgrazing by feral or domestic animals, fires and the use of insecticides (especially by aerial distribution) (Grund and Hunt 2000).

A total of 29 butterfly species were identified as present in the Eyre Peninsula coastal zone, with eight species in three families being of conservation significance in South Australia as identified by R. Grund (butterflies are not rated under the state legislation) (R. Grund pers. comm. 2009[16]). Only one introduced species was recorded.

TABLE 3.12 Threatened butterfly species present within the Eyre Peninsula coastal zone

Species	Common name	Larval food plant	Vulnerability in SA (Grund)
Family HESPERIIDAE (Skippers)			
Trapezites sciron eremicola	Sciron Rush-skipper	*Lomandra collina*	R
Antipodia atralba	Black and White Sedge-skipper	*Gahnia ancistrophylla*, *G. deusta*, *G. hystrix*, *G. lanigera*	R
Hesperilla chrysotricha cyclospila	Chrysotricha Sedge-skipper	*Gahnia deusta, G. filum, G. radula, G. sieberiana, G. trifida*	V
Family PIERIDAE (Yellows and Whites)			
Delias aganippe	Wood White	*Amyema melaleucae* and *A. miquelii*. Also *Exocarpos aphyllus*, *E. cupressiformis*,, *E. strictus*, *Santalum acuminatum*	R
Family LYCAENIDAE (Coppers and Blues)			
Ogyris otanes	Small Bronze Azure	*Choretrum glomeratum*	E
Jamenus icilus	Icilius Hairstreak	*Acacia* spp.	R
Candalides heathi heathi	Rayed Blue	*Stemodia florulenta*	R
Cyprotides cyprotus cyprotus	Cyprotus Pencilled-blue	*Grevillea huegelii* and *Hakea leucoptera*	R

Source: R. Grund pers. comm. 2009[17]; Grund 2007

Small Bronze Azure, *Ogyris otanes*, was the only butterfly species present along the Eyre Peninsula coast listed as endangered by Grund. With only one larval food species, *Choretrum glomeratum* (berry broombush), Small Bronze Azure will only occur in locations where significant numbers of berry broombush are found (Grund 2008). Berry broombush occurs mainly in mallee and occasionally in dry woodlands and does well after fire (if there are also nearby unburnt areas to distribute seed). Fire opens up the understorey, decreasing the competition with other species, and allowing berry broombush to flourish. Kangaroo Island has significant areas of berry broombush, while mainland Australia has very local and fragmented colonies in southern areas of the state. Fires in fragmented areas are detrimental to the Small Bronze Azure if seeds of the berry broombush can not be brought in (by birds) from surrounding areas to recolonise burnt areas. Increasing the size and numbers of patches of the larval food plant will aid in the conservation of this endangered butterfly (Grund 2008).

Chrysotricha Sedge-skipper, *Hesperilla chrysotricha cyclospila,* identified as vulnerable by Grund, is found in the southern areas of the Australian mainland and parts of Tasmania, being restricted to

R. Grund pers. comm. 20 July 2009
[17] R. Grund pers. comm. 7 November 2009

Chrysotricha Sedge-skipper. Photo: R. Grund

the cool temperate areas. This butterfly is extinct on the Yorke Peninsula and is only present in the most southern areas of Eyre and Fleurieu Peninsulas (Grund 2002). It is present in only a few locations in the lower southeast of South Australia, and is extinct in the Coorong. The western half of Kangaroo Island contains known locations of Chrysotricha Sedge-skipper, while a subspecies is present in south-west Western Australia. Their larval food plants include numerous *Gahnia* species, often occurring around wetlands; they are an indicator of coastal and near coastal saw-sedge wetlands, and are intolerant of wetland degradation. *Gahnia* wetlands have suffered fragmentation and degradation due to urbanisation and agriculture, contributing to their vulnerable status. Introduced species also threaten their survival, as they smother saw-sedge species. Revegetating suitable areas with *Gahnia* species and reducing the use of insecticides and tramping of areas around wetlands will aid the conservation of Chrysotricha Sedge-skipper (Grund 2002).

Eighteen of the 29 butterflies species recorded along the Eyre Peninsula coast have their known or suspected range in all EP cells. It can be assumed they would be found in any areas where their hostplant occurs, which differs for each species. Five species were found in all areas except the north east section of the Eyre Peninsula (approximately cells EP 1-6). Amaryllis Azure (coastal form) was not known to be found on the southern tip of the Eyre Peninsula, while Sciron Rush-skipper and Cyprotus Pencilled-blue avoided the whole southern Eyre Peninsula.


Male (left) and female (right) Black and White Sedge-skipper. Photos: R. Grund.

Two butterfly species were limited to coastal environments, while an additional species is not limited to the coast, but is found more often in areas near to the coast. The first coastal species, Bitter-bush Blue, *Theclinesthes albocincta*, relies solely on *Adriana quadripartita* form *klotzschii* and only occurs in coastal regions of South Australia, usually within and near coastal sand dune systems (Grund 2007). Bitter-bush Blue is likely to occur in all EP cells where its hostplant can be found. The second coastal species, Amaryllis Azure, *Ogyris amaryllis meridionalis* (coastal form) is usually found wherever its hostplant, *Amyema* mistletoe, occurs close to the coast. *Amyema* mistletoes occur in most habitats, but prefer open shrub and woodland in drier regions. The additional coastal species, Common Xenica, *Geitoneura klugii* requires rainfall of more than 300 mm, which could be the reason it is not usually found inland. This species prefers cool, damp and shady areas where native and/or introduced grasses occur; it could be found along most of the Eyre Peninsula. Common Xenica can occur in open temperate heathland, shrubland, woodland and forest, having some grass in the understorey and in mallee areas near the coast (Grund 2007).

Threats to butterfly species on the Eyre Peninsula include the clearing and fragmentation of vegetation leading to the loss of food plants, size and degradation of indigenous habitats, altered fire regimes, as well as the use of toxic sprays, especially via aerial spread, where toxins are damaging to the surrounding vegetation and butterflies (Grund and Hunt 2000). Measures that can be taken to conserve butterfly species and habitat include protecting representative areas of different environment types, improving the quality and quantity of vegetation conserved, incorporating food plants of butterflies into re-vegetation and restoration projects, creating buffer zones between agriculture/domestic use and conservation areas, and reducing or preventing the use of toxic sprays, especially via aerial spread (Grund and Hunt 2000).

3.2.5 Focal species

Focal species are given prominence within this report because of their conservation status or significance within the project area. They may also be a species typical of an area or vegetation type, which the community or focal groups can use to promote the conservation of the area. Focal species are important, as they can help to stimulate community involvement and enthusiasm for the natural environment, and lead to an increase in knowledge of the species. They may also help educate and promote the importance of retaining native vegetation and mitigation or management of the major threats to native flora and fauna. Focal species are usually easily identified species, in the hope that their identification and presence can be reported with reasonable confidence to relevant authorities. Three bird, one mammal and two reptile species have been selected as focal species with particular significance to coast of Eyre Peninsula, in that a large portion of the state's population and distribution of these species falls within the boundaries of this action plan.

Australian Pied Oystercatcher

Australian Pied Oystercatcher. Photo: P. Allen, DENR

The Australian Pied Oystercatcher, *Haematopus longirostris*, is a resident shorebird species listed as rare under the NPW Act. It is a large conspicuous, sturdy, black and white bird with a long reddish bill, stout pink legs and feet. The sexes are similar, but the female is slightly larger than the male, with a slightly longer more slender and pointed bill (Maguire 2008). On Eyre Peninsula, their preferred coastal habitats include intertidal sandflats, sheltered bays with salt marsh lagoons and sandy ocean beaches (Figure 3.60). Significant sites include Coffin Bay, Lake Newland CP ocean beach, Venus Bay, Tourville Bay, Murat Bay, Cape Missiessey, eastern Eyre Island, Acraman Creek CP and Streaky Bay. St Peter Island (not included in the study area) has a resident breeding population of over 400 birds (J. Cooper pers. comm. 2011.

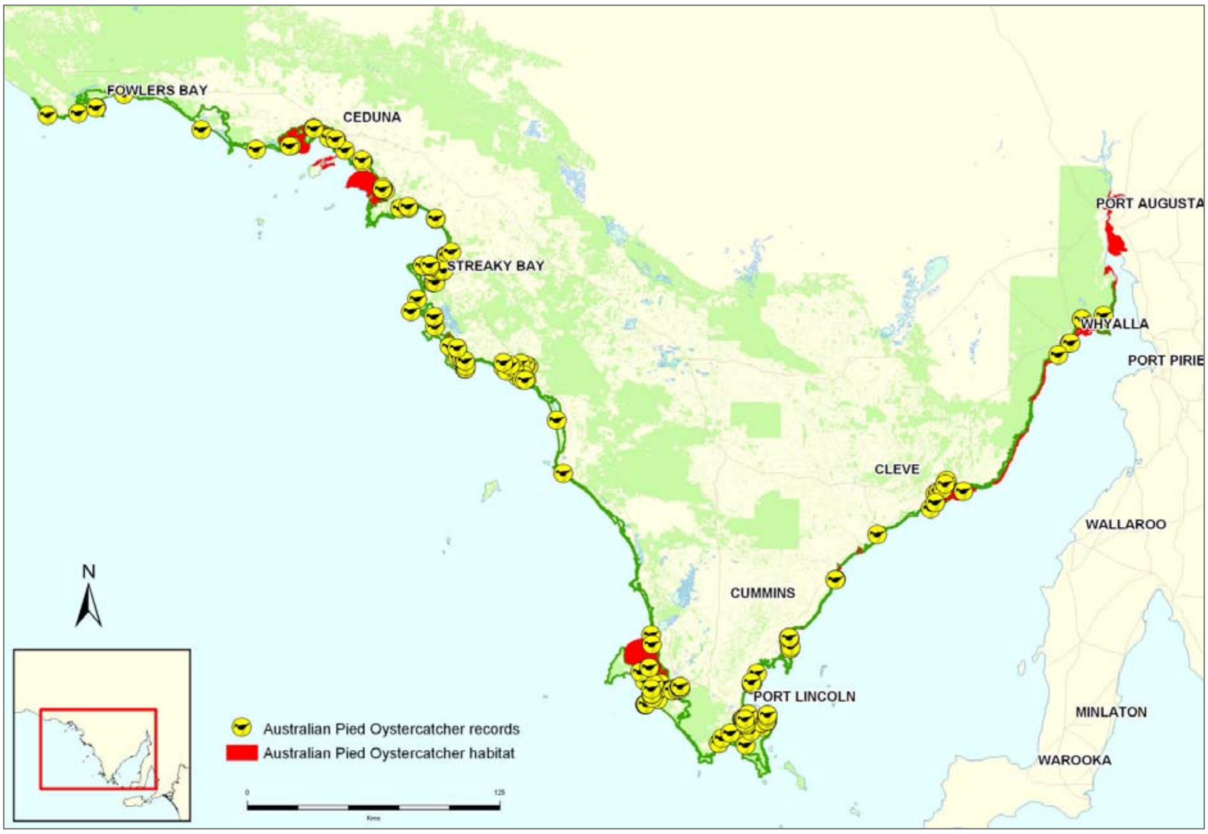

FIGURE 3.60 Location of Australian Pied Oystercatcher habitat and records within the study area.

The diet of Australian Pied Oystercatchers consists mainly of molluscs, worms and crabs. They nest on the open beach near the high tide line, making scrapings on the beach sand, shell grit or shingle just above high water mark, or on the edges of mudflats and salt marsh lagoons. The breeding season is between August and January. Their eggs are well-camouflaged, being pale brown with darker brown and black blotches and streaks. Significant breeding sites on the Eyre Peninsula include Venus Bay CP, supporting a minimum of 36 breeding pairs (D. Armstrong pers. comm. to J. Cooper 2009), Coffin Bay National Park: Gunyah Beach 60 birds with a minimum of 15 breeding pairs in 15 km, Seven Mile Beach eight breeding pairs in 9.5 km, Point Longnose salt marsh lagoons and sandy shore ten breeding pairs within 2 km, Newland CP ocean beach 15 breeding pairs in 28 km (J. Cooper EP HP biennial count 2010). Australian Pied Oystercatchers prefer undisturbed sites for breeding, in areas where disturbance increases, the distance between breeding pairs also increases.

Australian Pied Oystercatcher eggs. Photo: S. Detmar

Some Pied Oysterctachers on the Lake Newland CP beach prefer to nest on the low foredunes, and not at the base of the dunes. They are skilful at keeping their chicks hidden but eventually the young ones have to join their parents on the wet sand. Pied Oystercatcher parents on Seven Mile Beach hide their chicks up on the vegetated foredune and take them tiny morsels of cockles. As the chicks get older and bolder they dodge the traffic on the beach to join their parents at the water's edge. One breeding pair on Seven Mile Beach was recorded nesting (two eggs) in the centre of a large flat blowout with no view of the water and 200 m inland from the high tide mark.

Disturbance to feeding and nesting sites from natural causes (high tides and extreme weather and predators) and through human-related impacts (coastal development, habitat destruction, recreation, tourism, pest plant and animals) threaten Australian Pied Oystercatchers. Extra high tides and extreme weather can wash away nests, eggs and sometimes chicks. Strong winds can also bury the nests, causing adults to abandon the nest, while extreme heat or cold can cause the eggs and chicks to perish quickly in the absence of parents (Maguire 2008). Extreme weather events can be devastating to local populations, putting a whole breeding season at risk (BirdLife International 2008). Sea level rise, as a result of climate change, may increase the risk of washing away nests, as well as reducing the area of beach available for nesting. In areas where the beach can not retreat inland due to sea walls or development, oystercatchers (as well as other shorebirds) will have no choice but to move away and find more suitable areas.

Coastal development, tourism, recreation and commercial activities impact on oystercatchers by increasing disturbance to nesting areas (through increased access points, increased traffic, habitat destruction and resource reduction), potentially altering the topography of the beach and possibly decreasing the area available for birds to nest (BirdLife International 2008; Maguire 2008). People, dogs and vehicles on beaches (Figure 3.61) also directly destroy nests, or disturb the oystercatchers and cause them to leave their nest or chick for periods of time. Fishing and cockling practices may reduce the availability of food and thus impact on oystercatcher habitat. Feral animals such as foxes, cats and rats also prey upon the eggs, chicks and adults (Maguire 2008).

FIGURE 3.61 Off-road vehicles pose a threat to Australian Pied Oystercatchers by disturbing their feeding and breeding grounds. Photo: N. Rubbo.

Threats to oystercatchers can be reduced by restricting off-road vehicle access to beaches, especially during the breeding season. Reducing the number of access points to the beach may help the vegetation recover from disturbance, and provide longer stretches of less disturbed beach. The use of interpretive signs at major nesting sites will also help educate beach users of the threats they pose to beach nesting birds, including the rare Australian Pied Oystercatcher. In highly visited beaches, protection of known or potential habitat may be needed, including the implementation of protection zones (fencing) around breeding sites. Undertaking fox and feral cat control programs can also aid in reducing the number of predators and hence threats to the Australian Pied Oystercatcher.

White-bellied Sea-Eagle

In Australia the White-bellied Sea-Eagle *Haliaeetus leucogaster* occupies coastal and offshore island environments, and inland river systems and lakes, ranging from the tropical northern coastline to southern Tasmania. Although the population appears stable in tropical regions, declines have occurred in some regions in the southern part of its range, including in SA (Olsen 1998; Clunie 2003; Shephard *et al.* 2005; Dennis *et al.* 2011b). In recognition of these declines in White-bellied Sea-Eagle populations specific conservation strategies have been developed in Victoria (Flora and Fauna Guarantee Action Statement #60; Clunie 2003) and in Tasmania (Threatened Tasmanian Eagle Recovery Plan 2006-2010; Threatened Species Section 2006).

White-bellied Sea-Eagle. Photo: S. Detmar

In some areas inter-species conflict may cause displacement and therefore contribute to localised declines. This has occurred in recent years at a cliff nest site at Kianna on western EP (EP46), where a former sea-eagle primary nest site with a history of long-term occupation was found occupied by Wedge-tailed Eagles *Aquila audax* in 2009-10. Conflict between these species is likely to be spatial, rather than competition for prey (Olsen *et al.* 2006).

Surveys completed in 2010 found a total of 72 occupied White-bellied Sea-Eagle territories in SA, with the majority (79%) of these occupying offshore island habitats (Dennis *et al.* 2011b). Most nest sites in the EP coastal zone were on cliff-face ledges, and one nest was in a tree (<6m). These surveys identified a substantial decline of the mainland population of approximately 22%. Only 12 occupied sea-eagle territories were located on the mainland within the study area (Figure 3.x), these were in cells EP30, EP31, EP39, EP47, EP55, EP58, EP61, EP67, EP70, EP73, EP84 (Dennis *et al.* 2011b).

Sea-eagle prey consists mainly of fish, reptiles and a variety of birds (Marchant and Higgins 1993; Olsen *et al.* 2006). In part, their current distribution reflects the availability of these prey, but also highlights former habitats where these resources are present but breeding no longer occurs, and where additional territories could be spatially accommodated (e.g. in cells EP41, EP42-EP43, EP50, EP55-56, EP59, EP77, EP79, EP85) (Dennis *et al.* 2011b).

In contrast to the forested habitat available in other States, breeding sites for the White-bellied Sea-Eagle in SA are largely limited to offshore islands and remote coastal cliff sites, where low heath vegetation cover predominates and tree nests are largely non-existent. Nests are therefore in exposed settings with little visual screening and particularly vulnerable to disturbance from human activity or approach, as this invariably occurs in line-of-sight at long distance and above nest level, which is a perceived threat to nesting sea-eagles (Olsen 1998, Dennis *et al.* 2011a). A long-term study of productivity outcomes associated with human disturbance factors in sea-eagle habitat elsewhere in SA, found that pairs in disturbed territories produced eggs less often, had higher nest failure rates and fledged significantly fewer young compared with pairs in more isolated locations (Dennis *et al.* 2011a).

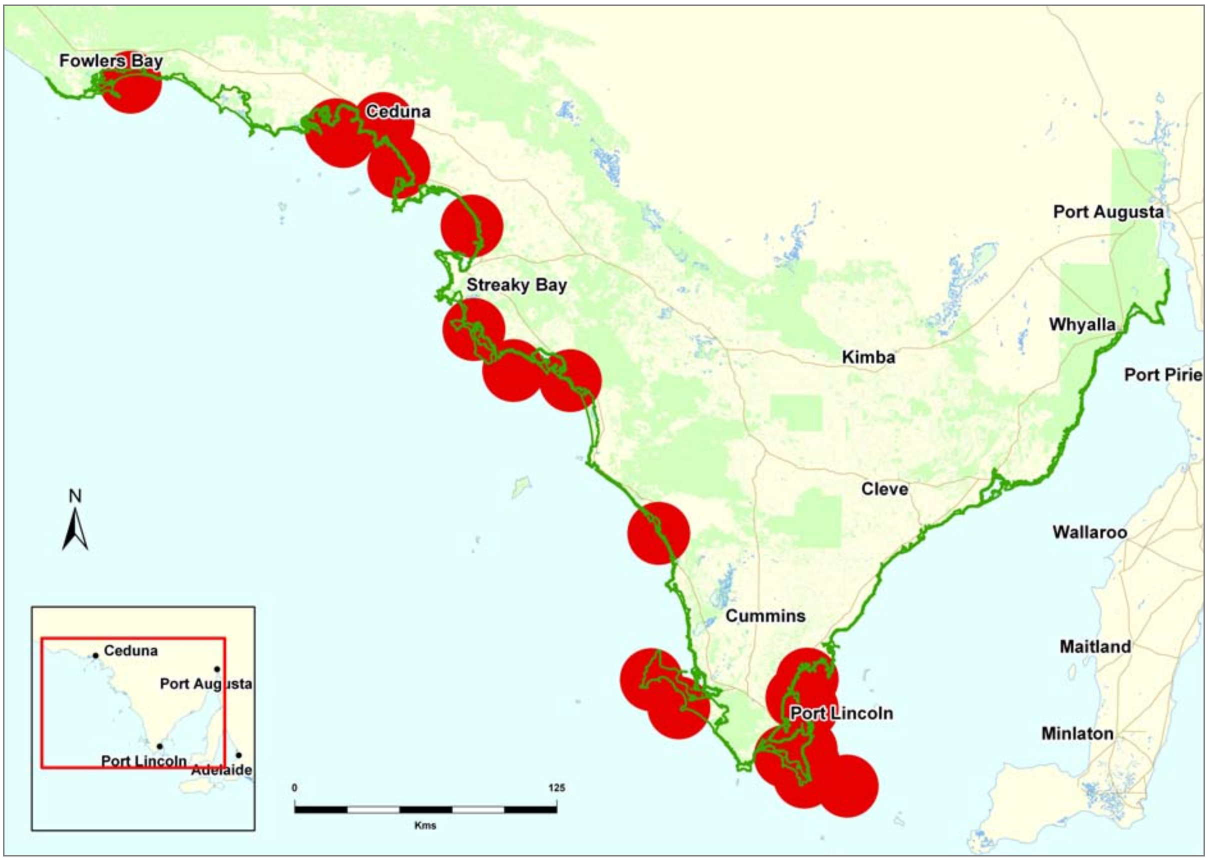

FIGURE 3.62 Location of White-bellied Sea-Eagle territories in, or adjacent, the study area.

In SA the White-bellied Sea-Eagle breeding season commences with courtship and nest repair activity in May; egg-laying extends from late June to late August with the majority in mid-July; and most young are fledged by December, but late fledging events are possible in early January (Dennis *et al.* in prep.).

As with many long-lived eagle species, the White-bellied Sea-Eagle is sensitive to disturbance during the breeding season (Figure 3.63) and will abandon the breeding attempt when disturbance occurs during the pre-laying phase or early incubation period (Olsen 1998; Threatened Species Section 2006; Dennis *et al.* in prep.). This behaviour, and the evidence of low productivity among a large proportion of the population in SA (Dennis *et al.* 2011a), accentuates the importance of habitat protection during the breeding season and the need for habitat management plans for this species.

In recent decades, change of land-use in coastal areas of SA has emerged as a threat to the refuge quality of sea-eagle habitat. Subdivision of grazing properties into smaller holdings with part-time or permanently occupied housing has exponentially increased the level of human activity and associated impacts in coastal landscapes.

In otherwise remote areas on EP, the entrenched practice of gaining access to remote beaches and coastal features by 4WD vehicles for recreational pursuits, such as fishing and surfing, has resulted in a plethora of vehicle tracks leading to serious erosion and vegetation damage. Also many of these tracks closely follow the cliff-edge and are in direct line-of-sight to nests and therefore can cause serious disturbance.

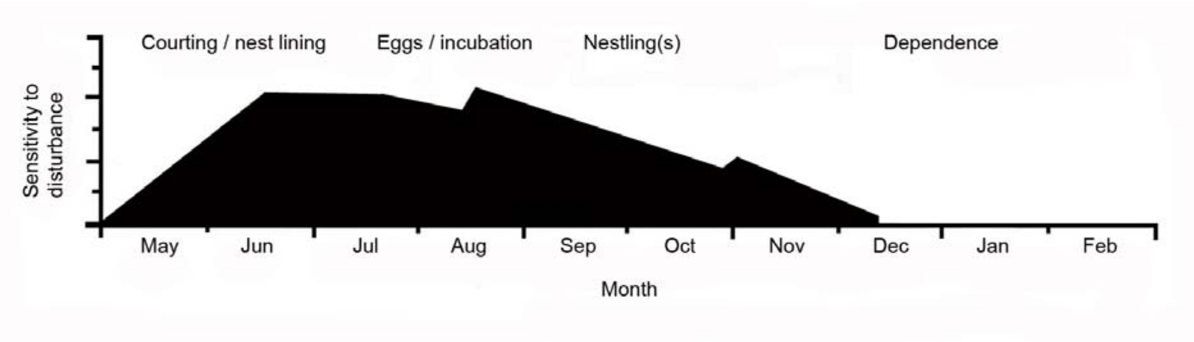

FIGURE 3.63 Based on proximity and duration of disturbances causing eagle nest desertions in Tasmania the above illustration (adapted to SA) shows the likely phases of greatest sensitivity and corresponding desertion risk during the White-bellied Sea-Eagle breeding season in South Australia (Mooney and Holdsworth 1991; Tasmanian Forest Practices Authority 2006).

Other threats include: clearance of native forest and bushland for agricultural development; expansion of urbanisation; recreation and tourism; activities associated with industries such as mining, forestry and windfarm development in remote coastal areas; ill-timed land management activities such as pest plant control programs coincident with the breeding season; low altitude aircraft operation; habitat contamination e.g. an oil spill affecting prey availability, or upward biomagnification of chemical pollutants; and inter-species conflicts (Bilney and Emison 1983; Olsen 1998; Clunie 2003; Threatened Species Section 2006; Dennis 2004; Dennis et al. 2011b).

Conservation measures to stabilise/secure the White-bellied Sea-Eagle population in SA include: developing community and government agency awareness of sea-eagle conservation issues and land management Best Practice protocols to minimise impacts; the development of species and specific habitat management plans; conduct regular systematic population monitoring; update and improve council development plans to improve protection of important sea-eagle habitats; improve use of pesticides, herbicides and other chemical agents to reduce or avoid impacts on sea-eagles; where necessary, develop site specific management plans to minimise threats and improve protection eg. vehicle and pedestrian access tracks, development, etc; encourage conservation management oriented research projects e.g. to investigate causes of nest failure and nest provisioning studies i.e. prey abundance or availability as a population limiting factor etc.

Eastern Osprey

Ospreys (*Pandion* spp.) are fish-eating raptors found on all continents with at least four geographically discrete sub-species recognised (Poole 1989). The Australasian species (Eastern Osprey *P. cristatus*) differs genetically and physically from northern hemisphere forms (12–14% smaller), there are minor plumage differences, and it is non-migratory (Poole 1989; Christidis and Boles 2008). On the Australian continent it occurs mainly in coastal or near-coastal estuarine habitats in tropical regions in the north, with minor disjunct populations extending from the Indian Ocean along the southern coastline as far east as Kangaroo Island in SA (Marchant and Higgins

Eastern Osprey. Photo: S. Detmar

1993; Dennis 2007a). There are no osprey breeding records from Victoria or Tasmania and are only rarely recorded there as vagrants (Marchant and Higgins 1993; Barrett *et al.* 2003).

In remote northern and tropical areas of Australia the osprey population appears stable, however, there is evidence of decline in historical times in the southern extent of its range (Marchant and Higgins 1993; Olsen 1998; Dennis 2007a). However, in northern New South Wales, population recovery has been remarkable i.e. <30 pairs in the late 1980s to >120 pairs in 2005, with many former coastal and estuarine habitats being re-occupied in recent decades (Clancy 2006). In contrast to the White-bellied Sea-Eagle in SA, the osprey appears to have adapted more readily to landscape change and human activity. As a consequence of this apparent resilience, ospreys have re-occupied primary nest sites in some areas after displacement following disturbance events (Dennis 2004). For example, ospreys returned after several years to a former primary nest site after development of cliff-top walkway and tourist lookout at Cape Bauer (EP64) in 2000; and similarly after site-works and residence construction at Searcy Bay (EP60) in 2003 (Dennis *et al.* 2011b).

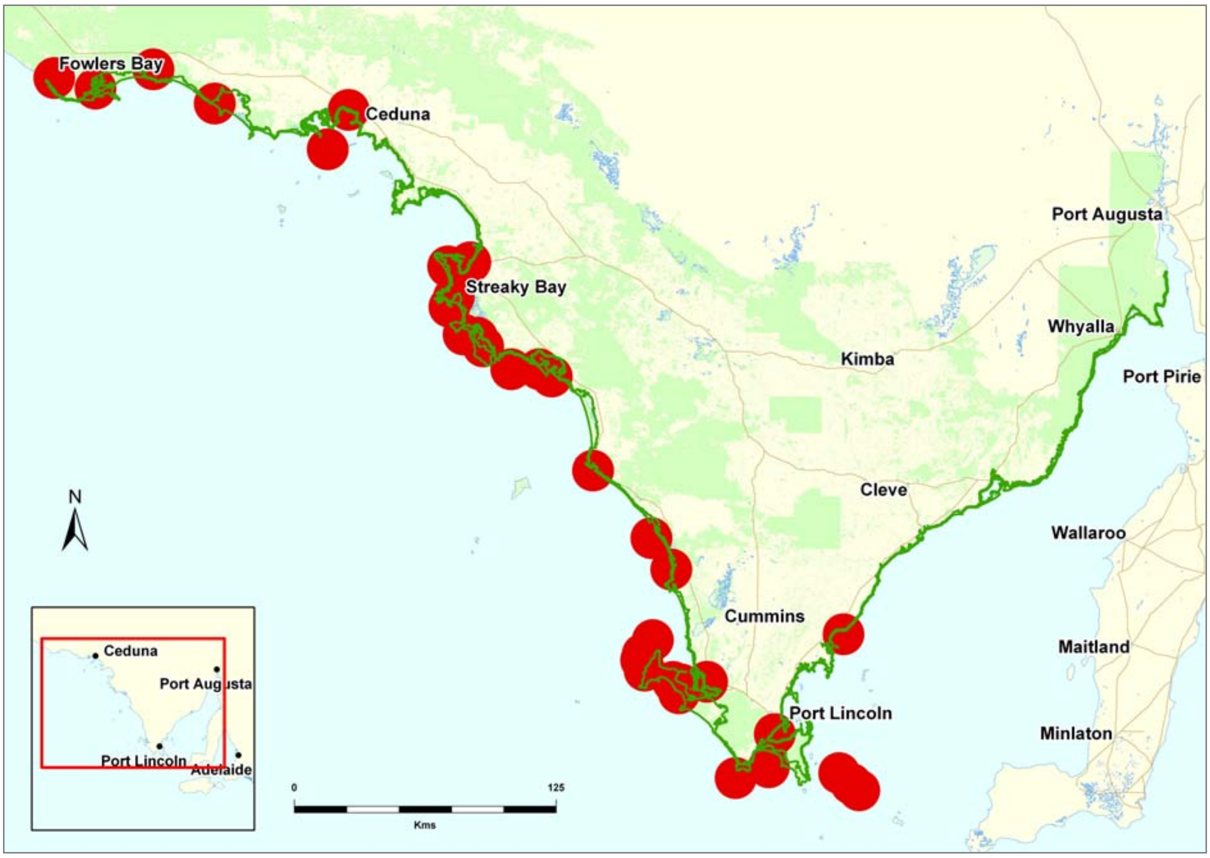

FIGURE 3.64 Location of Eastern Osprey territories in, or adjacent, the study area.

Surveys completed in 2010 found a total of 58 occupied osprey territories in SA, with the highest density of mainland territories found on western EP (Dennis *et al.* 2011b). Within, or immediately adjacent the study area there were 28 osprey occupied territories with nest sites situated on or near the mainland (Figure 3.64) (Dennis *et al.* 2011b). Most nest structures were on broken sections of coastal cliff and near-shore rock-stacks, but four active nests were on artificial platforms, three of which were provided by oyster farm operators, motivated by concern for the species in their area. One of these (adjacent EP40 in Coffin Bay) had been in continuous use since 1988 and another (adjacent EP76 in Denial Bay) since 1991, the latter being a wooden tripod structure that has been re-built three times after storm-surges. The fourth was situated on a specially provided platform on an abandoned bulk-loading wharf near Port Lincoln (adjacent EP28 in Proper Bay), occupied continuously since the mid-1980s.

In SA the Eastern Osprey breeding season commences with courtship activity and nest preparation in late July or early August; egg-laying extends from mid-August to early October with the majority of pairs laying in September; and most young are fledged by late December, with late fledging events in February (Dennis 2007b).

Unlike the disturbance-intolerant White-bellied Sea-Eagle, ospreys habituate to human activity more readily and there are many examples of them selecting man-made structures as nest sites in SA. However, specific threats include: inadequate spatial refuge provision around remote nest sites adjacent rural land subdivision residential developments or expansion of urbanisation; ill-conceived tourism developments; entanglements (commercial and recreational fishing gear); habitat contamination e.g. an oil spill affecting prey availability; upward biomagnification of chemical pollutants in prey from estuarine and marine environments/sources. Also the incidence of inter-species conflict between sea-eagle and osprey is common, manifested as varying levels of harassment and prey-robbing initiated by sea-eagles (Marchant and Higgins 1993; T. Dennis unpublished data).

Measures to conserve the Eastern Osprey population in SA include: developing community and government agency awareness of osprey conservation issues and land management Best Practice protocols to minimise impacts; develop species and specific habitat management plans; conduct regular systematic population monitoring; update and improve council development plans to improve protection of important osprey habitats; improve use of pesticides, herbicides and other chemical agents to reduce or avoid impacts on osprey; where necessary, develop site specific management plans to minimise threats and improve protection eg. vehicle and pedestrian access tracks, development, etc; identify locations with abundant prey where: a) breeding formerly occurred e.g. in mangroves at Murnininnie (ABBBS banding record 1964); and b) there are terrain limitations for nest sites; and where additional artificial nest platforms could be installed to reinstate or expand the breeding population e.g. Davenport Creek, Laura Bay, Venus Bay, Coffin Bay and Franklin Harbor.

Australian Sea-lion

Australian Sea-lion, *Neophoca cinerea* is listed as vulnerable under both the EPBC Act and NPW Act. They are distributed from Kangaroo Island, South Australia, to the Houtman Abrolhos Islands in Western Australia (Gales et al. 1994) with vagrant individuals coming ashore in eastern Australia as far north as central New South Wales (Jefferson et al. 2008). The Australian Sea-lion is especially important as it is the only endemic seal species in Australia (McIntosh et al. 2006). They can inhabit a

Australian Sea-lion. Photo: S. Detmar

range of environments including rocky platforms at the base of limestone cliffs, to low-lying limestone islands and sandy beaches (Gales et al. 1994; Shaughnessy 1999). Because Australian Sea-lions inhabit a range of habitats, it is possible their haul-out site preference is influenced by its proximity to optimal foraging sites (Goldsworthy et al. 2009). From the data available on diet and prey items of Australian Sea-lions, it appears they feed on a variety of items, including: fish, squid, cuttlefish, octopus, sharks, rock lobster, other small crustaceans and penguins (McIntosh et al. 2006; Marlow 1975; Gales and Cheal 1992).

The Australian Sea-lion was recorded in 34 of the cells along the Eyre Peninsula. Point Labatt (EP58) is the only mainland breeding site on South Australia (excluding Kangaroo Island), with a pup range of 1-6 (Goldsworthy et al. 2009), and is a major tourist area. Jones Island (EP57), within Baird Bay (and part of the Baird Bay Islands CP) also has a small colony of breeding Australian Sea-lions, which produces between 1-7 pups a year (Goldsworthy et al. 2009). Occasional pupping had been sighted at Point Fowler (Camel-foot Bay) (EP84); while haul-out sites are located at Fowlers Bay (EP85) and Slade Point (EP61) (Goldsworthy et al. 2009). Numerous other sites around the coast also provide short term resting areas, but are not used regularly or by many individuals at one time (Figure 3.65).

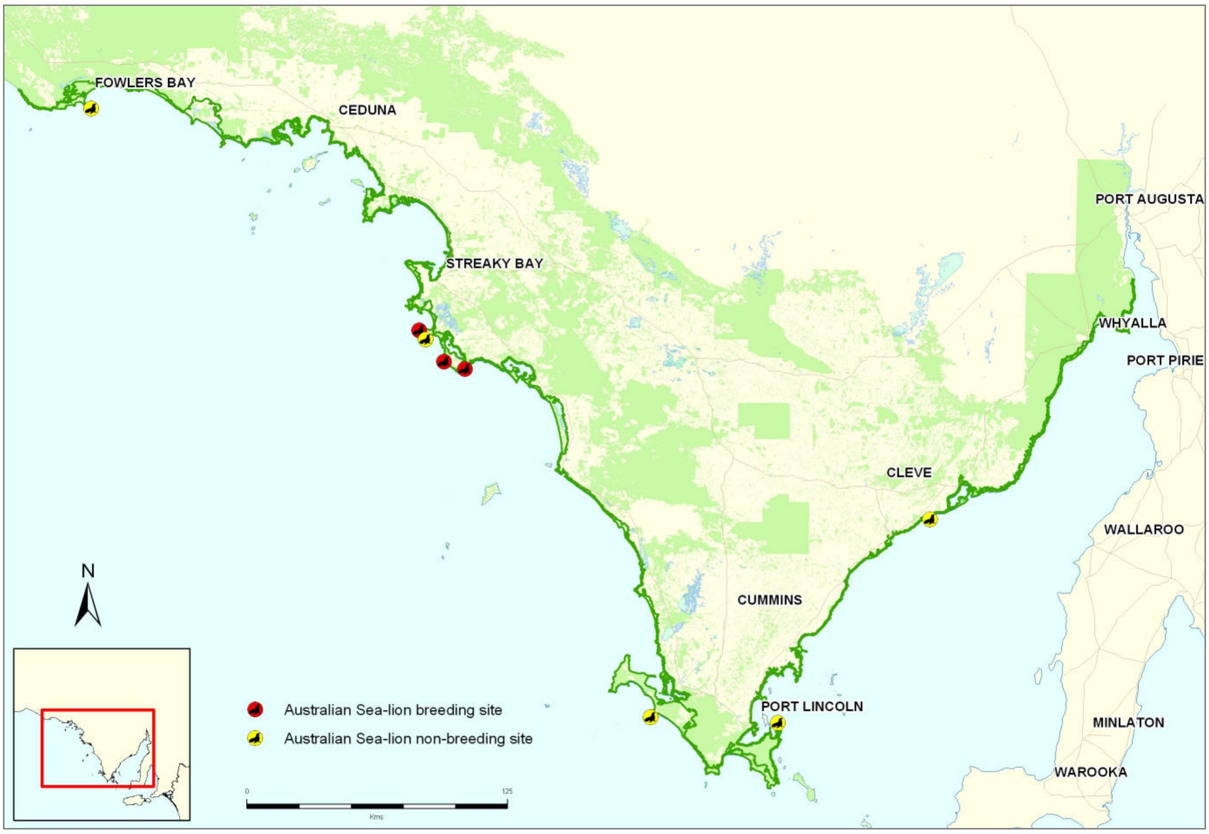

FIGURE 3.65 Location of Australian Sea-lion colonies within or adjacent the study area.

Most colonies of Australian Sea-lions are small and genetically distinct (Gales et al. 1994; Goldsworthy et al. 2009), therefore any impacts can impede the recovery of the population. Australian Sea-lions were subject to intensive sealing in the 18th, 19th and early 20th centuries (Goldsworthy et al. 2009), but are currently threatened mainly by disturbance to breeding colonies and interactions with fisheries (entanglement/by-catch) (Jefferson et al. 2008; Goldsworthy et al. 2009). In popular recreation areas and those areas used for aquaculture, they could suffer displacement and/or modification of foraging habitat as a result of changes to the environment, including prey depletion and competition. Entanglement in marine debris is also of concern, while impacts from climate change, in particular sea level rise may also cause the loss of some breeding colonies, as some of the smaller islands and shore platforms become submerged (Goldsworthy et al. 2009).

Point Labatt Sea-lion colony from viewing platform. Photo: N. Rubbo.

Providing areas where the coast can retreat inland with sea level rise is important for the conservation of sea-lions to ensure adequate habitats exist for breeding and haul-out sites into the future. The protection and conservation of possible haul-out sites is also important, as primary sites may become unsuitable (with climate change), or as the population grows. Controlling the number and location of tourism and visitor viewing sites, will help manage the direct impact humans have on Australian Sea-lions, especially through disturbance to breeding sites. Point Labatt is a good example of how tourism and disturbance can be controlled to minimise the impacts – by creating a viewing platform and interpretive signs, with the actual site being inaccessible to the general public. Management and monitoring of eco-tourism operations, such as those around Jones Island, is important to ensure they are not impacting the colony (DEH 2007); although reports suggest there are no significant behavioural changes to Australia sea-lions with the presence and activity of boat-based tourism (Martinez 2003 and NSSG and Stewardson 2005).

Sustainable management practices by the aquaculture and fishing (commercial and recreational) industries will also assist in protecting the sea-lion population. For example, the use of Seal Exclusion Devices (SEDs) by trawl fishing operators can be used to help minimise the impact they have on populations through bycatch (D. Hammer, pers. comm. 2008[18]; NSSG and Stewardson 2005). Educating companies and the public about the use of safe practices and the safe disposal of marine rubbish is also important.

Beach Slider

Beach Slider. Photo: D. Armstrong, DENR

From the few records that exist of Beach Slider, *Lerista arenicola* (SA: R) in South Australia and Western Australia, the preferred habitat of the Beach Slider is semi-arid and arid sandy shores (Cogger 2000), including nearshore coastal habitats (SAHG 1998). It is a member of a large genus of approximately 80 species of mostly cryptic, sand-swimming skinks, with progressive levels of loss of limbs and digits relating to their mostly sub-terrainian existence. Although a very efficient sand-swimmer, disappearing

[18] D. Hammer, pers. comm. December 2008

rapidly into lose sand when disturbed, the Beach Slider is one of only three members of this group which still has a full complement of four limbs with five digits on each. It is most frequently encountered on the surface when sheltering under dry seagrass wrack or other marine debris, close to but above high tide level.

There are only ten records of the Beach Slider in South Australia, two of these are outside the study area in the far west of the state. The remaining eight records are from coastal dunes or beaches in three locations of Eyre Peninsula; Coffin Bay NP (EP38), Talia Beach (EP53) and Acraman Creek CP (EP69).

Few reptile surveys have been conducted along the Eyre Peninsula coast, particularly for this species. It is likely that additional surveys in suitable habitat would identify other locations where the Beach Slider can be found (D. Armstrong, pers. comm. 2009[19]). Further surveys and research on this species will improve the knowledge and understanding of their distribution, ecology, conservation status and the threatening processes impacting upon it. This information can then be used to determine what management actions, if any, are required to conserve and protect this species.

Removal of seagrass wrack, vehicle traffic parallel to and above high tide, and destruction and clearing of coastal dunes or vegetation on the dunes, are all potential threats to this species. Improved management of vehicle access and commercial exploitation of seagrass wrack accumulations would protect important sections of the linear preferred habitat of the Beach Slider.

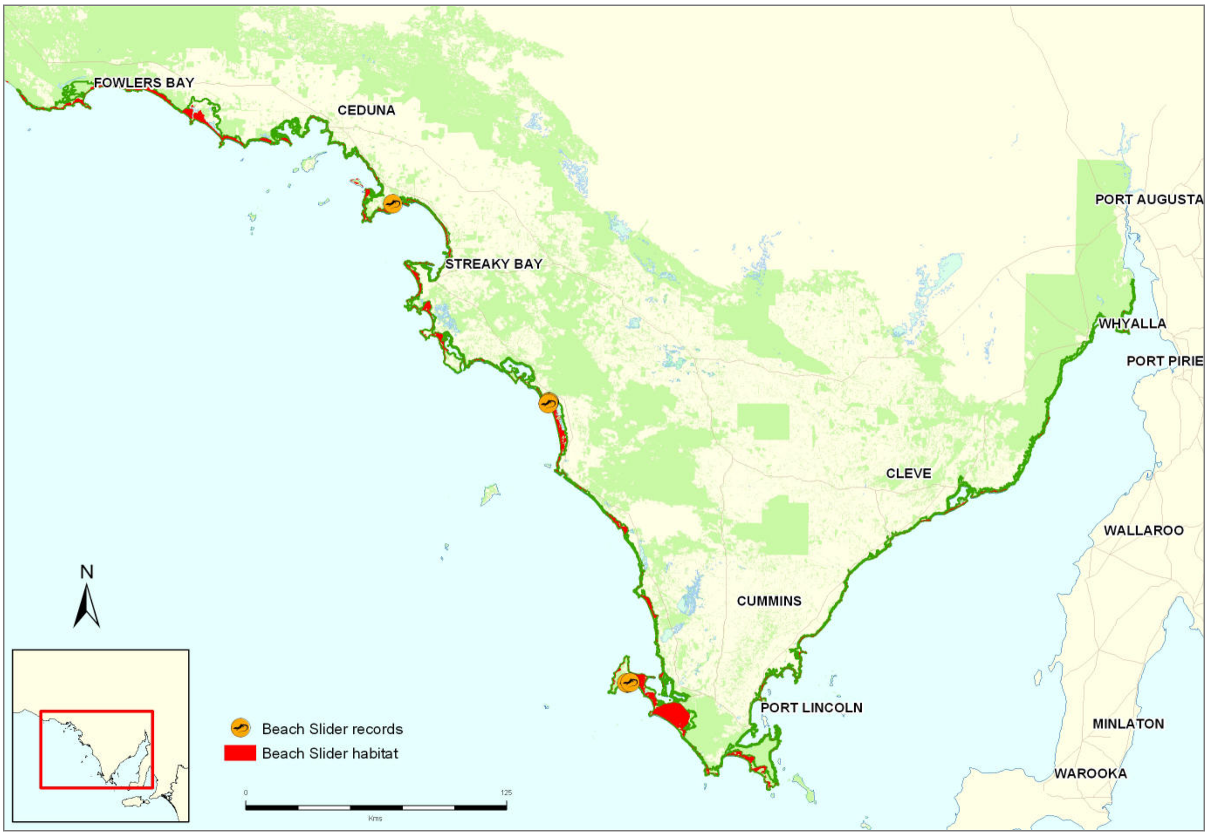

FIGURE 3.66 A map showing record sites and preferred habitat of the Beach Slider within the study area.

[19] D. Armstrong, pers. comm. 16 August 2009

Bight Coast Skink

Information from records indicate the Bight Coast Skink is found on open ground in sandy areas with shelter in vegetated dunes nearby (Cogger 2000), but also on coastal clifftops and near swamps (Brandle 2009). Of the 29 records of the Bight Coast Skink, *Pseudemoia baudini* (SA: R), (held in South Australia) four are on the mainland coast of western and southern Eyre Peninsula, one is in Western Australian, five are on islands within the Nuyts Archipelago and 19 within the Investigator Group CP (BDBSA).

Bight Coast Skink. Photo: T. Robinson, DENR

The Bight Coast Skink is a member of a genus of six species of small skinks, restricted to the cool climate areas of temperate south-eastern and southern Australia. It is frequently observed active or basking on sunny winter days, and most often located on south facing coastal slopes (D. Armstrong pers. comm. 2009[20]). Its occurrence seems to be dependant on pockets of habitat with a suitably cool micro-climate, within a narrow coastal corridor.

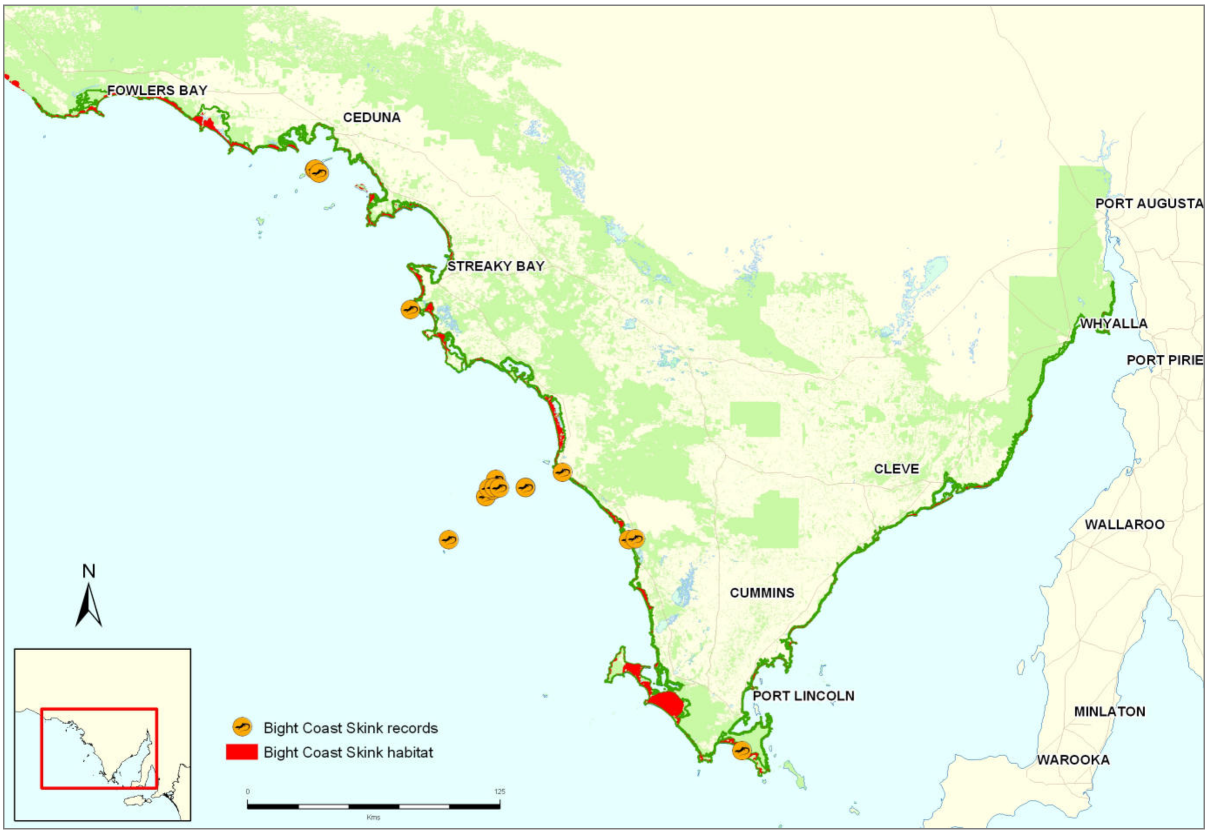

FIGURE 3.67 A map showing record sites and preferred habitat of the Bight Coast Skink in and adjacent the study area.

Similar to the Beach Slider, there are few records of this species as there have been few reptile surveys undertaken along the Eyre Peninsula coast, and increased survey effort in suitable habitat

[20] D. Armstrong, pers. comm. 16 August 2009

is likely to increase the records and locations where the Bight Coast Skink can be found. It is known from at least two other locations as yet not included in available data, near Streak Bay and Venus Bay (D. Armstrong pers. comm. 2009[21]). As with the Beach Slider, the conservation and protection of this species requires further survey and research to improve the knowledge and understanding of the skinks distribution, ecology, conservation status and threats, which will then determine what, if any, management actions are required.

Other than large scale modification or development of coastal areas, the principal threat to the long term survival of this species could be climate change. Its preference for the narrow strip of near coastal habitat and presence on off-shore islands indicate that it is one of several reptile species which have been isolated in these cool micro climate areas following the progressive warming and sea level rise since the last glacial or Pleistocene period over 10, 000 years ago. More rapid global warming may further isolate and fragment populations of these species.

3.2.6 Species richness

Priority areas for conservation and management are often determined through the presence and/or abundance of individual species. These species include those with a high conservation value, or those that have been identified as a focal species (e.g. Poiani et al. 2001, Simberloff 1997). A number of species, particularly birds, have a high conservation rating and therefore increase the conservation value of an area and demonstrate the importance for conservation management. However, areas containing high and representative species richness (total number of species) of native wildlife are also important and influence the value of an area for conservation. Managing the environment for multiple common species has been identified as a more successful and cost efficient method for the long-term conservation of native wildlife (Scott et al. 1987). As a result, the number of species can also be used to indicate biodiversity and is used as an indicator for conservation-based outcomes (eg Atauri and Lucio 2001, Scott et al. 1987).

Using the data available at the time of analysis the Coffin Bay area, including Coffin Bay NP (EP36-EP39), Coffin Bay (EP40) and Horse Peninsula (EP41), consistently recorded high species richness for birds, mammals and reptiles individually as well as combined (Table 3.13). Venus Bay CP (EP55-EP56) and Lincoln NP (EP31-EP32) recorded high species richness for mammals, reptiles and the combined records. Lake Newland CP (EP52) had high numbers of birds, reptiles and combined records. Franklin Harbor (EP10) scored highly for numbers of birds and combined records. Streaky Bay (EP66) and Point Gibson (EP65) both contained high numbers of bird species.

It must be noted that not all areas of the Eyre Peninsula have been surveyed equally, with the park reserves being surveyed more often, therefore the species richness is skewed toward those highly surveyed areas, as illustrated by the results below. Some cells recording high species richness did not contain areas protected under the reserve system, these included EP41, EP65 and EP66. More surveys and record collecting over the whole coastal area will help reduce this bias, and identify areas that may require improved management or protection to conserve fauna species.

Amphibians and butterflies were not included in the species richness assessment because of the lack of data; data for only a few cells was available, highlighting the need for more data collection.

[21] D. Armstrong, pers. comm. 16 August 2009

TABLE 3.13 Cells with the highest species richness (total number of species)

Rank	No. of bird, mammal & reptile species	No. of bird species	No. of mammal species	No. of reptile species
1	153 EP36 Coffin Bay NP	116 EP36 Coffin Bay NP	20 EP55 Venus Peninsula	28 EP39 Point Whidbey/Point Sir Isaac
2	148 EP40 Coffin Bay	114 EP40 Coffin Bay	13 EP37 Avoid Bay	27 EP38 Dead Man Corner
3	147 EP37 Avoid Bay	110 EP66 Streaky Bay	12 EP32 West Point/ Sleaford Bay	27 EP55 Venus Peninsula
4	142 EP38 Dead Man Corner	109 EP37 Avoid Bay	11 EP36 Coffin Bay NP	26 EP36 Coffin Bay NP
5	135 EP39 Point Whidbey/Point Sir Isaac	105 EP38 Dead Man Corner	11 EP56 Tyringa Beach	25 EP37 Avoid Bay
6	133 EP55 Venus Peninsula	104 EP65 Point Gibson	10 EP31 Cape Colbert to Cape Catastrophe	25 EP41 Horse Peninsula
7	129 EP41 Horse Peninsula	104 EP10 Franklin Harbor	10 EP38 Dead Man Corner	24 EP40 Coffin Bay
8	128 EP32 West Point/ Sleaford Bay	98 EP39 Point Whidbey/Point Sir Isaac	10 EP40 Coffin Bay	23 EP32 West Point/ Sleaford Bay
9	119 EP10 Franklin Harbor	96 EP52 Lake Newland CP	10 EP41 Horse Peninsula	16 EP52 Lake Newland CP
10	116 EP52 Lake Newland CP	94 EP41 Horse Peninsula	10 EP54 Venus Bay	15 EP56 Tyringa Beach EP62 Sceale Bay EP69 Acraman Creek

Phase one of "A Regional Species Conservation Assessment for the West Region" was completed in 2009 (Gillam and Urban 2009). The aim of phase one of the project was to assign a conservation status and population trend to all native flora and fauna at a regional level. The area covered within the west region was defined by the Interim Biogeographical Regionalisation for Australia (IBRA) V6.2 subregions, and bordering Interim Marine and Coastal Regionalisation for Australia (IMCRA), and so included a wider area than the current project's boundaries; it included areas up to approximately 400 km inland from the coast and to the Western Australian border. However, when the number of critically endangered, endangered and vulnerable fauna species within 1 km² grid cells was mapped, the highest threatened species richness was indicated at various locations along the coast (Figure 3.68) (Gillam and Urban 2009). Even though the threatened species hotspots were mostly concentrated on reserves, DENR managed land and those areas that have been highly surveyed (Gillam and Urban 2009), the results highlight the importance and significance of the coastal environment.

Priority areas for more research/data collection

The Eyre Peninsula coastal zone covers a large area, 71% of which is covered by native vegetation. Currently, most of the fauna records are for areas within the Parks reserve system, especially when considering mammal and reptile records. Priority areas for data collection are those cells with few or no records. 56 cells (66% of cells) did not contain a fauna survey site (see Appendix 6), while four cells did not contain any fauna records within the BDBSA (however, thanks to the additional data provided by Jane Cooper and Graham Carpenter, some bird records were available for three of those cells for use within this study).Thirty six cells did not contain any mammal records and 31 cells did not contain any reptile records. Bird records were found in all but one cell (EP46, Kiana Beach) with numerous sites along the coast known to be well suited to shorebirds (see priority areas for conservation and management below), and hence are monitored more regularly. Birds are also more easily surveyed than reptiles and mammals, with less effort and equipment needed. The development of shorebird monitoring (Shorebirds 2020) in conjunction with Birds Australia also increases and encourages the monitoring of shorebirds. This monitoring should continue, to aid the understanding of populations, and help identify trends in numbers.

Many of the areas with no mammal or reptile records overlapped, including Backy Point (EP1), Whyalla area (EP3, EP5), Point Gibbon to Port Neill (EP12-EP13, EP15-EP16), Lipson Island to Louth Bay (EP19, EP22, EP 24), Cathedral Rocks (EP35), Farm Beach to Kiana Beach (EP42, EP44-EP46), Calca Peninsula (EP59), Cape Bauer (EP64-EP65), Haslam (EP68), Clare Bay (EP82) and Cape Adieu (EP85). In some areas, especially toward the north western section of the coastal boundary, the habitat consists of mainly cliffs, with sparse vegetation. An effort should be made to survey these areas, as not all fauna require vegetation cover; reptiles and smaller mammals create tunnels and use rocks as cover (Cogger 2000; Van Dyck and Strahan 2008). In addition, areas with small or narrow patches of vegetation (such as on the east coast of EP), should be included in fauna surveys, as these may be found to be important refuge areas or transport corridors for fauna species.

Further research is also needed on fauna species, in particular reptiles, as many of these species are rare and are only found on the Eyre Peninsula and in Western Australia. Research and data collection should focus on those species with a threatened status because they are at a higher risk of extinction.

Priority areas for conservation and management

The Eyre Peninsula is covered by vastly different environmental conditions, from a hot and dry, almost arid climate, to the cooler, wetter conditions of the southern Eyre Peninsula. Some of these conditions combined with certain vegetation types provide the perfect habitat for some rare species including the Beach Slider and Bight Coast Skink. These species are generally found on the west coast of the Eyre Peninsula, and these areas should be conserved in order to protect these species.

Many sites within the Eyre Peninsula coastal boundary are also recognised as Nationally Important Wetlands or Important Bird Areas. These areas provide suitable habitat for feeding, breeding and roosting for numerous resident shorebirds and feeding and roosting sites for migratory shorebirds, many of which are nationally and/or internationally important.

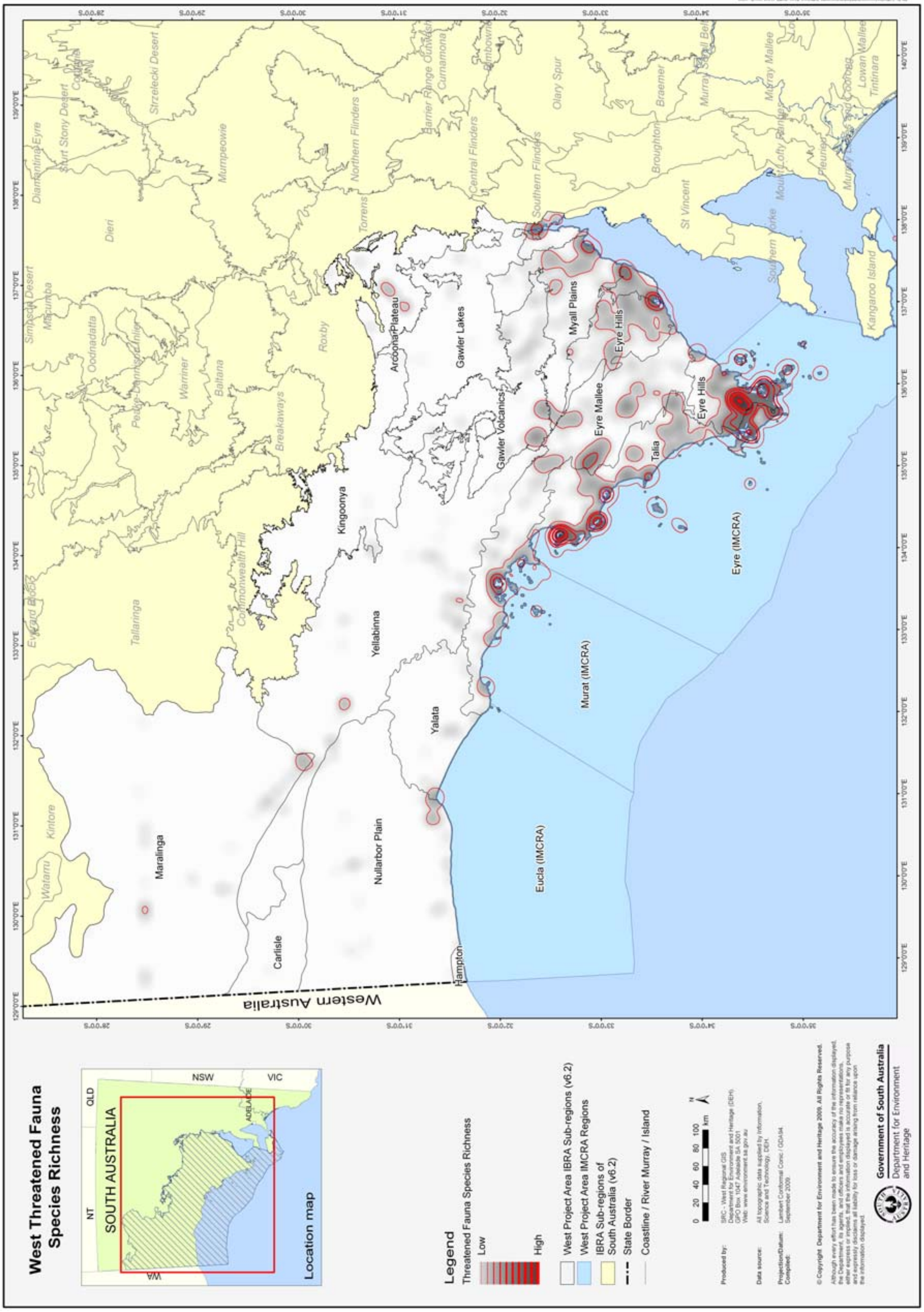

FIGURE 3.68 West threatened fauna species richness (from Gillam and Urban 2009, Figure 4. p.14). The number of Critically Endangered, Endangered and Vulnerable fauna species were calculated within 1km² grid cells over the project area, from all BDBSA records. Using ***ESRI GIS ArcInfo*** software, the Spatial Analyst Extension 'Kernel Density' was employed to calculate the density of threatened species richness, and presented in raster and contour form.

Coffin Bay NP, which includes part of the Nationally Important Coffin Bay Coastal Wetland System, is a highly significant area for all species; birds, mammals and reptiles. The wetland system is composed of various habitats, including intertidal mud, sand or sand flats (DEH and DWLBC 2003) and sandy ocean beaches. It is also an international site for Sanderling (by supporting more than 1% of the flyway population), and is nationally significant for Red-necked Stint (by supporting 0.1% of the flyway population) and regularly supports > 1% of the Australian population of Sooty Oystercatcher and Australian Pied Oystercatcher (Clemens et al 2008). The sandy beaches (Gunyah/Almonta, Avoid Bay, Seven Mile Beach) and the sheltered salt marsh and mudflats within Port Douglas support a significant breeding population of Australian Pied Oystercatchers and are the most important areas to manage for conservation (J. Cooper and D. Armstrong pers. comm. 2009[22]). One particular site of importance within Coffin Bay NP is the sandflats and sandbars surrounding Point Longnose, which support 13 migratory species. This area is also vulnerable, as it is a low lying area, threatened by erosion from storm surges and being submerged with sea level rise (C. Bell pers. comm. 2009[23]). Point Longnose is also a prime area for oyster farming and cockling, which threaten the fauna species through disturbance and loss of food resources. A dramatic reduction in the numbers of shorebirds at this location has been recorded since the 1980s (J. Cooper pers. comm. 2011), which highlights the importance of managing and conserving this area. Coffin Bay NP, (as well as many other areas on the Eyre Peninsula) is also threatened by off-road vehicles, which destroy native vegetation and landforms, disturb native fauna species and open up new areas to disturbance. This issue has devastating effects on breeding birds, including beach nesting birds and raptors, and needs to be managed in order to protect the fauna species. The diverse vegetation associations present throughout the park provide habitat and refuge areas for species which have been pushed out of their original habitat by development and agriculture, although some associations have still suffered the effects of past land use, for example the Drooping Sheoak woodland (DEH 2004b).

The shallow embayment which is Franklin Harbour is also important 14 shorebird species (four resident and ten migratory). The long, narrow, sandy peninsula with inner islands and seagrass beds on the seaward side provides optimal feeding grounds for 2,000 shorebirds, and a safe roosting and breeding site for many bird species. On the eastern side of Eyre Peninsula, and particularly around Franklin Harbour, the vegetation gradually changes moving inland, from mangrove to samphire to saltbush to mallee, providing important areas for all types of fauna species.

Because many of the fauna records on the Eyre Peninsula are in and around National Parks and Conservation Parks, these tend to be highlighted as the most important areas. However, any coastal area that still contains reasonable patches of remnant vegetation or suitable habitat, are important to various fauna species. Patches of vegetation, including roadside corridors aid the movement of fauna species from one area to another. Corridors allow the movement of genes through a population and provide species with a refuge in times of danger, such as during a bushfire. Improving the health and size of current patches may aid in improving the biodiversity of the whole area. One of the South Australian Government initiates aimed at connecting areas through the Eyre Peninsula region is the East meets West NatureLinks project. This aims to connect biologically important areas in Western Australia with the Great Victoria Desert and Yellabinna regions in South Australia in a landscape scale approach to biodiversity management. It is one of five-large scale conservation corridors planned by the State Government to help South Australia's plants, animals and ecosystems to survive and adapt to climate change.

[22] D. Armstrong pers. comm. 11 August 2009
[23] C. Bell pers. comm. 18 September 2009

3.2.7 Threats to fauna

Prior to European settlement the extensive mallee, woodland, shrubland, sedgeland, dunes, cliffs and wetland habitats within the Eyre Peninsula coastal zone supported a more diverse range of native wildlife. While more than 70% of the study area remains in native vegetation and continues to support much of this biodiversity, it has been impacted by the development of agriculture, industry and residential areas around the region. Habitat clearance, fragmentation and degradation, altered fire regimes, wetland drainage, predation and competition from introduced species, development, human disturbances and climate change have lead to the loss of some species, reductions in the distribution of others and continue to threaten the survival of native wildlife. The key threatening processes acting within the Eyre Peninsula coast are highlighted in Table 3.14.

TABLE 3.14 Key threats and their implications to native wildlife within the Eyre Peninsula coastal zone

Threat	Implications	Affects
Biological threats		
Degradation of habitat (e.g. loss of leaf litter and fallen timber, soil compaction, weed invasion)	Reduction in population size, change in ecosystem productivity, loss of food source (e.g. invertebrates), increase in animal pest species	All fauna - particularly reptiles and bush birds
Competition between native species and introduced, domestic or abundant native species	Spread of disease, reduced food source, competition for nesting and breeding areas, loss of native species	Mammals, birds
Predation by introduced species or abundant native species	Reduction in population size, loss of native species	Mammals, reptiles, birds, amphibians
Decline in prey availability e.g. loss of small native species	Reduction of natural recruitment rates, loss of native species	Reptiles, predatory birds (eg. raptors)
Insufficient information known about the biology, ecology and status of the species	Loss of native species, inappropriate management decisions	All fauna
Hunting and over-harvesting	Loss of native species, reduction in population size	Mammals (marine and terrestrial), birds (raptors)
Climatic threats		
Sea level rise e.g. at Point Longnose, Coffin Bay, Point Labatt	Flooding and destruction of nests, flooding and inundation of shoreline habitats	Shorebirds, bush birds, butterflies, marine mammals e,g, Australian sea-lions
Climate change / adverse weather	Drought and storms – increased aridity, loss of coastal habitat, increased salinity and water table levels, and changes in water temperature and quality - loss of species	All fauna
Resource use threats		
Land clearance, degradation, alteration and fragmentation	Reduction in population size, reduction in genetic diversity within a small population size, increase in pest plant and animal species, isolation	All fauna
Development	Disturbance to breeding and foraging	All fauna

Threat	Implications	Affects
	habitats (terrestrial and marine), loss of native species and habitat, increase in pest plant and animal species, isolation	
Recreation and tourism e.g. Point Labatt, Coffin Bay NP, Baird Bay	Disturbance to nesting birds and sensitive species (flora and fauna), and foraging and calving areas	Birds and mammals - particularly raptors, shorebirds and marine species
Human and off-road vehicle activity e.g. Streaky Bay, Sceale Bay, Anxious Bay & Coffin Bay	Disturbance of nesting birds and sensitive species, destruction and fragmentation of native coastal habitat	Mammals, birds, particularly shorebirds and raptors
Altered fire regimes	Loss of habitat, reduction in population size, reduction in genetic diversity within small populations, increase in animal pest and plant species, isolation	Mammals, reptiles and bush birds
Pollution e.g. oil spills, chemical contaminants, heavy metals, pesticide use and stormwater run-off	Reduction in water quality, sediment loading, loss of seagrass, loss of habitat, injury and death to marine species, accumulation of heavy metals in species, loss of invertebrates as a food source and loss of butterfly species	All fauna – particularly marine mammals, raptors, water birds, shorebirds and butterflies
Fishing e.g. Franklin Harbour, Port Lincoln, Coffin Bay, Streaky Bay	Entanglements from active fishing causing death and injury, loss of food source, disturbance of nesting and sensitive species	Marine mammals, seabirds, water birds, shorebirds
Aquaculture eg Franklin Harbour, Coffin Bay, Streaky Bay, Murat Bay, Smoky Bay	Loss of habitat, reduction in available food sources, damage and depletion of seagrass meadows. Biosecurity risks involved in translocations. Feral species. Entanglements. Contamination from effluent from near shore abalone farms (bacteria, viruses, pathogens)	Shorebirds, waterbirds, marine mammals food webs - meiofauna, macrobenthic invertebtates,
Mining and seismic survey activity	Loss of native species and habitat, disturbance to sensitive species (terrestrial and marine), increase in pest plant and animal species, isolation	All fauna

Habitat clearance, fragmentation and degradation

Across Eyre Peninsula native vegetation has been cleared to make way for agriculture, aquaculture, industry, urbanisation, mining and development, and some areas of remaining native vegetation have become degraded and/or isolated (fragmented). This has resulted in the loss of shrublands, grasslands, mallee, vegetation dune systems and wetlands necessary to support the indigenous biodiversity of the region. Clearance of native vegetation can also remove those flora species important to animals and invertebrates. This is especially important where specialist fauna species rely on a particular plant species, or type of environment. Butterfly species are a good indicator of the presence of particular species and conditions, where their presence can reflect a healthy ecosystem.

The clearance of vegetation has resulted in remnant vegetation communities that vary in size and shape, and have become separated in the landscape – factors that all influence the ability of species of native flora and fauna to persist in the remaining habitat. Several general principles apply, including (modified from Bogaert et al. 2001):

- large patches of remnant vegetation are preferred to small ones
- one large patch of remnant vegetation is preferred over several small patches with a similar area
- compact patches of remnant vegetation are preferred over elongated or perforated patches
- small distances are preferred between patches of remnant vegetation.

Patch size is an important factor contributing to the suitability of an area for the long-term occupation of native flora and fauna. Typically, larger patches of remnant vegetation are less disturbed and support a greater diversity of species (e.g. Loyn 1989; Wagner and Edwards 2001). This may vary according to the availability of habitat and the ability of a species to occupy and persist in the remnant patch and surrounding landscape.

Native wildlife generally exhibit preferences for particular vegetation communities that best provide their required resources, such as sites for nesting, foraging and sheltering. Remnant patches often consist of a variety of vegetation associations and habitats, and thus limit specific species to preferred habitat types within a patch. Larger patches are more likely to contain a greater diversity of habitats large enough to provide a diversity of resource requirements, buffer against increased predation and invasion by introduced species, support a larger population likely to survive natural mortality rates and, therefore, maintain a sustainable number of species for long-term persistence in an area. Hence, larger patches not only generally contain a greater mosaic of vegetation associations, they also have a greater likelihood of being able to support native wildlife for the future.

The influence of patch size on the ability of a species to maintain adequate genetic variation and adapt to future changes to the landscape, requires a good understanding of the species biology and ecology. Generally, large patches have been found preferable for maintaining species genetic variation within a population; small patches have been found to contain a greater number of individuals with similar genetic composition, which may be beneficial in certain events (Boecklen and Bell 1989). Hence, the conservation of both large and small patches across the landscape is important for the future conservation of native wildlife.

Smaller patches of remnant vegetation may contain habitat for a specialised species and therefore also be important for the long-term conservation of native flora and fauna. In addition, small patches, which maintain a higher abundance of species, in the vicinity of larger patches can enhance species dispersal across the landscape (Fischer and Lindenmayer 2002; Henein and Merriam 1990). Species can thus move through the landscape and replenish populations that have recently declined or become extinct (Friend 1989).

The ability of flora and fauna to adapt and persist in remnant vegetation is influenced by numerous factors, including the distance between patches. The closer together patches are, the more reasonable it is for individuals of a species to interact with each other. This interaction could increase their genetic diversity and survival of the species. The density and fragmentation of vegetation can impact how easily invasive flora and feral animals penetrate into a patch. The greater the fragmentation the easier it is for foxes, cats and dogs to enter the remnant patch; and the further wind and other dispersal mechanisms can transport seeds of introduced plants into the patch; resulting in competition with native species.

Some species are able to adapt to the changing environment by moving into urban areas, such as the Common Brushtail Possum (C. Kemper pers. comm. 2009[24]) and Marbled Gecko (M. Hutchinson pers. comm. 2009[25]), while other species adapt to the changes in vegetation type and composition created by a disturbance (e.g. land clearance, degradation). Whereas, mammals, particularly the Critical Weight Range (CWR) species and small species are less tolerant and sensitive to habitat fragmentation and degradation (Garden et al. 2007; D. Armstrong, pers. comm. 2008). Amphibian species are influenced by patch size but are mainly affected by water quality and cycling (Garden et al. 2006)

Some animals may adapt to weed species. Weeds may provide habitat where native species have been removed or are degraded. Low vegetation, which may be in the form of weeds, is found to be important for reptile species for sheltering, foraging and dispersing, (Garden et al. 2007). When deciding on a revegetation program for a given area it is important to consider what fauna species may be using the existing weeds at the site, and what native plant species may be able to replace those weeds. It is also important to recognise that rubbish (e.g. discarded metal, tin, car bodies) can act in similar ways to that of natural occurring structures which reptiles species may be able to use (Garden et al. 2007). Therefore, conservation management decisions may need to be based on the requirements of single species (Garden et al. 2007).

Western coastal wattle, *Acacia cyclops*, although native to western South Australia, has been found growing along the coast, outside of its natural range (R. Sandercock, pers. comm. 2008). It was initially introduced as a coastal stabiliser for dunes but has become a weedy species in certain areas, and is therefore being removed (R. Sandercock, pers. comm. 2008). However, the plant species produces high amounts of leaf litter that litter-loving reptiles could use. For example, the Common Death Adder prefers dense leaf litter beneath shrubs where it can conceal itself and lure its prey. The severe decline of the adder in some coastal areas is attributed to the loss or degradation of suitable habitat and associated food source.

The introduction of livestock is a cause of land degradation. Land is not only cleared and replaced with introduced plants and grasses for livestock (e.g. cattle, sheep) but the hard sharp edged hooves of livestock can also damage the soil and its micro-organism balance. Livestock may also damage native vegetation, not only by eating adult plants, but by reducing recruitment through consumption of seedlings. The reduction in young plants and shrubby growth affects those animals that require or prefer a dense understorey for protection, in addition to reducing available food sources. Erosion is also more likely in areas where vegetation is removed or cover reduced, destabilising the soil and possibly causing major changes to the landscape.

Predation and competition

All species of native wildlife have some capacity to withstand loss of individuals from the population. However, in heavily cleared, fragmented and isolated environments with introduced competitive and predatory species, mortality rates have increased in many susceptible species.

Introduced species are present in most Eyre Peninsula cells with records, and their impact on the environment varies. Competition by rabbits and sheep and predation by foxes, cats and dogs results in the loss of many native species (Goonan 1993).

Foxes prey on a range of mammals, birds and invertebrates, and target medium to small ground-dwelling and arboreal mammals (Mitchell and Banks 2005). Cats prey on ground-dwelling and

[24] C. Kemper pers. comm. 19 October 2009
[25] M. Hutchinson pers. comm. 26 August 2009

arboreal mammals, birds, reptiles, amphibians and invertebrates (Jones and Coman 1981). The predation efficiency of foxes and cats on native wildlife has been suggested to lead to the collapse of prey populations and, in some cases, their local extinction (Johnson et al. 2007). Beach nesting birds are particularly vulnerable due to the open and exposed nature of the habitat. Domestic dogs can also prey on a range of mammals, birds and reptiles.

Rabbits and sheep compete with many species of our native wildlife. Competition may be directly for food and habitat, or indirectly for shelter as the protective understorey is grazed upon. Native species in high numbers in small areas, such as kangaroos, silver gulls and galahs can also become a pest by out-competing other native species for food and habitat resources.

All terrestrial species that forage and/or nest on or near the ground are at risk of increased predation by introduced species. Species that require dense vegetation for shelter or food may be sensitive to competition with introduced herbivores. Therefore, the management of pest and weeds is important to minimise the decline and loss of native fauna species. There are a number of organisations within the region involved in weed and pest animal control.

Development and human disturbance

Recreation activities along the coastline include shore and boat fishing, bush walking, beachcombing, camping, sightseeing, picnicking, off-road vehicle use, photography, surfing, swimming, bird watching, bird-banding and research. These activities have the potential to affect the behaviour of a variety of wildlife, especially shorebirds and predatory birds. Shorebirds have been observed to reduce their foraging in response to frequent disturbance by humans (Thomas et al. 2003). Walking dogs off-leash and off-road vehicle activity in particular can disturb the nesting, feeding and resting of shorebird and raptor species. The effect of disturbance on the nests of raptors and beach-nesting birds is well known; where nests and young chicks may be crushed on the beach (Commonwealth of Australia 2009; Maguire 2008), or nests and eggs are abandoned with increased disturbance (Dennis 2004; Maguire 2008). Tourism, off-road driving and other recreational activities along the coast are also likely to impact on the numbers of birds and other fauna, especially where habitat is destroyed or altered. Bird watching activities may target areas of high bird abundance and could disturb a number of birds from what would probably be high quality habitat. Therefore, it is important to monitor and regulate these recreational activities and provide protection to areas of high significance and sensitivity, such as the intertidal zone for shorebirds and areas around raptor nesting habitat.

Other acts have a more direct impact on the survival of native fauna. They include illegal destruction and collection of individuals, eggs, and nests.

Development can impact on both the terrestrial and marine environments. With urbanisation and development comes the increased number of fences and barriers, including roads. These barriers prevent the movement and migration of species, especially mammals and reptiles because they lack the ability to fly in order to cross the barriers. Roads, especially those that have a cleared buffer either side of the road, discourage the movement of some smaller mammals and reptiles across the open, unprotected area because of the increased threat of being seen by predators. The ability to cross and move around and within areas without barriers is important for the mixing of genes between populations and also for animals to escape predators without being trapped against a fence (except for birds).

An increase in regional development also increases surface runoff, through the introduction of physical infrastructure particularly in the form of areas of concrete and bitumen. The associated increase in the human population also creates more treated sewage. As a result of the increase in treated sewage being released into the sea, higher nutrients can be expected around the coastal settlements, impacting on seagrass, invertebrates populations and hence the numbers of shorebirds. Regional development also encourages farmers to subdivide their land, selling off the more profitable areas; those close to the coast, again, increasing development and pressures along the coast. A large population also increases pressures on freshwater systems, such as the Pt. Lincoln basin. If alternative sources of fresh water are needed, impacts of 'producing' water could create more environmental issues in the future; for example from desalination.

Increased urbanisation also impacts the land and soil directly, through compaction. Soil compaction prevents and or hampers burrowing species, such as frogs, reptiles and mammals from creating homes and shelters. Compacted soils also have less vegetation that many species require for shelter or foraging. Much of the South Australian human population is concentrated on the coast, which has negatively impacted on the number of seabirds (Copley 1996).

The few wetlands present near the Eyre Peninsula coast provide important habitat for amphibian species and refuge areas for migratory birds to stock up on food before their flight back to their breeding ground. Modification or alteration of these ecosystems can impact on a range of fauna species, including many types of birds, mammals, reptiles, amphibians, invertebrates and fish. Altering the natural habitat changes the local environment's capacity to store/hold water, especially during rain periods; which is an important characteristic of the land for frogs. Local extinctions can also occur in systems that have been converted to permanent water storages (Wassens 2005) or been drained completely. Wetlands and surrounding watercourses can also become contaminated by the use of pesticides in surrounding areas. The impact of the use of chemicals especially influences invertebrate and frog species as they are sensitive to changes in water quality (Harley et al. 2005; Frog Census nd) and are good indicators of environmental change (Jansen and Healey 2003). The pesticides and chemicals can also enter the marine environment, causing a build-up of nutrients resulting in seagrass die-back or algal blooms (Copley 1996).

The fishing and aquaculture industry is important to, and prevalent in the waters off the Eyre Peninsula, but these businesses also impact the natural coastal and marine systems by removing food stocks, altering marine habitats and creating pollution (Copley 1996; EP NRM 2009). The fishing and aquaculture processes impact on the coastal environment by altering the food resources available to fauna (such as birds and marine mammals), creating unnatural levels of pollution, increasing hazards and disturbances and in some cases changing the movement of sediment (through the destruction of seagrasses, and alteration of bay systems) (EP NRM 2009). For example, cockle collection increases sedimentation, removes seagrass and disturbs the sand bottom, all which impact on the food and resting sites for shorebirds. Entanglement and by-catch can cause injury or death, and also threatens marine life as a result of human interaction (DEWHA 2007). The fishing and aquaculture industry, including the cockle industry should be monitored for their impacts. Restrictions are an option to control and protect some important areas, such as limiting the number of licenses, and or the location where fishermen are permitted to take species, such as set distances from major shorebirds sites.

Between 1991 and 2000, an annual litter survey was conducted on 26 km of Anxious Bay beach, fore dunes and frontal edge of the main dunes. The aim of this survey was to monitor compliance as part of the Commonwealth obligation under international treaty MARPOL – the international convention covering the prevention of pollution of the marine environment by ships from operational or accidental causes (IMO 2002). The majority of debris washed ashore originates from commercial fishing activities within the Great Australian Bight; such as bait buckets, pots, rope, plastic bait wrapping and plastic packing bands from bait boxes (Edyvane et al. 2004). An overall reduction in ocean or ship-based litter was found over the period of the study. The reduction in marine litter collected could be due to a significant reduction in fishing effort in the region and greater compliance with international litter regulations (Edyvane et al. 2004). Levels of glass and soft plastic (general rubbish) collected from the Anxious Bay survey has reduced by 93%. Surveys on other parts of the Eyre Peninsula coast that have recently begun, have resulted in the collection of large amounts of debris, especially small pieces of rope (less than 10 cm long) (K. McEwan pers. comm. 2009[26]). Further education and enforcement of correct rubbish disposal may help reduce the level of rubbish on beaches, and hence reduce the threat to fauna.

Toxic spills, especially of oil, also impact not only the marine environment but also the coast; through oil washing up onto the coast. Many of the pressures that affect these areas are focused in shallow coastal waters where subtidal and sand mudflat habitats exist. These areas are very diverse and are important feeding and breeding habitats for many shorebirds and are also sensitive to environmental change (EPNRM 2009).

Climate change (see also section 4.11)

Climate change may affect the distribution, abundance and status of numerous species. As a result of changes in temperature and rainfall species will have to alter their feeding habits and/or distribution within habitats in order to survive. Rehfisch et al. (2004) found the distribution of species may also alter following changed season parameters, such as mean winter temperature and rainfall. Predictions from the CSIRO indicate that by 2070, the temperature could increase by 1.5°C to 2.0°C (depending on emissions), with an increase in the frequency of hotter days over 35°C, and fewer frosts (CSIRO and Bureau of Meteorology 2007). In a low emissions scenario, there is expected to be about a 10% chance the temperature will rise by more than 2°C in most Australian coastal areas. Annual rainfall is expected to decrease in the southern areas of Australia; decreases of around 10% to 20% less rain is estimated by 2070 (CSIRO and Bureau of Meteorology 2007). A number of reptile species are only found in specific locations, and changes to temperature and or rainfall could further limit their distribution. For example, in South Australia the Western Three-lined Skink is only found on the southern tip of the Eyre Peninsula, and two other species, Beach Slider and Bight Coast Skink are restricted to a narrow strip of suitable coastal habitat on the west coast of Eyre Peninsula and the Far West coast and a few off-shore islands.

As a result of climate change, sea levels are rising; current projections indicate that sea levels could rise up to 80 cm by the end of the century (CSIRO 2009). With rising sea levels, salt marsh, intertidal reefs and low-lying rocky shoreline areas, such as at the base of Point Labatt (Figure 3.69) may become flooded with sea water. Where possible, these systems will retreat further inland over time, however, this can not always occur. Areas at the base of cliffs, areas with large dune barriers and areas that have had changes in land use may be unable to retreat or counteract the rise in sea levels, resulting in the loss of habitats, particularly for shorebirds, including migratory species which travel long distances to the same area each year.

Small low-lying islands will also suffer as they disappear under rising sea levels. The loss of small islands is likely to impact on fur seals, sea-lions, penguins and sea birds, as they loose their haul out or breeding sites. Sea levels rise as a result of melting ice sheets; the acidity of oceans has increased significantly due to greater quantities of dissolved carbon dioxide, while salinity levels have decreased (CSIRO 2009). It is possible changes in water quality may also affect marine fauna, either directly, or indirectly.

[26] K. McEwan pers. comm. 30 October 2009

FIGURE 3.69 The low shore platform at Point Labatt, used by Australian Sea-lions and birds for breeding, feeding and resting may become inundated with sea level rise. Photo: N. Rubbo.

Loss of hollows

Several species recorded on the Eyre Peninsula coast, including the state Vulnerable Greater Long-eared Bat and Rare Major Mitchell's cockatoo, require hollows for nesting and roosting sites. Many non-threatened native fauna also use hollows, such as the Australian Owlet-nightjar, Mulga Parrot, Tree Martin, Gould's Wattled Bat, Chocolate Wattled Bat, Lesser Long-eared Bat and Southern Forest Bat.

The number of available hollows for roosting or nesting is likely to have declined where land has been cleared for agriculture or development, near tracks, car parks and campsites because of the collection of firewood and nest hollows for the captive bird trade.

Wildfire and changed fire regime

In a fragmented and isolated landscape, wildfire can devastate local populations resulting in local species extinctions. However, the ability of a species to survive a wildfire may be outweighed by its resilience to the subsequent changes in resource availability. For some species, loss of scarce resources through wildfire is as catastrophic as the fire itself.

Species without natural fire responses, such as travelling large distances quickly or taking appropriate shelter, may not escape a wildfire front or be able to locate resources after the event. For example, the Splendid Fairy-wren, *Malurus splendens,* is known to decline in frequently burned areas and needs several years to return to pre-fire numbers (Rowley and Brooker 1989). In addition to most small mammals and reptiles, a number of bird species, such as the Black-faced Woodswallow, Weebill, Western Yellow Robin, Shy Heathwren, Rufous Fieldwren and White-winged Fair-wren may be affected by wildfire.

Altered fire regimes have occurred as a result of human interference; as humans try to control the frequency and intensity of fire. Where possible, the creation of fire mosaics would aid fauna conservation, by creating patches of land with different times since fire. This technique can help prevent large patches of habitat being burnt at once, leaving little vegetation and habitat and resources for those species which survived the fire (Bradstock et al. 2002).

Illegal destruction

Activities known to cause a decline in native fauna and fauna include hunting, poisoning, egg collecting and vandalism of bird nests.

All native birds, mammals and reptiles are protected under the *National Parks and Wildlife Act 1972*. Individuals are required to obtain a permit to keep native species in sanctuaries, possess rare or prohibited species, release prohibited or controlled species, keep more than one, sell or import protected animals, hunt, and poison or manage native wildlife (Bates 1983).

3.3 Heritage

Aboriginal and European heritage sites have been used in the process of assessing conservation priority within the Eyre Peninsula coastal region. Aboriginal heritage sites have been buffered, and so only generalised location is shown for these.

3.3.1 Aboriginal Heritage

The Eyre Peninsula Natural Resources Management Plan 2009 describes the occupation by traditional owners of the coastal lands, plains and deserts of the region. The following excerpt is from Volume 4 of the plan, State of our Resources, Section 3.2 Aboriginal Heritage:

> "Eyre Peninsula has been home to Aboriginal people for thousands of years, with the Nauo (southwestern Eyre), Barngarla (eastern Eyre) and Wirangu (northwestern Eyre) being the predominant original cultural groups present at the time of the arrival of Europeans (Tindale 1974 in DEH 2004a; SATC 1999)."

Whilst the above mentioned groups were predominant, other Aboriginal tribal groups have connections with country across the Eyre Peninsula.

> "During initial European contact the population of Aboriginal people on the peninsula is estimated to have been no more than about 2000 individuals (Berndt 1985 in Welz 2002). The number of people in each language group varied, as did the size of the territory they occupied. In the northern parts of the State, tribal areas tended to be large and boundaries were not always well defined. Along the coast where water and food resources were more easily accessible, smaller tribal areas had loosely defined boundaries. All Aboriginal groups on Eyre Peninsula are known to have used a wide variety of native plant and animal (including fish) species for food and other resources.
>
> No comprehensive, wide ranging or exhaustive study has been undertaken for Eyre Peninsula to date. Many sites of cultural significance are recorded under the State Heritage Register but there are many unrecorded sites of major significance to Aboriginal people."

Aboriginal heritage is protected under state and Commonwealth legislation. The South Australian *Aboriginal Heritage Act 1988* protects all aspects of Aboriginal cultural heritage within the state. Under this Act it is an offence to damage, disturb or interfere with Aboriginal sites or objects without written permission from the Minister for Aboriginal Affairs and Reconciliation (section 23) and any 'discovery' of an Aboriginal site, object or remains must be reported to the Minister (section 20). The Department of Premier and Cabinet also maintains a Register of Aboriginal Sites and Objects. All sites are protected, whether or not they are listed in the register.

The Commonwealth's *Aboriginal and Torres Straight Islander Heritage Protection Act 1984* also provides protection to Aboriginal areas, sites and objects and contains similar, but not identical, provisions to the state legislation.

Aboriginal heritage sites registered with the Department of the Premier and Cabinet, Aboriginal Affairs and Reconciliation Division have been used in the conservation analysis. These sites are buffered on the digital maps to the cell level: thus if the cell contains one or more registered site, the whole cell would be given a high value for this digital layer. This process had two values for the analysis: firstly, Aboriginal sites contributed to identification of places with a high

conservation priority; secondly, the digital layer flags to users of this report, areas where there are registered Aboriginal sites. This aims to trigger a dialogue between users of the locality and the Aboriginal custodians of the site.
There are obvious shortcomings in this form of analysis. Many sites of great significance to Aboriginal people are not registered. The analysis identified 49 cells with registered sites and 36 with no registered sites. As mentioned above, Eyre Peninsula has not had a regional, all-encompassing Aboriginal cultural heritage survey, and therefore the cells with no registered sites may not have been surveyed, rather than have no significant sites or objects.

The buffering of registered sites within the analysis introduces another problem: they are to some extent protected but within the analysis their value is diluted by extending it over a large area. To take an extreme hypothetical case: if all significant sites were recorded and located on the digital map, it is likely that there would be one or more in every cell and thus the entire coastal region would receive the same priority score. No areas would be discriminated from others and the object of the analysis would be defeated. In reality, the process has identified 49 coastal cells as containing one or more registered significant sites. Clearly, buffering reduces the spatial discrimination of the analysis and the scoring method does not introduce any relative values for differing sites or cells with numerous registered sites.

3.3.2 Non-Indigenous Heritage

There are a number of non-Indigenous heritage registers currently in use in Australia: World Heritage, National Heritage, Commonwealth Heritage, Register of the National Estate (RNE), State Heritage and Local Heritage. These are discussed in more detail in Appendix 8. There are no places recorded in the World or National heritage registers within the EP coastal boundary.

All non-Indigenous heritage sites with legislated heritage protection in South Australia are recorded in the South Australian Heritage Register Database (SAHRDB). This includes places of State significance as well as other categories of heritage places in South Australia including World, National, Commonwealth, local and contributory places. Other places of heritage significance, which were identified in regional heritage surveys commissioned by the Heritage Branch of DENR, are also included in this database.

Cultural heritage places that are protected by legislation (World, National, Commonwealth, State, Local and Shipwrecks) are generally deemed to have significance according to specific criteria and so have values that should be protected and conserved.

The majority of coastal townships in the Eyre Peninsula were established because of their connection with the sea, providing a service centre and link between the farming (or mining) activities nearby and the ships which provided transport to other parts of the state, Australia or the world.

There are 190 non-Indigenous built heritage sites recorded within the Eyre Peninsula coastal region, this includes 21 State Heritage Places, 32 Local Heritage Places and 137 Identified Places. Many of these are buildings within or outside townships that are unlikely to be the subject of coast or land care action within the region. However, many of these sites have a maritime connection and still add conservation value to their localities and are relevant to the management decisions within the area. Table 1 in Appendix 8 provides a full list the built heritage sites within the study area, which includes jetties, landing sites, anchors and former whaling sites. An example is the whale bone area and Point Fowler structure, which is a result of European whalers during the early 1840s and is indicative of the early whaling industry, one of the first successful export industries to be established in South Australia.

Over 800 shipwrecks are recorded along South Australia's coast and inland waters reflecting the state's significant maritime history. However, the position of many of these wrecks is unknown or estimated. The remains of these vessels are important historical, educational, recreational and tourism assets. Therefore, shipwrecks that occur within the project area have also been included within the conservation analysis. There are 15 shipwrecks that occur within the Eyre Peninsula coastal region, of these six are protected under the state or National legislation. Only three of the 15 shipwrecks have been found, these are; the 'City of Adelaide' at Port Lincoln, the 'Cecelia' at Port Le Hunte and the 'Lucy Flinders' at Sheringa Lagoon.

Heritage places identified as part of this study that are not covered by legislation are still deemed to have some cultural significance and conservation value. Most of these have been identified by qualified professionals in the course of heritage surveys or assessment work, but have not been formally included in statutory registers for a number of reasons, particularly the 'voluntary' nature of the establishment of Local Heritage lists by local councils.

3.4 Geology and geomorphology

The Eyre coastal region encompasses many types of coastal landform, including tidal sandflats, mangroves, calcareous and mineral beach ridges, estuaries, sand beaches, dunes, cliffs and steep headlands. This variety is a result of the dynamic interaction of the processes of wave action, wind and runoff with underlying rocks and sediments.

3.4.1 Significant geological features

A significant geological feature (formally known as a geological monument) "is a site showing features of outstanding geological or physiographic significance that is considered by the community of earth scientists to be worthy of conservation" (McBriar and Giles 1984, p.2). These features are examined in the field and assessed in terms of being representative of wider features or rare. Taken together, the significant geological features should represent the geological history of the state.

Significant geological features do not have any particular extent and may be very large areas or a very small site. They may be a site or feature with aspects of geology or geomorphology such as a fossil locality, a type section, a landform, or a distinctive structural feature (Geological Society of Australia Inc., Heritage Policy). The Geological Society of Australia (GSA) uses the following definition:

> *"significant geological features are those features of special scientific or educational value which form the essential basis of geological education, research and reference. These features are considered by the geological community to be worthy of protection and preservation."*

The list of significant geological features is reviewed and revised by the Geological Heritage Sub-committee of the SA Division of the Geological Society of Australia Incorporated. Information on significant geological features is stored at Primary Industries and Resources South Australia (PIRSA) and at the South Australian Museum.

Significant geological sites provide the principal visual evidence from which the geological history of the region has been written and taught. Geology and related landform variation provides the basis of the scenic attraction of many parts of the coast. Thus the geology and geomorphology of the coast is of both scientific and economic value to the region and its natural resources management.

The sites listed in this report contribute in important ways to the documentation of the geological history of the region, as identified by the leading geologists of the state, and supported by published reports. As such they are of high conservation priority, and a score assigned to the site within the analysis represents this. The presence or absence of a significant geological site within a coastal cell can be seen in the digital maps that form part of this report.

Conservation of significant geological features

Significant geological features are irreplaceable and need to be conserved but the means of conservation varies from site to site. Some need protection by isolation; some need protection by reservation; others by fencing or access control; while more well-known sites may benefit from local interpretation. Almost all are threatened if development and earthmoving are proposed at the site and the list of these features should be included in council development plans, in order to inform such decisions.

Sites or features identified as a significant geological feature are not automatically protected under legislation through that process, although they may be protected under some other legislation, such as the *NPW Act 1972*, *EPBC Act 1999*, *Heritage Places Act 1993*, *Crown Lands Management Act 2009*, *Development Act 1993*, or the *Aboriginal Heritage Act 1988*. However, if a site is not within a reserve created under the *NPW Act 1972*, is not on the State or National heritage registers, and is not identified within the council's development plan, it may have little legal protection and may be vulnerable to damage, degradation or destruction.

The PIRSA website on Geological Monuments states: "At the outset of the process of designating geological monuments, it was thought that protection should precede any publicity as this would inevitably increase visitation which would likely lead to damage. Attitudes throughout the community have changed since that time and it is now accepted that, except for rare and vulnerable features, the location of sites needs to be publicly known if they are to be effectively protected".

3.4.2 Significant geological features within the Eyre Peninsula coastal region

Significant geological features within the study area are distributed throughout all parts of the coast. The list below has been compiled from the DVD 'Geological Monuments in South Australia, March 2008' produced by the PIRSA Customer Services Branch. Original descriptions and maps are held by PIRSA, State Library SA and the Geological Association of Australia South Australian Branch.

Douglas Point

GSA reference	W1.4; Locality 4; Part 1
Cell(s)	EP1
Significance	The Backy Point Formation of Mesoproterozoic (now believed Neoproterozoic – ie. 1,000-542 million years ago) age, which consists of gritty, heavy mineral-laminated cross-bedded sandstones and conglomeratic-sandstones, unconformably overlies the Mesoproterozoic (1,600-1,000 million years old) intrusive Cultana Granite of the Hiltaba Suite.
Preservation state	Appears to be adequate.
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	30km north-east of Whyalla

Backy Point

GSA reference	W1.5; Locality 5; Part 1
Cell(s)	EP1 and EP2
Significance	Unconformity between the sedimentary sequences of the Palaeoproterozoic (2,500-1,600 million years ago) Moonabie Formation and the overlying Mesoproterozoic (now believed Neoproterozoic) Backy Point Formation conglomerate and extrusive amygdaloidal lavas.
Preservation state	Appears to be adequate.
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	Approximately 22km north-east of Whyalla

Arno Bay

GSA reference	E24; Part 3
Cell(s)	EP13
Significance	Low coastal cliffs (4 – 10m) exposing a laterite and associated pallid zone profile of Tertiary age and overlain by thin bed of probable Pleistocene Pooraka Formation. Active erosion leads to caves, platforms, stacks and 'badlands' immediately inland
Preservation state	The features are well displayed and susceptible to erosion from wave action, but under no obvious human threat
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	The cliffs begin approximately 4km north-east of Arno Bay at Redbanks, and run a further 10 km north-east.

Port Neill - Kalinjala Mylonite Zone

GSA reference	E39; Part 8
Cell(s)	EP17
Significance	Part of the type locality of the Palaeoproterozoic Kalinjala Mylonite Zone of the Kimban Orogeny. Part of an intensely deformed band of rocks extending from Sleaford Bay to the Middleback Ranges, which corresponds with marked magnetic anomaly. The products of extreme metamorphism may be seen. Of educational and research value into mylonite formation.
Preservation state	There appears to be no current threats
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	Headlands at Port Neill

Southern Eyre Peninsula (Kirton Point)

GSA reference	E2.1; Locality 1; Part 1
Cell(s)	EP27 and EP28
Significance	Palaeoproterozoic Lincoln Complex metasediments with meta-dolerite intrusives. Of value for research into the age relations of Precambrian rocks in South Australia. Dating analysis of some of the granite gneiss in this area was found to be 1845 (±10) million years old (Ma).
Preservation state	There appears to be no threat
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	City of Port Lincoln, approximately 2 km east of city centre

Cape Donington

GSA reference	E31; Part 6
Cell(s)	EP30 and EP31
Significance	The only known occurrence in South Australia of quartz gabbronorite gneiss, which is part of the Donington Granitoid Suite of the Palaeoproterozoic metasedimentary Lincoln Complex. Contains numerous xenoliths. This is a rare roack-type. The gabbronorite gneiss is believed to be the earliest intrusive of the Donington Suite, having an age of 1,843 ±2 million years ago. At the time of the original dedication as a monument there was some uncertainty over the origin rocks which had been metamorphosed.

Preservation state	There appears to be no current threat to the outcrop
Protection	National Estate: Y – place no. 11568, registered on RNE; State Heritage: N; Protection in Park: ✓, Lincoln NP
Comments	Located at the top end of the Cape Donington Peninsula, Lincoln National Park. The outcrops are in shore platforms.

Southern Eyre Peninsula (Cape Donnington to Cape Catastrophe)

GSA reference	E2.2; Locality 2; Part 1
Cell(s)	EP30, EP31 and EP32
Significance	Intrusive and metasedimentary rocks of the Palaeoproterozoic Lincoln Complex including the only known occurrence (at the time of writing) of charnockite (hypersthene granites) in South Australia, which is a rare rock-type on a world scale. Of petrological interest
Preservation state	These rocks generally crop out in rugged cliffs. There appears to be no threat
Protection	National Estate: N; State Heritage: N; Protection in Park: ✓, Lincoln NP and Memory Cove WA
Comments	10km east of Port Lincoln on Jussieu Peninsula

Southern Eyre Peninsula (Fishery Bay to Cape Carnot)

GSA reference	E2.3; Locality 3; Part 1
Cell(s)	EP33 and EP34
Significance	Metasediments and basic intrusives of the Archaean Carnot Gneisses of the Sleaford Complex are some of the oldest known rocks in SA; dating at Cape Carnot indicates an age of 2,750 to 2,100 Ma. Of interest for research into age relations. At Fishery Bay garnet gneiss layered with variants are seen; at Cape Carnot rocks consist of a series of mafic and felsic layers
Preservation state	These rocks generally crop out in rugged cliffs. There appears to be no threat
Protection	National Estate: N; State Heritage: N; Protection in Park: N, part within HA
Comments	Outcrops extend from Redbanks in the west to the western end of Sleaford Bay. Access for scientists needs to be preserved; currently along the privately owned Whalers Way

Cape Carnot

GSA reference	E8; Part 2
Cell(s)	EP34
Significance	Metasediments of the Archaean Sleaford Group (now Sleaford Complex) with intrusive granite, dolerite dykes, and younger pegmatites and aplites. Some of the oldest known rocks in SA. Of value for studying age relations
Preservation state	These are strong and resistant rocks. There appears to be no threat.
Protection	National Estate: ✓ - place no 14297, registered on RNE; State Heritage: N; Protection in Park: N, part within HA
Comments	The Sleaford Complex is exposed along the western peninsula at Cape Carnot, and along the shore leading to the eastern promontory; the exposures are in a shore platform, covered inland by aelianite

Drummond Point

GSA reference	E28; Part 4
Cell(s)	EP45
Significance	Shore platforms (backed by degraded aeolianite cliffs) representing former Tertiary weathering surfaces (Twidale et.al. 1977); mylonite zone of probable early Tertiary age; and unweathered intrusive Palaeoproterozoic Kiana Granite – at c.2,400 million years bp it is amongst the oldest rocks in SA
Preservation state	There appears to be no threat.
Protection	National Estate: ✓ - place no 15015, registered on RNE; State Heritage: N; Protection in Park: N
Comments	Between Coffin Bay and Elliston, 9 km due west of Mount Hope

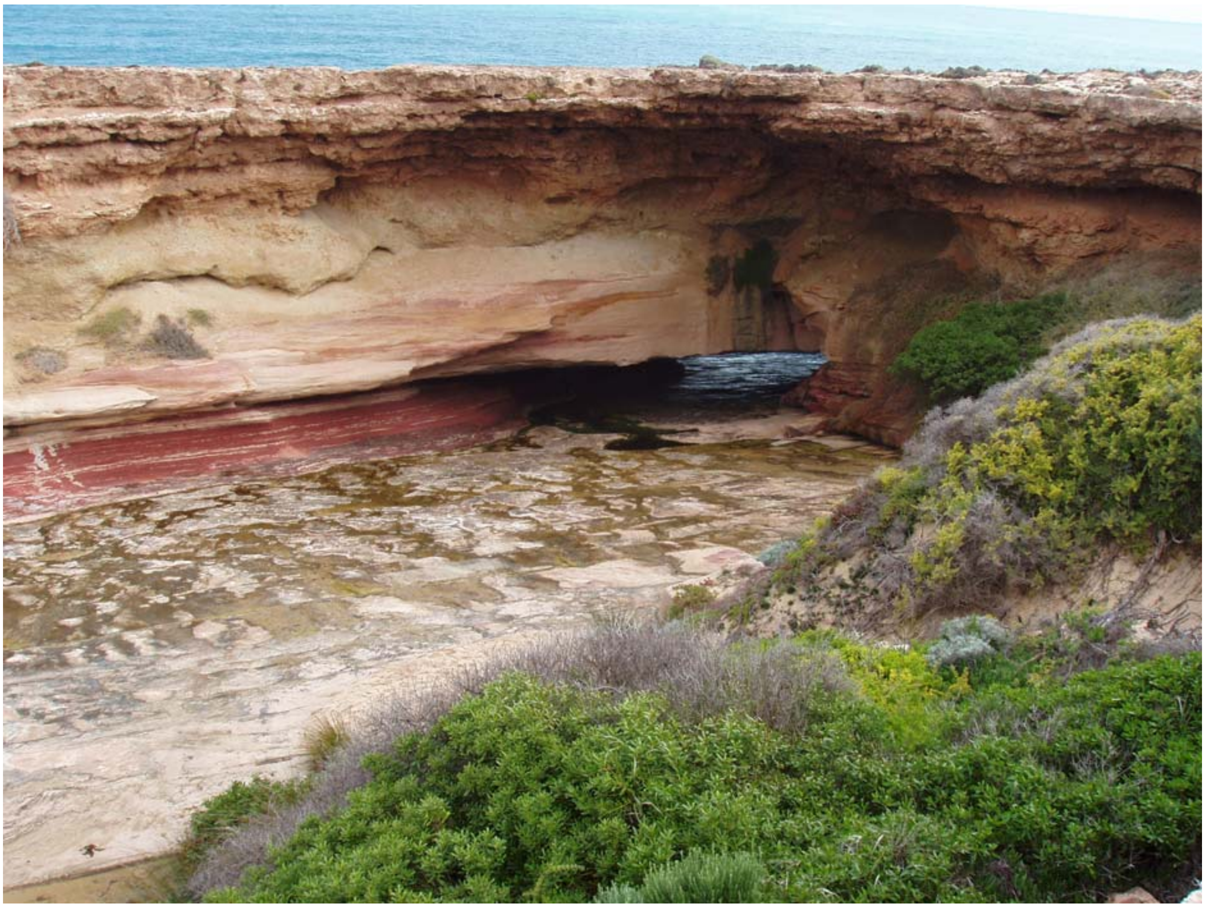

FIGURE 3.70 Talia caves, calcarenite over basement rocks. Photo: Sharie Detmar

Talia Caves

GSA reference	E23; Part 3
Cell(s)	EP53
Significance	Caves cut by wave action at the base of sea cliffs of Pleistocene Bridgewater Formation aeolianite overlying Mesoproterozoic Pandurra Formation (now referred to Palaeoproterozoic Blue Range Beds). Also a spectacular mobile Holocene dunefield to the south of scenic beauty and geomorphological significance.
Preservation state	The vegetated dunes are threatened by off-road vehicle activity.
Protection	National Estate: N; State Heritage: N; Protection in Park: N

Comments	The original nomination suggested this should be part of a conservation park, together with the dunes to the south and the Lake Newland wetland. Lake Newland CP does not include the caves

Smooth Pool

GSA reference	E36; Part 7
Cell(s)	EP63
Significance	Wide intertidal shore platform with good exposures of granitoid and basic intrusives of the Archaean Sleaford Complex. Of value for research into rock relations. Twidale et al 1977 explains the considerable width of the shore platform as a late Tertiary weathering feature
Preservation state	There appears to be no current threats
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	Part of the complex Westall Peninsula, 25km south-west of Streaky Bay

Point Brown

GSA reference	E33; Part 7
Cell(s)	EP70
Significance	A rare South Australian occurrence of compositional banding and rhythmic layering in a granitic rock which occurs here in an intrusive Palaeoproterozoic granodiorite dyke; other features of Proterozoic intrusion are also seen. The exposure is on a shore platform, backed by aeolianite that runs around the entire peninsula. The granodiorite banding is best seen in a small area at the north-east part of the headland
Preservation state	There appears to be no current threats
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	Located on the prominent headland which separates Smoky Bay and Streaky Bay

Port Le Hunte: Pleistocene Outcrops, Jetty Exposure

GSA reference	E35.2; Locality 2; Part 7
Cell(s)	EP80
Significance	Good exposure in a cliff face of the upper and lower members of the sedimentary Pleistocene Bridgewater Formation. Most cliffs on the West Coast are in the Late Pleistocene Bridgewater formation: at Port Le Hunte both the upper and lower parts of the formation are exposed.
Preservation state	There appears to be no current threats
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	Port Le Hunte is on the eastern side of Point Sinclair, a calcarenite headland 65 km west of Ceduna; sandy bays, backed by Holocene transgressive dunes extend on both sides of the headland. The famous break at Cactus, just west of Point Sinclair, is over a calcarenite reef

Port Le Hunte: Pleistocene Outcrops, Glanville Formation Exposure

GSA reference	E35.1; Locality 1; Part 7
Cell(s)	EP80

Significance	One of the rare known exposures of the contact between the Pleistocene fossiliferous beds of the Glanville Formation and the overlying Bridgewater Formation; of value for research into the stratigraphical relations of these beds. Dating from similar strata in upper Spencer Gulf place the *Anadara trapezia* within the Glanville Formation at c.100,000 years., indicating warm bay/estuarine conditions and a high sea level
Preservation state	There appears to be no current threats
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	65km west of Ceduna; adjacent to a small lake immediately inland of Point Sinclair, 3km north of the jetty at Port Le Hunte

Clare Bay

GSA reference	E34; Part 7
Cell(s)	EP82
Significance	Indurated sedimentary beach calcarenite of Pleistocene age in two raised shore platforms which illustrate the coastal processes and sea level changes operating in SA during the Quaternary. Buckley et al, 1987, suggest a late Pleistocene age for the higher, 3m, platform; this backed by an aeolianite cliff. Twidale et al (1977) has suggested that a number of these flights of platforms around the Eyre Peninsula are Recent, forming now due to 'pool' weathering along lithological changes in the aeolianite
Preservation state	Good, as the feature is above the level where it will be affected by wave action. While long term weathering and erosion may change the feature, it will not reduce it's significance.
Protection	National Estate: N; State Heritage: N; Protection in Park: N
Comments	A 10 km section of rocky coast 25km west of Fowlers Bay township

FIGURE 3.71 Clare Bay, raised shore platforms indicate previous higher sea level. Photo: Coast Protection Board, 2007.

4 Threats

4.1 Recreational activities

Recreational activities are popular along the coast and have many impacts on the environment. They often take place in areas of highest conservation value, increasing the need for appropriate management. On the long list of recreational activities along the coast are off-road driving, camping, fishing, hunting, sight-seeing, sandboarding, swimming, walking and surfing. These activities can be a direct or indirect threat to conservation values. The coastal areas of Eyre Peninsula are very popular for a huge variety of recreational uses (and some commercial uses), most of these uses bring with them two activities that are the focus of this section: camping and day use; and vehicle tracks, particularly by off-road vehicles (ORV).

The coast has highly sensitive vegetation and soil, and tends to have slow recovery times, and is thus highly susceptible to damage by vehicles and camping. Damage is often exacerbated by the harsh conditions that frequently affect the coast.

The impacts of vehicles and camping on coastal environments are quite similar and include:

- wildlife disturbance, harassment, displacement and destruction, including disruption of wildlife feeding and breeding and/or disruption of predator-prey relationships – the effects of ORV noise on wildlife is reviewed in http://www.wildlandscpr.org/biblio-notes/impacts-off-road-vehicle-noise-wildlife; the effects of vehicles and recreational activities on shorebirds, mammals and reptiles has been discussed in Section 3.2 – Fauna. Beach-nesting birds are particularly threatened by these activities, since seasonally they lay eggs on the beach a little above HWM protected only by camouflage, blending in with the sand. For example the Hooded Plover (vulnerable in SA), breeds in various locations around the Eyre Peninsula coast. Breeding sites that have ORV and/or camping increases the pressure on this species, it is estimated that 95% of eggs are lost in Southern Australia, because of pressure of use on beaches(see Maguire, 2008, Chapter 2);
- vegetation and wildlife habitat change, fragmentation or destruction. This includes pedestrian and vehicular traffic impact on vegetation, collection of firewood, creation of access tracks and increased risk of wildfire;
- introduction of weeds and plant diseases. This is especially evident in the spread of weeds that flourish in disturbed areas of soil such as Pyp Grass, *Euphorbia sp.*, Gazania and Beach Daisy for example. Tracks and deflated dunes are often colonised first by these plants, spreading then into intact vegetation;
- soil disturbance, compaction and degradation. Dune blowouts are obvious examples of this impact, but also compaction of soils on samphire flats and cliff tops may inhibit vegetation growth or colonisation and/or increase run-off erosion. Disturbed beach sediments are more likely to become mobile and thereby lost to the beach system;
- beach compaction, leading to crushing of microscopic life forms within the sand. The impacts on beach meiofauna are well documented, (see e.g. Schlacher et al 2008). The consequent impacts on shorebirds and fish that rely on this food source are not well understood;

- litter, waste (including human waste) and other pollution. Litter surveys show that large volumes of rubbish and debris wash up on the beach, with consequent fauna, amenity and safety impacts. Similarly, rubbish and waste left by fisherman, campers and other visitors to the coast is a costly and harmful reminder of visitation;
- loss of heritage and amenity values. There are numerous Aboriginal Heritage sites along the Eyre Peninsula coast that maybe being impacted by vehicles and/or human disturbance. The scenic amenity of the coast is jeopardised by networks of tracks and damage to headlands.

Other impacts from camping and vehicles may include animal captivity, collection (e.g. of plants, rocks, cultural artefacts), chemical pollution, disfigurement of the landscape and coastline, alteration to drainage patterns and vandalism.

4.1.1 Camping and Day Use Areas

Camping and day use areas include formal and informal camping areas and car parks. Formal camping takes place in a caravan park or a camping reserve designated by, for example, council, community, property owner or DENR. These sites may require a permit and may have basic facilities such as toilets, bins, fencing. Informal camping happens outside of designated camping reserves where people camp for one night or more. Car parks and day use areas, like camping areas, may be formalised specifically for that purpose, whereby they may have some facilities such as barriers defining the area, toilets, shelters, etc, or they may be informal areas in any location, with no facilities that people utilise for recreational activities.

Many people taking part in recreational activities or taking a rest stop while travelling, camp along the coast. Significantly more people have been coming to the area over the years, facilitated by improved transport infrastructure (road and vehicle) and therefore quicker travelling times. More people increase the pressure on camping areas and the coastal environment.

The Eyre Peninsula region is a popular camping destination due to its popular fishing, surfing and scenic locations. Many formal bush camping areas are provided around the coast, these include areas within NPWSA reserves (eg. Lincoln NP, Coffin Bay NP, Lake Newland CP, Laura Bay CP, Point Bell CP, etc), Council reserves (eg. Farm Beach, Baird Bay, Lipson Cove, Sheringa, etc) and on privately owned land (eg. Westall Way, Sceale Bay, etc). There are also many caravan and tourist parks located around the coast.

Much of the Eyre Peninsula coast is subject to informal camping, which often occurs in sensitive areas, such as native vegetation, sand dunes or cliff tops. Informal camping also occurs in formal and informal car parks. As informal camping areas do not provide any facilities, there is an increased risk of impact on the surrounding environment eg. from waste (including human waste), wildlife and vegetation disturbance or destruction and soil disturbance. Informal camping is also often linked to increased ORV tracks. Education and signage on permitted camping areas, combined with control of ORV tracks is likely to reduce informal camping.

4.1.2 Off-road vehicles and tracks

ORVs can be 4-wheel drives, 2- and 4-wheel motorbikes, dune buggies and conventional vehicles that are driven off designated roads. The coast is a popular area for people to use ORVs to get to remote fishing, scenic, picnic or camping areas, to cross dunes and travel along beaches, or for the general 'fun' of driving off road or to out-of-the way places. ORVs have already caused significant damage to coastal areas in the Eyre Peninsula region.

Historically little thought was given to vehicles travelling through untouched coastal areas, creating a myriad of poorly formed and located tracks through native vegetation. Over time an increase in the number of vehicles capable of travelling off road has seen a significant increase in the use of ORVs on the coast and thereby the impacts and damage caused by them. In 1980 Cullen & Bird wrote in a report for the Coast Protection Board:

> "*Such vehicles have long been used by fishermen and others to cross dunes and travel along beaches, but in the last few years there has been a dramatic increase in the ownership of such off- road vehicles and this is now seen as an important recreational activity*" (Cullen & Bird, p.36)

This trend has continued, and in recent years there has been a further increase in 4WDs and motorbikes, together with the addition of quadbikes, and also in numbers of small boats and jet-skis launched from trailers on beaches. ORV activity has been shown to have a significant impact on dune stability (Anders and Leatherman 1987; Stephenson 1999) and the improvement of 4WDs and quadbikes is likely to have increased the pressure on the coast as well as fish stocks and disturbance on beach nesting birds, such as hooded plovers, by allowing fishermen to get to previously inaccessible areas. Unregistered vehicles, such as quadbikes and unregistered motorbikes are not allowed in parks (eg. conservation parks or national parks) or on public roads, which includes beaches and tracks on coastal reserves.

In addition to the conservation threats, ORVs are seen as a threat to human safety on many beaches near to towns and cities, e.g. Waikato beaches, New Zealand (Waikato Regional Council, 2010).

Off-road vehicle analysis

Tracks were used in the 'threatening processes' analysis to represent ORV activity. Existing road and sand dune databases were used, together with additional mapping of tracks undertaken by DENR utilising the most current aerial and oblique photography (which varied between 2004 and 2009). It should be noted that where 2004 and 2008 or 2009 aerial imagery was available, a significant increase in the number of tracks was clearly evident in a number of locations. Therefore, where only 2004 aerial imagery is available and in areas where tracks are hard to identify from aerial imagery (eg. areas with tall vegetation, salt marsh or no vegetation), it is likely that the number of tracks is underestimated. In addition, tracks that have been closed in recent years may still be mapped as existing. Bare sand dune areas and beaches were included as tracks as they provide little restriction to vehicle movement and are often used by vehicles. Bare sand dune areas are often linked directly to a track network, the presence of which, indicates an increased threat on the environment in the adjacent areas.

The analysis found that all cells within the EP region contained ORV activity. Figure 4.1 shows that ORV occurs throughout the whole region, with areas of high ORV activity interspersed with areas of lower ORV activity. Tracks occur on both public and private land, and through all types of landforms, such as sand dunes, clifftops, salt marsh and beaches. The network of tracks often lead to campsites, beaches, viewing areas, fishing spots, favourite quad/ trail bike locations, etc. The network reportedly changes and increases constantly, as drivers – old and new – find creative ways to 'improve' old tracks or find new areas to access.

There does not appear to be a distinctive pattern of ORV activity across the EP coastal region. Few cells have a very low ORV value. However, cells with relatively high values are spread widely across the region, occurring in all local government areas. This makes managing ORV activity and the associated impacts difficult and highlights the importance of a strategic and regional approach to access management. The slightly lower values for the cells from EP47 to EP63, maybe partly attributed to that area only having 2004 aerial imagery available (as with some other areas, ie. EP5-EP9 and EP79-EP80). Values for these areas are likely to increase with ground-truthed track mapping.

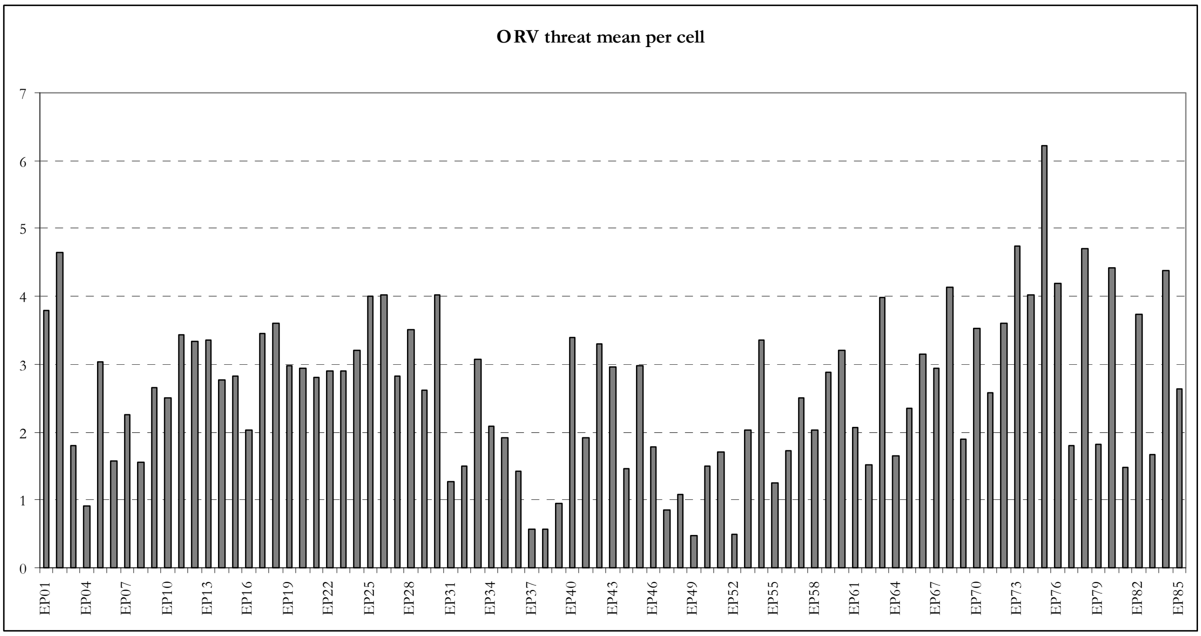

FIGURE 4.1 Mean ORV threat values by cell

Some areas of particular concern included: the very narrow coastal reserves backed by agricultural land with a high number of tracks (Figure 4.2), which puts a huge pressure on the limited remnant native vegetation that provides habitat to coastal species and protects inland areas from coastal processes (eg. salt spray, sand drift erosion, etc); areas of very low or no vegetation cover (eg. salt marsh, bare sand dunes, beaches) where tracks tend to proliferate and impacts are widespread; areas with threatened flora and/or fauna species (eg. raptor breeding habitats, shorebird breeding, feeding and/ or resting areas, specialised threatened flora habitat).

Impacts caused by ORV tracks observed during field trips to the area, included vegetation destruction, landscape degradation, gully erosion, damage to cultural sites, fauna disturbance, litter and the introduction and spread of weeds. A safety risk was also observed along the cliff tops, with tracks and informal viewing areas close to undercut and unstable cliffs (Figure 4.3).

Managing off-road vehicles

Controlling access in coastal areas is not easy due to the remoteness, the terrain, the extent of the issue and the limited resources available. Controlling access requires policing of vehicle activity and a quick response to the creation of new tracks or the reopening of old tracks, the remoteness of the area and the limited resources makes this difficult. The terrain of the area also makes access control difficult and expensive, in salt marsh areas and along cliff tops the vegetation is generally fairly low, making it easier for vehicles to create new tracks and/or drive around tracks that have been closed. The surface rock in some areas is also very hard requiring specialist equipment to install posts or using alternative methods to block tracks. The vast areas of mobile dunes and the sparser vegetation often occupying dune areas compared to inland areas again make the creation of new tracks and/or driving around tracks that have been blocked off relatively easy.

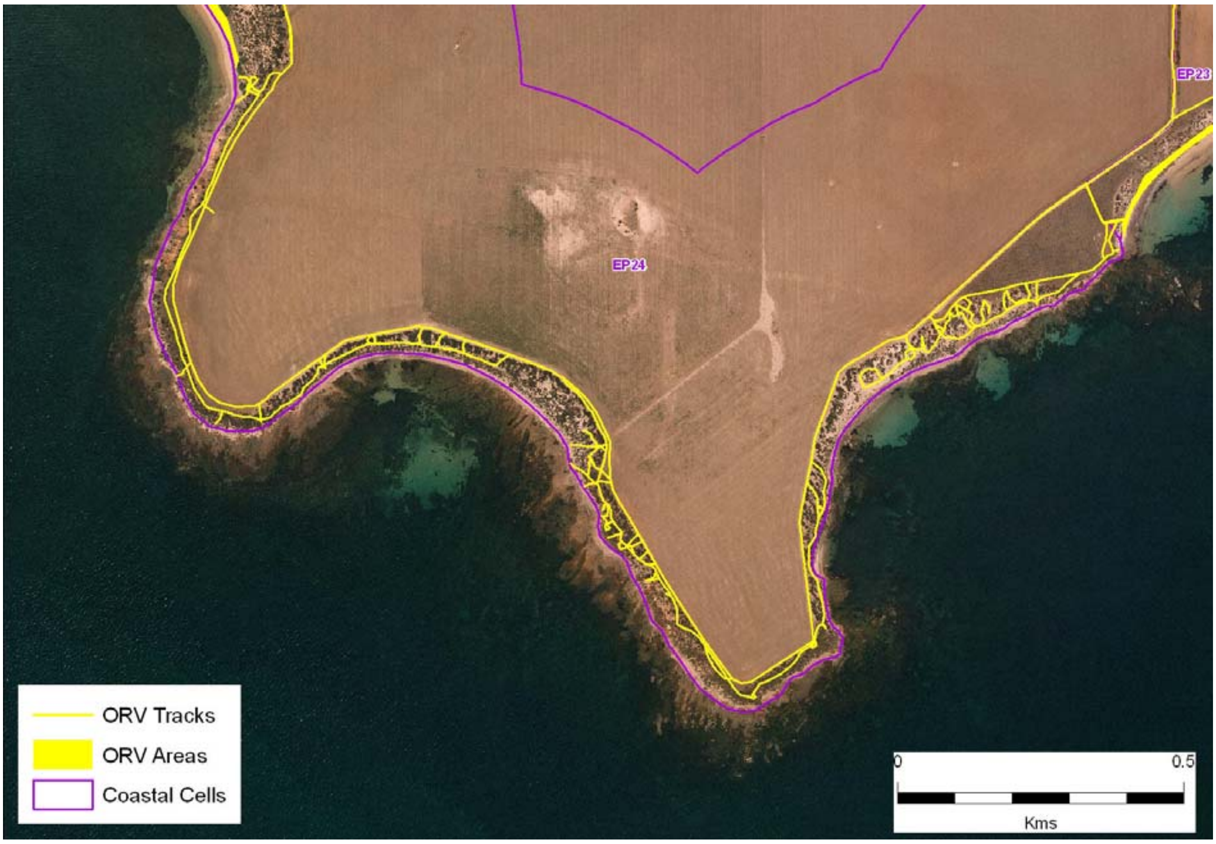

FIGURE 4.2 High number of tracks within the narrow vegetated coastal reserve

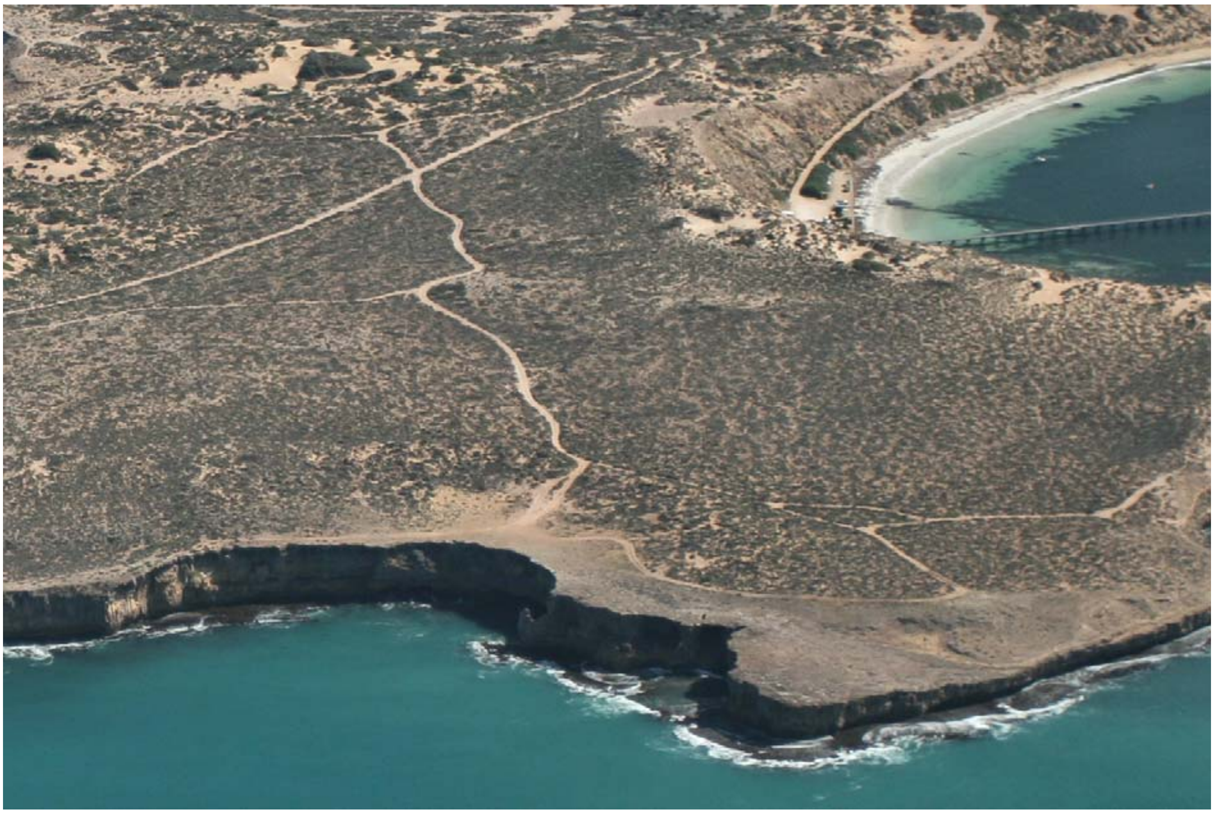

FIGURE 4.3 Track to undercut cliff at Point Sinclair, EP80. Photo: Coast Protection Board, 2007

The complexity of managing ORVs in coastal areas is increased by the varying management responsibilities, land tenures and conflicting demands. Some local councils have by-laws prohibiting vehicles from Council land unless designated. However this does not cover vehicles on state and privately owned land. Even on Council land, controlling off-road vehicles requires Council staff or police enforcement and council's may not consider this to be a high priority or if the vehicles do not appear to be causing significant problems they may decide to ignore it. Where tracks used by ORVs have been fenced to prevent entry, historic access to the area often leads to vandalism to regain entry. In some areas there is ambiguity over Council's powers to pass and enforce by-laws affecting traffic on beaches. Within Conservation and National Parks, the extension of the park boundaries to low water mark allows the potential for control of traffic in these areas. Further to this, where marine park boundaries include beaches, access could be regulated through relevant management plans.

The challenge for managers in controlling ORV activity is striking a balance between increasing human pressure and the protection of natural and cultural values, while also ensuring public safety. There are some recent good examples of the balance that can be struck between providing access and the protection of sensitive sites along the coast, within the EP region and around the state. Within the Eyre coastal region, EP NRM, DENR, local councils and community groups have been undertaking works to minimise the impact of ORVs, such as educational signage at beaches with beach nesting birds, track closures and rehabilitation works. Along the Coorong a seasonal closure to vehicles is enforced during the Hooded Plover nesting and fledging season from September to December. Within the Northern and Yorke NRM region a "Coastal Motor Vehicle Access Management Strategy" has been developed for the coastal councils within the area "to provide a framework for a cooperative and cohesive approach to the management of motor vehicles to beaches and adjacent coastal land." (Allen 2008).

The increase in ORV tracks and the impacts observed throughout the Eyre Peninsula coastal region show a clear need for improved access control to be undertaken. This will require a coordinated approach from many different parties, including EP NRM, DENR, DTEI, local councils, SAPOL, Tourism SA, EP LGA, private land owners and community groups. Developing a regional strategy, similar to that of the Northern and Yorke NRM region, would assist in providing a coordinated and consistent approach across the region, thus reducing the problem of managing an issue in one area, only to have it move to a nearby area. To effectively manage access detailed mapping of exiting tracks is required to strategically assess the track network and determine which tracks should remain open and which tracks require closure. This strategic approach can increase the effectiveness of the access control by permitting to access the coast, but reducing the number or routes and access points. However, for success this needs to be complemented with appropriate signage, education, policing and rehabilitation of closed tracks and damaged sites. While some of this detailed track mapping is now available, as identified above, some additional mapping is still required. This mapping can then be used as a baseline and used to monitor areas of increased/ decreased ORV activity and the effectiveness of access control measures.

4.2 Development zoning, land ownership and existing development

Development zoning, land ownership and existing development were used in the analysis of threatening processes because they have the potential to lower conservation priority values through development, land use change and/or other activities.

Land proclaimed under the *National Parks and Wildlife Act 1972* (including all Parks and Reserves) has been given low threat values for development, land ownership and existing development, because they are specifically set aside for preserving and managing conservation. Development within these areas is expected to be minor, such as toilets, showers or campsites.

Where development zoning allowed urban, residential, tourism or industrial type development, high threat scores were allocated; where zoning principles and objectives sought to conserve, low threat scores were given. Mean values for cells are high where a large proportion of the cell is zoned to allow urban or industrial development.

Existing development was included to address the direct impacts of development, such as vegetation clearance and landform modification, as well as the associated impacts that occur on the surrounding land, including increased pedestrian and vehicle traffic, weeds, fire risk and feral animals. A high threat value was given to built up areas such as townships and individual dwellings with an inner buffer (i.e. 500m for built up areas and 200m for individual dwellings) to include the increased threat and activity expected in the immediate vicinity. An outer buffer area of 500-1000m for built up areas and 200-500m for individual dwellings were given medium threat ratings, to acknowledge the reduced threat with increased distance from development.

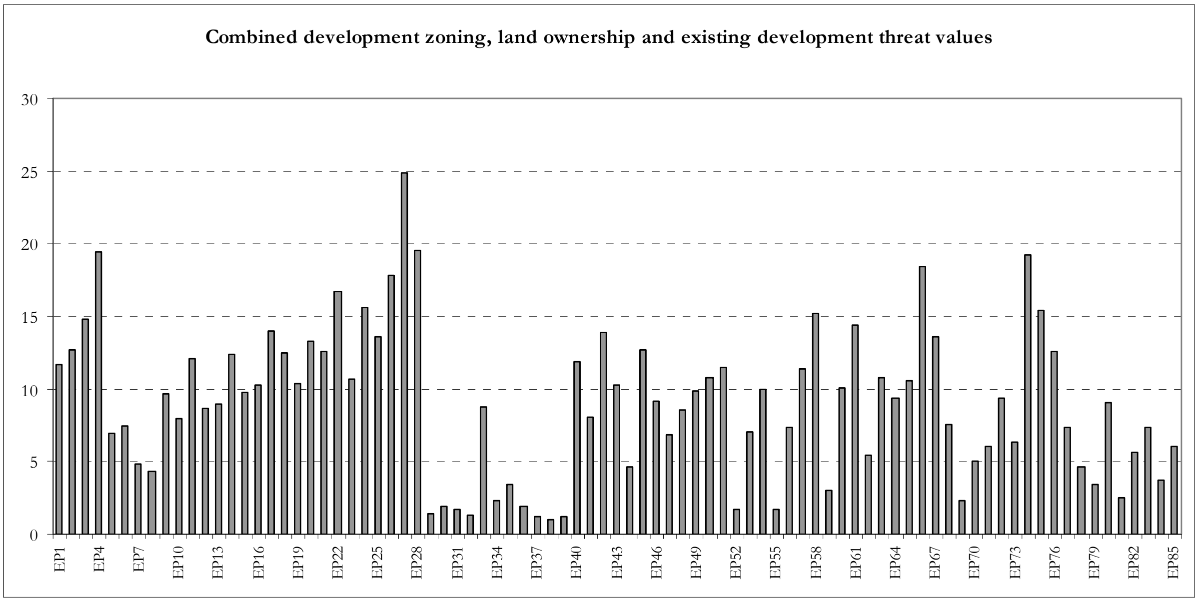

FIGURE 4.4 Combined threat values for development zoning, land ownership and existing development.

There is a large variation in the values for the combined threat of development zoning, land ownership and existing development across Eyre Peninsula. Eastern Eyre Peninsula (EP1 – EP31) generally has higher threat values for these layers than the western side of the Peninsula, this is likely to be due to the eastern side having less land protected under the National Park system, narrower coastal reserves under Crown ownership and more existing developments including townships, industry, shacks and individual dwellings. The areas with the highest threat values are those containing the cities or larger townships in the region, the four highest are Port Lincoln (EP27 – EP28), Whyalla (EP4), Ceduna (EP74) and Streaky Bay (EP66). The areas with the lowest threat values are generally the areas proclaimed under the *National Parks and Wildlife Act 1972* such as Lincoln National Park (EP29 – EP32), Coffin Bay National Park (EP36 – EP39) and Lake Newland Conservation Park (EP52). However, cells with a large area under a Heritage Agreement, such as Whalers Way (EP34), Cathedral Rocks (EP35) and Calca Peninsula (EP59) also have low threat values.

4.3 Coastal viewscape and viewshed analysis

In 2004-05 a South Australian analysis of the scenic value of coastal lands was undertaken for the Department of Environment and Heritage, (Lothian 2005); this was termed a viewscape survey. Where coastal areas had a high score for visual amenity, this was regarded as a pressure for development and/or recreational activities (e.g. lookouts, off-road vehicle activity, camping), and hence given a high threat score. The mean threat values for cells in the analysis are shown in Figure 4.5. Visual amenity scores are moderate throughout the region, however, two areas had markedly lower values, these were Whyalla (EP4) and Port Lincoln (EP27 – EP28) and one area, the southern tip of Eyre Peninsula (EP33 – EP35), which is characterised by it's high, spectacular cliffs, had higher than average values.

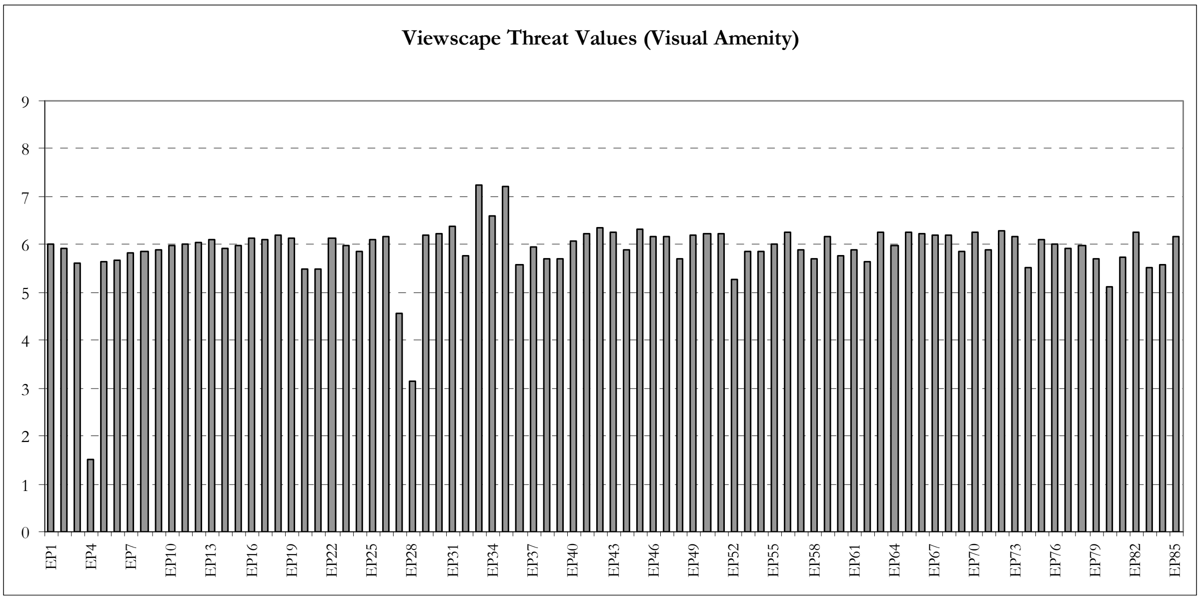

FIGURE 4.5 Mean viewscape values by cell

FIGURE 4.6 Cape Wiles, EP34 (left) contained high threat values for viewscape, while Whyalla, EP4 (right) had very low viewscape threat values

A complementary viewshed analysis identified areas that can be seen from the sea and therefore have sea views. These areas are also assumed to be under increased pressure from development and/or recreational activities and were given higher threat values according to the quality of the sea views (from Lothian, 2005). The mean viewshed threat values for cells in the analysis are presented in the graph below. The graph shows that the threat values for viewshed are much more variable than for viewscape, and the eastern coast of Eyre Peninsula appears to have a slightly higher values than the western coast. One of the main reasons for the lower values on the west coast is due to the large dune systems that occur there, these dunes act as a barrier, blocking the sea views from the land behind, while the east coast contains more gently sloping cliffs which provide a sea view for a considerable distance inland.

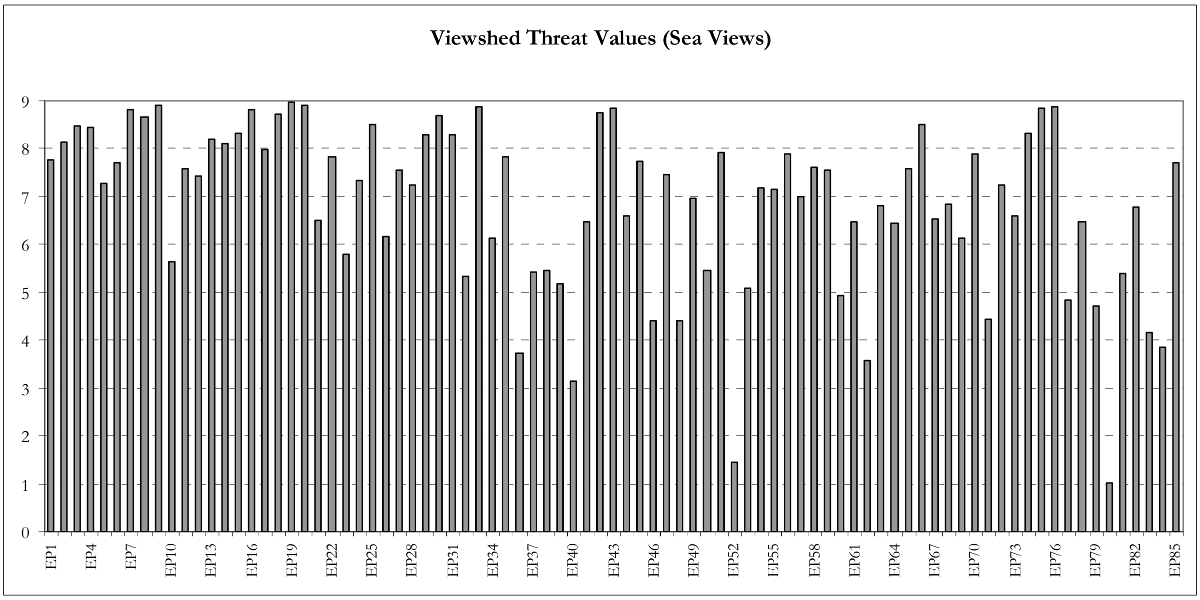

FIGURE 4.7 Mean viewshed threat values by cell

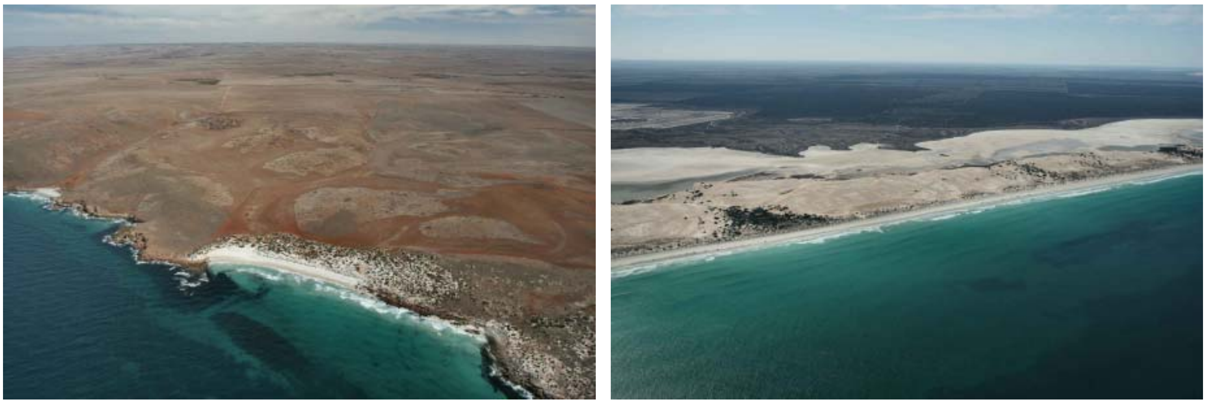

FIGURE 4.8 EP19 (left) south of Lipson Cove had high threat values for viewshed where the gently sloping cliffs provide sea views to almost all of the cell, EP80 (right) near Point Sinclair, had low threat values due to the sand dunes blocking the sea views from the low lying land behind

4.4 Land use and mining activities

Land use was included in the threat analysis to ensure that land uses that may be a threat to conservation were included that may not have been included, or may have been under emphasised, in other layers such as development zoning or existing development. For example, an area of land may be being used for agricultural purposes, but zoned as Coastal Conservation, therefore the zoning and existing development threats would be identified as low, but the current use of the land is potentially threatening the conservation values of that land and the surrounding land. Land uses that received high threat values included commercial, industrial, agriculture, horticulture and mining.

Mining activities can decrease conservation values through vegetation clearance, track creation, soil and wildlife disturbance, weed introduction, increased fire risk, creating corridors for feral animal activity and opening areas for recreational use. There are a variety different mining applications, leases and activities occurring throughout the EP coastal region. The main mining tenements are for sand, salt or gypsum. Gypsum is mined near Lake Macdonnell (EP80), salt is mined at the Whyalla saltfields in False Bay (EP3), and sand mining tenements exist near Mount Young (EP5), Murninnie (EP6), Louth Bay (EP25), North Shields (EP26), Coffin Bay (EP36), Baird Bay (EP56), Streaky Bay (EP64) and Ceduna (EP74). There are numerous mineral exploration licences, mineral exploration licence applications and petroleum exploration licence applications that occur within the coastal area. There are also many quarry sites within the coastal boundary across the whole region, the majority of these appear to be used to source material for road construction and/or maintenance.

4.5 Rubbish dumps and waste treatment areas

Historically little thought was given to the environmental impact of rubbish dumps or waste treatment areas and therefore their placement. Many farmers would have their own rubbish dump for both household and farming waste, which would generally be in an area that was not productive for farming, such as a creek, over a cliff or down a disused well. If these were not available they would then dig a hole, again if possible in an area where it would have least impact on farming land, eg. in sand dunes or salt marsh. More recently, dumping of waste still occurs in coastal areas and may occur on State, Council or privately owned land. Some of this dumping occurs illegally by people who do not want to either pay a fee, or do not want to travel to a designated dump site. This can include household waste, building materials, chemical waste, green waste and other hard rubbish.

One of the main threats of dump sites is leachate (such as pesticides, heavy metals and chemicals). When in a coastal location these leachate may seep directly into the marine environment, causing numerous detrimental impacts to marine organisms and a potential risk to humans swimming in the area. Other threats of dump sites include gases produced by the waste, air pollution caused by burning the waste, visual amenity, weed spread, or the hard waste going directly on to the beach and into the sea.

This layer included areas identified as rubbish dumps, treatment plants, stockpiles, sewage or effluent ponds and saltwater evaporation pans from existing EPA, DENR and Planning SA datasets. However, these datasets do not identify all the dumps and treatment areas, particularly the private or informal dumpsites, which often occur on private land or illegally on State or Council owned land. Nor do the datasets identify dumpsites or treatment areas that are now closed, although these areas may still be impacting on the conservation value of the area. Therefore, it is likely that the values for this layer are significantly under stated and further work to locate and assess the impact of the dump sites and treatment areas not identified through this process would be recommended.

4.6 Environmental weeds

Weeds are a major threat to our coast particularly as they continue to be an insufficiently recognised ecological problem in coastal habitats. The coastal strip is particularly vulnerable and accessible to weed invasion. The coast supports a range of unique weed species that do not occur in the rest of the region. Populations of introduced plants are expanding and pose a threat to the values of the coast. They may be causing major declines in native plant and animal communities.

4.6.1 Weeds threat

Adapted from Coastal dune management: A manual of coastal dune management and rehabilitation techniques (Department of Land and Water Conservation NSW 2001)

Weeds cause many impacts on the coast. Just as in any other natural environment they often grow faster than native plants and successfully compete for sunlight, water, nutrients and pollinators. They also prevent or interfere with natural regeneration. Their capacity to establish and spread allows them to invade and displace native plant communities, thereby reducing biological diversity and threatening the viability of many plant communities.

Floristically and structurally diverse natural vegetation can be changed dramatically to a much-simplified state where one or several weeds dominate. Coastal heath and native grassland, which naturally hold sand dunes together, are some of the plant communities that have been crowded out by weeds and contribute to the destabilisation of coastal dune systems. Native fauna is also adversely affected by the loss of plants that provide shelter, food and nesting habitat, or by animals that thrive in response to the changed conditions. Generally the spread of exotic plants to the coast has been accidental as a result of various human activities (e.g. in ballast or on vehicles). They are also commonly spread by fauna, particularly birds. However, some weed species have been introduced to the coast purposely for agricultural or ornamental use. The use of the coast as a dumping ground for domestic garden refuse is also a common cause of weed invasion. The many disturbances along the coast have accelerated the spread of exotic plants within the coastal zone.

Weeds may also cause problems such as:

- providing habitat or a food source for feral animals
- altering nutrient content of low fertility soils
- altering hydrological cycles
- altering dune sand mobility by changing the vegetation cover e.g. creating a weed monoculture and increasing beach erosion
- increasing fire risk by raising available fuel levels in fire danger periods
- reducing visual amenity and aesthetics of natural landscapes
- losing representative examples of original coastal plant communities.

CSIRO are reporting weeds that will thrive with the onset of climate change. It is suggested there is potential for weeds spread to change by altering the climatic limits that constrain the range of weed species. It is also possible that increasing temperatures might allow some ‘sleeper’ weeds to become invasive.

Weeds are an indication of vegetation degradation and sign of coastal health. More than 500 weeds species, or over 30% of the total known coastal flora, have been recorded in the South Australian coastal zone. Within the Eyre Peninsula coastal region approximately 21% of the vascular plants recorded are not native to the areaHowever, vegetation survey sites are usually selected in ‘good’ remnants of native vegetation and may produce a bias (Oppermann 1999).

In the analysis, the proportion of weeds against natives was used to assess the health or degradation of vegetation and to highlight areas that require conservation priority. Weed species have also been assessed for their threatening values. The following sections identify the highest priority environmental weeds and assign values to weed species to scale the threat. That information has been incorporated into the analysis of threatening processes within the Eyre Peninsula coastal region.

4.6.2 Methodology for determining priority weeds and values

Weed lists for the Eyre Peninsula coastal region were obtained from the State Biological Survey Database, together with a vast amount of additional information from EP NRM. This combined information provided a list of 265 of weed species present in the study area.

Assigning threat values

To display the weeds as a GIS threat layer for this study, individual species were allocated a threat value on a scale of 1 to 9, with 1 being the lowest and 9 being the highest. Values were designed to align with the five threat categories outlined in the Nature Conservation Society's (NCS) bushland condition monitoring manual: *Coastal vegetation communities of the southern Mount Lofty Ranges* (Croft et al. 2006). The categories are based on the:

- weed's degree of invasiveness or ability to expand into intact scrub
- weed's capability to disrupt natural processes in bushland
- degree of difficulty in preventing or controlling an infestation.

Assessment in this study was based on the NCS weed threat categories and adapted to incorporate the present and potential distribution of species (i.e. widespread versus limited). Potential for distribution incorporates the number of vectors a species has (more vectors enable the species to spread more readily) and the potential area(s) a weed species may inhabit (preference for specific habitats). Table 4.1 summarises the weed value allocation system used to assign threat levels to weed species in the Eyre Peninsula coastal region, including the NCS bushland condition monitoring threat categories.

Utilising the above system, an internal DENR/EP NRM assessment identified 126 priority environmental weed species from the original list of 265. The results were analysed by DENR and EP NRM staff, incorporating local experience and knowledge of weed management.

It should be noted that the surveys undertaken for the original weed lists may have occurred several years before this Action Plan was developed, thus distributions may have changed for some species, with some being much more widespread or control programs reducing the coverage.

Assigning values to environmental weeds not only enables identification of the highest priority species, but also allows levels of threat to different coastal areas (cells) to be determined and compared. When the values of all priority environmental weeds within each cell are averaged, it provides a nominal value that subsequently enables comparison of this threat layer between cells, shown in Figure 4.9.

TABLE 4.1 Weed value allocation system

Study threat rating	NCS category	NCS weed threat category description	Distribution
9	5	Highly invasive in either disturbed or intact remnant bushland, spreads rapidly producing very dense stands and a blanket cover; potential to eliminate almost all native understorey species; very difficult to control without outside help	Widespread or Currently limited with numerous vectors
8			Limited distribution with few vectors
7	4	Highly invasive in either disturbed or intact remnant bushland, with the potential to spread rapidly and produce very dense stands given favourable habitat and/or vectors; high potential to reduce native species diversity and abundance; can be controlled with sustained effort	Widespread or Currently limited with numerous vectors
6			Limited distribution with few vectors
5	3	Invasive in intact bushland with moderate potential to reduce native species diversity; rate of spread slower than Cat 4 and 5 but once present will persist and threaten biodiversity; may produce dense stands over wide area but can be controlled with sustained effort	Widespread or Currently limited with numerous vectors
4			Limited distribution with few vectors
3	2	Generally only invade disturbed bushland but may spread rapidly; generally only a slight potential to reduce native species diversity, unless present in high densities	Widespread or Currently limited with numerous vectors
2			Limited distribution with few vectors
1	1	Generally only invade disturbed bushland; often widespread and abundant but not considered a significant threat to native biodiversity, unless present in very high densities	n.a.

It is important to note that the presence of higher value weeds in a cell will increase the average. However, the collective presence of many lower value weeds will also have a similar influence. Some discussion occurred amongst DENR GIS and scientific staff regarding the possibility of simply presenting the threat value for red alert weeds (those with a value of 4 or greater) per cell so as not to dilute the threat value of higher priority weeds. It was decided that lower priority weeds should still be featured due to their collective impact and contribution towards the overall threat to an area of coastal vegetation.

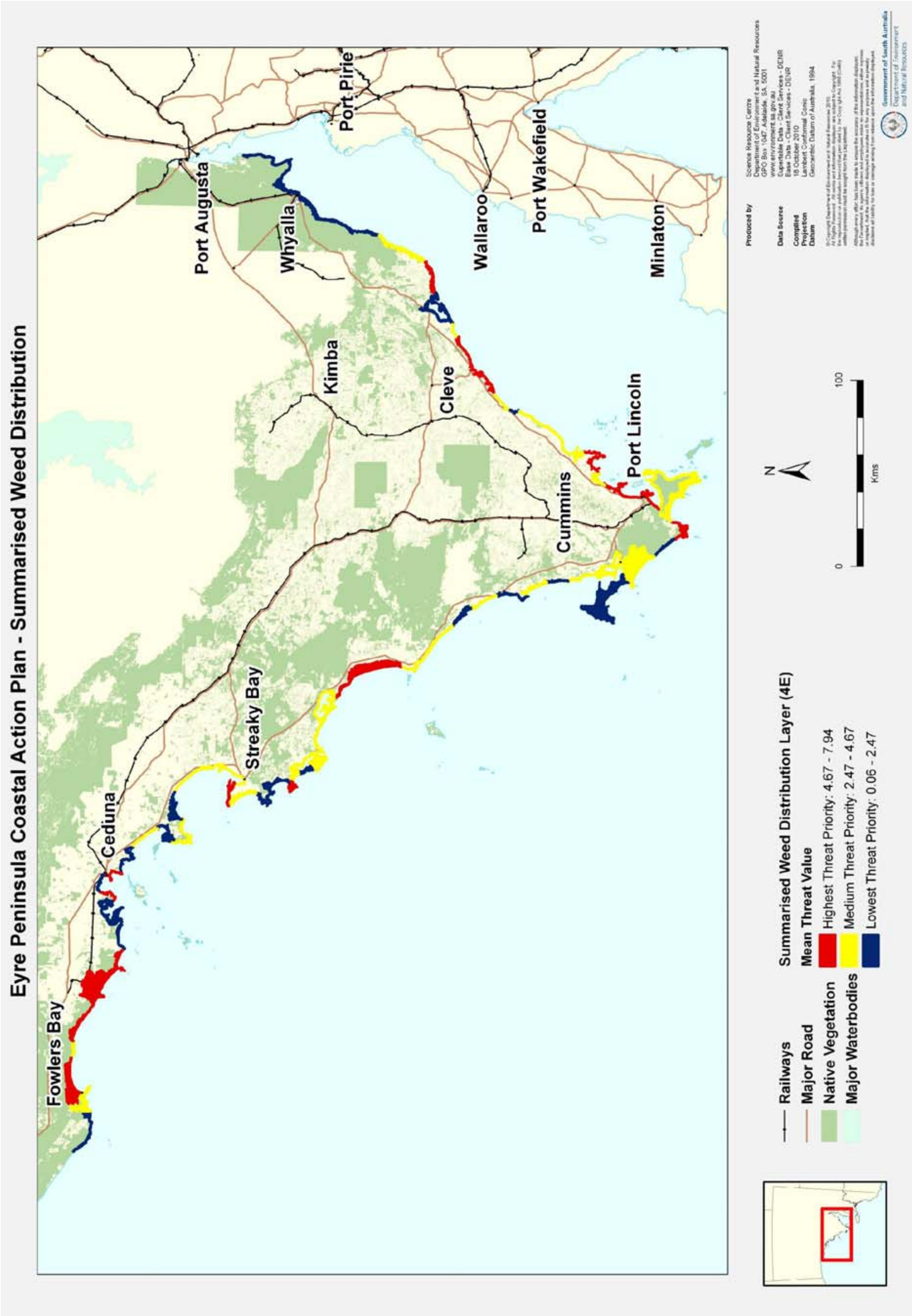

FIGURE 4.9 Summarised weed threat

4.6.3 Results

The threat value allocation process identified a total of 126 priority environmental weeds for the Eyre Peninsula coastal region, each featuring a weed threat value between 1 and 9. The results and distribution of species (by cell) are displayed in Table 4.2.

TABLE 4.2 Priority weed species with ratings and distribution

Species name	Common name	Study rating	Cell number
Acacia cyclops	Western coastal wattle	5	17, 24, 25, 27, 28, 36, 41, 42, 50, 83, 84
Acacia saligna	Golden wreath wattle	5	28, 29
Aeonium arboreum	Tree aeonium	1	2, 40, 50, 72
Agave americana	Century plant	1	28
Ammophila arenaria	Marram grass	2	36, 48, 52, 57, 60, 67
Anagallis arvensis	Pimpernel	2	2, 12, 14, 15, 16, 17, 19, 23, 24, 26, 27, 28, 29, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 60, 62, 63, 64, 67, 69, 70, 72, 73, 77, 78, 79, 80, 82, 83, 84, 85
Arctotheca calendula	Cape weed	1	10, 15, 18, 29, 32, 33, 39, 40, 41, 57, 85
Arctotheca populifolia	Beach daisy	7	32, 36, 39, 52, 62, 77, 78, 79, 80, 81, 83, 84, 85
Argyranthemum frutescens ssp.	Marguerite daisy	4	18, 20, 21, 28, 50, 54, 61, 63, 64, 67, 68, 72, 76, 84
Argyranthemum frutescens ssp. foeniculaceum	Teneriffe daisy	4	20, 36, 50, 52, 54, 58, 63, 64
Asparagus asparagoides	Bridal creeper	9	17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 57
Asparagus declinatus	Bridal veil	8	28
Asphodelus fistulosus	Onion weed	3	8, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 36, 38, 39, 40, 62, 63, 65, 67, 72, 74, 80, 84
Avena barbata	Bearded oat	2	17, 18, 19, 20, 24, 28, 30, 32, 36, 37, 38, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 60, 62, 64, 65, 67, 69, 74, 80
Avena fatua	Wild oat	5	40, 41, 50, 54, 62, 82
Avena sativa	Cultivated oat	2	74
Avena sp.	Oat	2	55, 60, 63, 64
Brassica tournefortii	Wild turnip	3	2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 23, 28, 39, 41, 43, 49, 53, 55, 56, 60, 62, 63, 64, 65, 67, 69, 70, 72, 74, 75, 80, 82, 83, 84, 85
Briza minor	Lesser quaking-grass	2	26, 32, 33, 34, 37, 38, 39, 40, 41, 46, 55, 84

Species name	Common name	Study rating	Cell number
Bromus diandrus	Great brome	2	17, 23, 28, 32, 34, 37, 40, 41, 43, 44, 46, 48, 49, 50, 53, 54, 55, 56, 57, 64, 84
Bromus hordeaceus ssp. hordeaceus	Soft brome	2	28, 36, 37, 41
Bromus madritensis	Compact brome	2	28, 32, 34, 37, 40, 41, 42, 43, 49, 55, 57
Bromus rigidus	Rigid brome	2	50, 52, 55, 65, 70
Bromus rubens	Red brome	2	15, 16, 17, 18, 20, 30, 32, 33, 34, 36, 39, 41, 43, 44, 46, 47, 48, 49, 50, 52, 53, 54, 55, 57, 58, 60, 64, 65, 67, 69, 70, 72, 80, 83
Cakile maritima ssp. maritima	Two-horned sea rocket	1	2, 4, 10, 12, 16, 18, 23, 25, 28, 30, 31, 32, 36, 39, 40, 44, 48, 50, 51, 52, 53, 55, 62, 69, 70, 72, 73, 77, 78, 83, 84
Carduus tenuiflorus	Slender thistle	2	27, 29, 32, 37, 39, 42, 44, 46
Carrichtera annua	Ward's weed	4	2, 8, 10, 11, 18, 40, 54, 55, 62, 64, 65, 67, 72, 73, 74, 75, 83
Catapodium rigidum	Rigid fescue	1	28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 49, 52, 53, 54, 55, 62, 69
Centaurea melitensis	Malta thistle	1	20, 28, 32, 36, 41, 55, 59, 60, 64, 70, 79, 80, 84,
Centaurium erythraea	Common centaury	1	30, 32, 37, 84
Centaurium sp.	Centaury	1	55, 58
Centaurium tenuiflorum	Branched centaury	1	23, 28, 29, 37, 38, 41, 55, 56
Cerastium balearicum	Chickweed	1	28, 32, 33, 34, 36, 38, 39, 41, 43, 44, 46, 54, 62
Cerastium glomeratum	Common mouse-ear chickweed	1	23, 26, 30, 42, 65
Chrysanthemoides monilifera ssp. monilifera	Boneseed	6	27, 40, 54
Coleonema pulchellum	Diosma	3	28, 36, 40, 66
Coprosma repens	New Zealand mirror-bush	4	28
Cotyledon orbiculata var. orbiculata	Pig's ear	1	11, 17, 20, 26, 27
Dimorphotheca pluvialis	Cape marigold	1	40
Diplotaxis tenuifolia	Lincoln weed	3	23, 27, 28, 36, 40, 41, 43, 44, 46, 48, 49, 50, 52, 53, 54, 60, 61, 62, 63, 65, 75, 76
Dipogon lignosus	Lavatory creeper	4	29, 32, 40
Dittrichia graveolens	Stinkweed	1	31, 32, 39, 40, 41
Echium plantagineum	Salvation jane	2	1, 11, 30, 32, 36, 38, 40, 63, 64
Ehrharta calycina	Perennial veldt grass	6	25, 26, 27
Ehrharta longiflora	Annual veldt grass	3	20, 24, 26, 28, 32, 33, 34, 36, 37, 39, 40, 41, 42, 43, 44, 48

Species name	Common name	Study rating	Cell number
Ehrharta villosa var. maxima	Pyp grass	8	62, 63, 64, 67
Eucalyptus gomphocephala	Tuart	3	28, 40
Euphorbia paralias	Sea spurge	5	9, 10, 14, 17, 18, 21, 25, 27, 28, 30, 32, 33, 36, 37, 38, 39, 40, 41, 44, 48, 50, 51, 52, 53, 62, 63, 64, 65, 70, 71, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 85
Euphorbia peplus	Petty spurge	5	28, 31, 33, 36
Euphorbia terracina	False caper	5	14, 28, 36, 50
Freesia cultivar	Freesia	7	28, 40
Gazania rigens	Gazania	6	14, 17, 18, 26, 28, 36, 40, 50, 52, 54, 61, 63, 68, 72, 74, 76, 84
Hordeum distichon		1	53
Hordeum glaucum	Blue barley-grass	1	15, 18, 20, 23, 40, 41, 43, 44, 46, 49, 54, 60, 62, 64, 69
Hordeum leporinum	Wall barley-grass	1	39, 42, 55, 61, 69
Hordeum marinum	Sea barley-grass	1	24, 52
Hypochaeris glabra	Smooth cat's ear	2	15, 17, 19, 20, 24, 26, 32, 33, 34, 36, 37, 39, 40, 41, 43, 44, 47, 50, 54, 57
Hypochaeris radicata	Rough cat's ear	3	15, 20, 44, 46
Hypochaeris sp.	Cat's ear	1	10, 12, 14, 15
Juncus acutus	Sharp rush	4	28, 32
Juncus capitatus	Dwarf rush	4	32
Lagurus ovatus	Hare's tail grass	2	28, 30, 31, 32, 33, 34, 36, 38, 40, 41, 43, 44, 46, 47
Leptospermum laevigatum	Coast tea-tree	5	21, 41, 76
Limonium binervosum	Dwarf sea-lavender	3	10, 32
Limonium companyonis	Sea-lavender	7	10, 28, 32, 36, 37, 38, 40, 41, 48, 49, 50, 51, 52, 53, 54, 72, 74, 75, 76, 77, 79, 80, 81, 82, 83, 84, 85
Limonium hyblaeum		3	28, 40
Limonium sinuatum	Notch-leaf sea-lavender	3	17, 20, 50
Limonium sp.	Sea-lavender	7	40
Lolium multiflorum	Italian ryegrass	1	67
Lolium perenne	Perennial ryegrass	1	28, 54, 67
Lolium perenne X Lolium rigidum	Hybrid ryegrass	1	55
Lolium rigidum	Wimmera ryegrass	1	16, 17, 24, 28, 36, 65

Species name	Common name	Study rating	Cell number
Lycium ferocissimum	African boxthorn	8	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 30, 31, 32, 34, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 60, 61, 62, 63, 64, 65, 67, 70, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85
Malva dendromorpha	Tree mallow	3	27, 28, 40, 41
Marrubium vulgare	Horehound	5	2, 18, 26, 28, 29, 30, 31, 38, 39, 40, 41, 42, 46, 53, 54, 56, 60, 61, 62, 63, 64, 65, 67, 72, 74, 83
Medicago minima var. minima	Little medic	1	2, 8, 9, 10, 14, 15, 18, 42, 43, 46, 47, 49, 53, 54, 55, 60, 64, 67
Medicago polymorpha var. polymorpha	Burr-medic	1	8, 10, 15, 16, 17, 18, 19, 20, 24, 28, 41, 43, 44, 46, 49, 55, 57, 64, 67, 69
Medicago praecox	Small-leaf burr-medic	1	39
Medicago sp.	Medic	1	10, 30, 53, 58
Medicago truncatula	Barrel medic	1	18, 19, 20, 44, 45, 53, 64
Melilotus indicus	King Island melilot	1	24, 28, 30, 31, 37, 38, 39, 41, 43, 44, 46, 47, 48, 49, 50, 52, 54, 55, 62, 64, 65, 84
Mesembryanthemum crystallinum	Common iceplant	4	4, 10, 11, 15, 16, 17, 18, 21, 23, 28, 30, 32, 39, 40, 49, 50, 55, 56, 57, 58, 62, 63, 65, 67, 75, 80, 82, 83, 84, 85
Mesembryanthemum nodiflorum	Slender iceplant	2	10, 11, 20, 21, 30, 80
Mesembryanthemum sp.	Iceplant	3	10, 13, 14, 15, 16, 18, 21, 28, 39, 52, 57, 62, 63, 65, 67, 72, 76
Olea europaea ssp.	Olive	5	27, 28, 40, 41, 42, 57
Orbea variegata	Carrion-flower	2	1, 4
Oxalis pes-caprae	Soursob	5	14, 20, 25, 27, 28, 30, 36, 40, 50, 56, 57, 63, 64, 65, 72, 73
Parapholis incurva	Curly ryegrass	1	4, 10, 14, 16, 20, 21, 24, 28, 31, 32, 34, 36, 39, 42, 43, 44, 45, 46, 48, 49, 50, 53, 54, 55, 56, 63, 64, 69, 70, 71, 73, 79, 80, 83, 84
Paspalum vaginatum	Salt-water couch	2	57
Pennisetum clandestinum	Kikuyu	4	27, 28, 54, 61, 68, 74
Pennisetum setaceum	Fountain grass	2	27, 72
Pinus halepensis	Aleppo pine	5	20, 25, 26, 27, 28, 32, 36, 40, 41, 52, 54, 74, 76
Piptatherum miliaceum	Rice millet	2	28
Plantago bellardii	Hairy plantain	2	55
Plantago coronopus ssp. commutata	Bucks-horn plantain	2	32, 84
Plantago coronopus ssp. coronopus	Bucks-horn plantain	2	19, 24, 39, 49

Species name	Common name	Study rating	Cell number
Polygala myrtifolia	Myrtle-leaf milkwort	9	24, 28, 29, 32, 33, 40, 41
Polygala virgata		7	60
Reichardia tingitana	False sowthistle	3	8, 14, 16, 17, 18, 25, 32, 36, 39, 43, 54, 70, 80
Retama raetam	White weeping broom	3	18
Rhamnus alaternus	Blowfly bush	8	25, 27, 28, 33, 41
Romulea rosea var. australis	Common onion-grass	2	53, 67
Rosa canina	Dog rose	1	27
Rostraria cristata	Annual cat's-tail	2	14, 15, 16, 17, 18, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 52, 53, 54, 55, 56, 57, 59, 60, 64, 65, 69, 70, 84
Rostraria pumila	Tiny bristle-grass	2	64, 69, 70, 73, 74, 75, 77, 80, 81, 82, 84
Scabiosa atropurpurea	Pincushion	3	28, 29, 36, 40, 41, 42
Senecio pterophorus	African daisy	2	19, 21, 27, 28, 29, 30, 32, 33, 34, 36, 38, 39, 40, 41, 42, 43, 46
Silene nocturna	Mediterranean catchfly	1	18, 24, 32, 33, 35, 36, 38, 39, 40, 41, 42, 43, 45, 46, 49, 50, 53, 55, 56, 57, 62, 70, 74
Solanum elaeagnifolium	Silver-leaf nightshade	2	10
Solanum linnaeanum	Apple of sodom	2	37, 41, 42
Solanum nigrum	Black nightshade	2	10, 27, 29, 31, 36, 38, 39, 41, 55, 84
Sparaxis bulbifera	Sparaxis	3	27, 40
Stenotaphrum secundatum	Buffalo grass	2	28
Tamarix aphylla	Athel pine	3	43
Trifolium angustifolium	Narrow-leaf clover	2	28, 36
Trifolium arvense var. arvense	Hare's-foot clover	2	19, 24, 40, 67, 40
Trifolium campestre	Hop clover	2	28, 29, 32, 33, 37, 39, 40, 41
Trifolium glomeratum	Cluster clover	2	41
Trifolium tomentosum	Woolly clover	2	24, 39
Vinca major	Blue periwinkle	1	29
Vulpia muralis	Wall fescue	2	32, 33, 42
Vulpia myuros f.	Fescue	2	28, 30, 32, 40, 55
Vulpia myuros f. megalura	Fox-tail fescue	2	31, 32, 38, 39, 69, 70
Vulpia myuros f. myuros	Rat's-tail fescue	2	15, 20, 23, 30, 32, 34, 38, 39, 40, 41, 42, 44, 46, 47, 54, 55, 56, 64, 69, 70, 73, 75
Vulpia sp.	Fescue	2	26, 43, 49
Zaluzianskya divaricata	Spreading night-phlox	2	24, 26

The cells that recorded the highest apparent weed threat included, EP12 Mills Bay, EP33 Fishery Bay, EP22 Red Cliff, EP15 Werrina, EP23 Ethla Wells, EP79 Point Bell and EP81 Chadinga CR. The spread of weeds in these cells is likely to be influenced by adjoining agriculture (and past grazing) and urban land uses along with disturbance caused from vehicle access. These high values could be a combination of presence of higher value weeds in a cell or the collective presence of many lower value weeds which also has a similar influence. This combination with the cells that have high vegetation block metrics also contributed to the threat. EP22 and EP12 coincidentally had the highest proportion of weeds versus native species which was also a scored degradation value.

4.6.4 Priority weeds

Part of the process for assessing weeds as a threat within the Bushland Condition Monitoring Manual is identification of 'Red Alert Weeds'. Red Alert weeds are species that are already presenting a major threat to bushland or have the potential to become major threats (ie. the highest priority weeds). NCS gives weeds with a threat category of 3, 4 or 5 a classification as Red Alert Weeds as they have the capacity to spread quickly, even in intact vegetation, and are difficult to control (Croft et al, 2006). The higher the number of Red Alert species present in bushland, the greater the threat of weed invasion in the future. Any category 4 or 5 species should receive immediate attention. In the context of the weed value allocation process, Red Alert Weeds are those with values from 4 to 9 (refer to Table 4.2). A total of 34 Red Alert weeds have been identified in the Eyre Peninsula coastal region through this methodology.

The following provides a brief threat analysis for NCS category 4 and 5 weed species (weeds with values in the GIS analysis from 6 to 9) that represent the highest level threat. They are listed in threat rating order.

Asparagus asparagoides **(bridal creeper)**
Study rating: 9
Regional distribution: Widespread
Local density: Widespread


Photo: R. Sandercock

Bridal creeper is a rhizomatous and tuberous cool season low growing *vine*, growing on supporting vegetation to over head high. Short-lived above ground stems and long-lived tubers that are produced on creeping underground stems. Wiry *stems* and glossy, bright-green flat alternately arranged *leaves* with fine veins. Short tubular scented *flowers* are white with 6 petals on slender drooping stalks in leaf axil along the stem, singularly or pairs. Flowers late winter and spring. Stamens prominently protruding from the flower. *Fruits* when mature are round fleshy red berries.

A *Weed of National Significance*, is a serious environmental weed of high impact regarded as one of the worst weeds in Australia because of its invasiveness and environmental impacts. Bridal creeper was originally introduced as a garden plant and now poses a significant threat to biodiversity throughout the temperate regions. It is a climber that smothers native vegetation and competes for space, light, water and nutrients. It is also able to survive hot summers due to underground tubers that retain moisture. The seeds do not need disturbed soil to germinate and establish. This means that bridal creeper is able to invade bush that is in good condition and can be widely dispersed. Formerly known as *Myrsiphyllum asparagoides*.

Polygala myrtifolia **(myrtle-leaf milkwort)**
Study rating: 9
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

Myrtle-leaf milkwort is a densely leaved, evergreen woody *shrub* to head high. Crowded large, dark green elliptical shaped *leaves* alternately arranged along the stem and borne on very short stalks. Small drooping clusters of showy, pea-like *flowers*, are borne at the ends of branches. The flower has white with purple and green side wings streaked with darker veins. Forward pointing tuft of white bristles occur on the folded lower petal. *Fruit* a circular capsule.

Widely cultivated as a garden ornamental, particularly in the temperate regions of Australia. An invasive environmental weed in coastal environs and its status in a national context needs to be reviewed. It does not need disturbance to colonise and can germinate in heavy shade. Readily regenerates by seed and spread into coastal dunes and cliff tops by birds, water and ants. Seed remains viable for some time. Do not confuse with *Bursaria spinosa*.

Asparagus declinatus **(bridal veil)**
Study rating: 8
Regional distribution: Localised
Local density: Isolated

Photo: R. Sandercock

Bridal veil is rhizomatous and tuberous perennial, cool season *vine*, low growing on supporting vegetation to waist high. Short-lived above ground *stems* and long-lived tubers that are produced on creeping underground stems. Numerous needle likes *leaves* are grouped in threes along the stem. It has small white *flowers* with 6 petals borne singly. It has fleshy green-globular *berries*, appearing in October, and turn pale bluish-grey or whitish as they mature.

A highly invasive environmental weed that climbs, out-competes and smothers, kills and prevents regeneration of native vegetation. Has the potential to become a severe threat to biodiversity in heavily infested areas, its impacts appearing similar to those of bridal creeper. Birds spread the seeds which are able to germinate and establish in undisturbed soil. It also spreads vegetatively via its creeping underground stems. Formerly known as *Asparagus crispus*. Recorded on the outskirts of Port Lincoln. This is a timely early warning reminder.

***Ehrharta villosa var. maxima* (pyp grass)**
Study rating: 8
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

Pyp grass is a robust perennial *grass* with long creeping deep rhizomes, erect tall, spindly single or small tufts to waist high. *Leaf* blades are bluish green, smooth, rolled gradually and tapering at the tip. *Spikelets* often 1 sided, slightly hairy and straw coloured. Flowering occurs sporadically.

Pyp grass has varied growth habit but can be a rampant coloniser of disturbed areas with thick suffocating thatches through which limited native seedlings can penetrate. First collected in Australia in 1912 it was generally introduced as a dune stabiliser. Can be very difficult to remove. Its mat-forming habit also compromises rehabilitation projects and can have an impact on the structure and dynamics of coastal dunes.

***Lycium ferocissimum* (African boxthorn)**
Study rating: 8
Regional distribution: Widespread
Local density: Widespread

Photo: R. Sandercock

African boxthorn is a stout much branched thorny introduced woody *shrub* to over head high. Large spines are borne along the *stems* and short side stems. *Leaves* bright green, oval shaped, blunt tipped and smooth and sometimes slightly fleshy and are usually borne in groups of 5-12 clustered along stem and at the base of spines. Can be deciduous. Fragrant tubular *flowers* are pale-lilac to white in colour with 5 petals, sometimes with dark purple markings in the centre. *Fruit* a bright orange egg shaped or rounded berry when mature. Can be confused with the native boxthorn *Lycium australe* along with *Nitraria billardierei, Scaevola spinescens* and *Bursaria spinosa.*
A serious environmental weed of high impact it is a *declared plant of South Australia*. It can be habitat to pest and indigenous animals e.g. it is used as shelter by penguins. Therefore, thoroughly check habitat values before removing and make alternative provisions if necessary. It has been known to interfere with sea-lion breeding.

Rhamnus alaternus **(blowfly bush)**
Study rating: 8
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

Blowfly bush is a large robust woody *shrub* to over-head high. *Stems* angular, hairy and usually purple when young. *Leaves* alternately arranged, shiny dark green, tough and have a glossy leathery surface and borne on short stalks. Often shallowly toothed and a pointed tip. Small yellow–green tubular *flowers* have 5 petals and are in small dense clusters in the leaf forks. *Fruits* are fleshy and berry like, turn from green to red and eventually black as they mature and are prolific.

Introduced shrub or tree from the Mediterranean it is quick growing and invasive and dominating environmental weed. Long lived plants, prefers disturbed soils but can germinate in established vegetation. Prefers a climate with dry summers and particularly invasive of dry coastal vegetation but also lower light conditions in closed shrub and woodlands. Strongholds emerging and is considered a serious risk to coastal areas and will invade undisturbed areas. Do not confuse with *Alyxia buxifolia* or *Adriana quadripartita.*

Arctotheca populifolia **(beach daisy)**
Study rating: 7
Distribution: Localised
Density: Common

Photo: R. Sandercock

Beach daisy is a low spreading thickset hairy perennial *herb* to shin high. Fleshy, semi-succulent prostrate *stems* are covered with hairs. *Leaves* also matted with hair are oval-shaped, pale grey-green in colour and are on short stalks. *Flowers* a yellow daisy, the ray florets are bright yellow and widely spaced and the central flowers are greenish yellow from winter to early summer. Produced on long stalks in the axils of leaves, extending beyond the leaf structure. *Fruit* is 5 mm long with a white woolly cover, remains closed when ripe.

A coastal species, it grows in deep sand and is a pioneer of beaches and foredunes. It is capable of rapid regeneration in extreme conditions. It is short lived but persistent and an invasive environmental weed and is more strongly sand-binding than the natives which it replaces, resulting in more mounded dune shapes. Seed spread by wind and being highly viable and buoyant also travel by tidal currents. Found on open-ocean coasts often on western facing beaches and possibly spread on the Leeuwin current with seed sources from Western Australian coastal sources, where it is found from Perth to Esperance. Replace gradually with *Spinifex*.

***Freesia cultivar* (freesia)**
Study rating: 7
Regional distribution: Localised
Local density: Widespread

Photo: R. Sandercock

Freesia is a small *herb*aceous annual plant growing to knee high from underground 'bulbs'. This species has long-lived underground corms and short-lived above ground vegetation. It is usually dormant during summer. It has short strap-like elongated *leaves* mostly clustered together at the base of the plant. Slender flowering stems are upright, but bent horizontally just below the flowers. Sweetly-scented tubular *flowers* are white or cream in colour with purplish and yellow markings borne in short spikes at the tips of the flowering stems. These flowers have six 'petals' with rounded tips that are partially fused together. *Fruit* is a small green capsules with a rough or wrinkled surface texture.

A garden escape, this species can form dense infestations that compete with native vegetation and can become a serious weed in coastal heath.

***Limonium companyonis* (sea-lavender)**
Study rating: 7
Distribution: Common
Density: Widespread

Photo: R. Sandercock

Sea-lavender is a perennial *herb*, to shin high, with a basal rosette of narrow to round spoon shaped *leaves*. Erect *stems* and inflorescence with tiny purple paper-like *flowers* in loose spreading spikelets, bearing branched, one-sided groups of small funnel shaped papery purple flowers. Flowers early summer.

Copes well in saline soils and invades the perimeter of salt marsh areas and limestone cliffs. It forms dense mats, crowding out native plant species. It is a hungry feeder and difficult to control.

Limonium sp. **(sea-lavender)**
Study rating: 7
Regional distribution: Common
Local density: Common

There is some uncertainty botanically in the identification of Sea-lavenders with potential hybridizations. The most common species found on the coast are *L. companyonis* and *L. hyblaeum*. These are separated by the number of flowers per spikelet.

Polygala virgata **(broom milkwort)**
Study rating: 7
Regional distribution: Localised
Local density: Isolated

Broom milkwort is an erect, evergreen *shrub* and grows to over head high. A single *stem* is formed at the base of the plant and slender hairless branches occur at the top. Simple *leaves* are alternately arranged on younger branches and usually drop before flowering. The leaves are narrow in shape, dark green with a velvety texture. Drooping racemes of deep purple to pale lilac pea like *flowers* are borne at the ends of branches. The flower has two side wings streaked with darker veins. Forward pointing purple tuft of tiny hairs occur at the tip of the folded lower petal. The *fruit* is a two-celled capsule and the seed is small, black and oval shaped.

Broom milkwort has escaped cultivation as a garden ornamental and become naturalised in coastal dune vegetation and is an emerging environmental weed.

Chrysanthemoides monilifera ssp. monilifera **(boneseed)**
Study rating: 6
Regional distribution: Isolated
Local density: Common

Boneseed is an evergreen erect woody *shrub* forming a dense canopy to head high. Woody *stems* are heavily branched and often purple tinged towards the tip. *Leaves* alternately arranged, smooth, paddle shaped and coarsely toothed with downy tufts on young growth. Bright yellow daisy like *flowers* with 5 to 8 petals in short stalked clusters on the tips of branches. *Berries* are firm and green, ripening to black and contain a single smooth bone-coloured long-lived seed.

Photo: R. Sandercock

A *Weed of National Significance*, a heavy seeder and rapid spreader and is an invasive environmental weed of headlands and dunes. Don't confuse with the coastal boobialla *Myoporum insulare*. Spread by birds, it is a prolific seeder and has a long-lived seed bank and has the ability to establish in disturbed and undisturbed native vegetation. It can form dense thickets several metres high which exclude most native understorey species and prevent their regeneration. This aggressive species has spread rapidly and is replacing entire ecosystems and invading conservation areas in southern Australia. Its weediness is largely due to its vigorous growth and its ability to regenerate quickly and out-compete other species after fire.

Ehrharta calycina **(perennial veldt grass)**
Study rating: 6
Regional distribution: Isolated
Local density: Common


Photo: R. Sandercock

Perennial veldt grass is a variable tufted *grass* to thigh high. Dull or blue-green *leaves* usually flat or in-rolled often tinged purple and red or purple. Reddish-purple *flower* spikelet is a narrow but loose cluster. When mature the brown drooping fruit hang down towards one side. Sets abundant seed in spring.

It is a persistent, invasive environmental weed and can become a nearly continuous cover. Has a competitive advantage and grows well on loose, sandy soils with low fertility. On these soils veldt grass sets profuse amounts of seed and will readily move into disturbed areas or invade native bushland. It is not considered a resilient species under heavy grazing and does not tolerate shading, but if left is invasive, being drought tolerant its dry dormant state creates a fire hazard and increases fire frequency in dunal systems. It also suppresses the presence of native dune grasses. It is mostly seen in low salt exposure areas in swales, hind and mid dunes.

Gazania rigens **(gazania)**
Study rating: 6
Regional distribution: Common
Local density: Common


Photo: R. Sandercock

Coastal gazania is a clump forming perennial *herb* growing to shin high. *Leaves* are small, linear and dark green with a white under surface. Solitary daisy-like *flowers* are produced on long stems. Can be easily confused with *Gazania linearis*.

Gazania linearis: Gazania is a much-branched creeping perennial *herb* to shin high. *Leaves* variable but generally lobed and fleshy have a leathery green surface with white hairs, and a vein on the underside. *Flowers* daisy-like with many petals on long stems. The disk floret is orange to yellow in colour, changing to a deep yellow or black marking near the base of each petal. It is distinctive, not easily mistaken with native species.

Both Gazania species flower most of the year. Seeds spread rapidly by water, wind and in dumped garden waste. Many hybrids have been developed for cultivation, which makes identification difficult. Withstands salt-laden winds and grows well in sandy soils. They can severely alter the vegetation structure in plant communities by replacing and suppressing native plants possibly from a high moisture demand.

At the next level of threat are the remainder of the Red Alert weeds with threat values between 4 and 6. This list is also in threat rating order:

***Acacia cyclops* (western coastal wattle)**
Study rating: 5
Regional distribution: Common
Local density: Common

Photo: R. Sandercock

***Acacia saligna* (golden wreath wattle)**
Study rating: 5
Regional distribution: Localised
Local density: Isolated

Photo: R. Sandercock

***Avena fatua* (wild oat)**
Study rating: 5
Regional distribution: Widespread
Local density: Widespread

***Avena sp.* Photo: R. Sandercock**

***Euphorbia paralias* (sea spurge)**
Study rating: 5
Regional distribution: Widespread
Local density: Widespread

Photo: R. Sandercock

Euphorbia peplus **(petty spurge)**
Study rating: 5
Regional distribution: Widespread
Local density: Widespread

NO PHOTO

Euphorbia terracina **(false caper)**
Study rating: 5
Regional distribution: Common
Local density: Common

Photo: R. Sandercock

Leptospermum laevigatum **(coast tea-tree)**
Study rating: 5
Regional distribution: Isolated
Local density: Isolated

Photo: R. Sandercock

Marrubium vulgare **(horehound)**
Study rating: 5
Regional distribution: Common
Local density: Common

Photo: R. Sandercock

Olea europaea ssp. **(olive)**
Study rating: 5
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

Oxalis pes-caprae **(soursob)**
Study rating: 5
Regional distribution: Common
Local density: Common

Photo: R. Sandercock

Pinus halepensis **(aleppo pine)**
Study rating: 5
Regional distribution: Localised
Local density: Common

Pinus sp. **Photo: R. Sandercock**

Argyranthemum frutescens ssp. **(tenerrife daisy)**
Study rating: 4
Regional distribution: Localised
Local density: Isolated

Photo: R. Sandercock

***Carrichtera annua* (Ward's weed)**
Study rating: 4
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

***Coprosma repens* (New Zealand mirror-bush)**
Study rating: 4
Regional distribution: Isolated
Local density: Isolated

Photo: R. Sandercock

***Dipogon lignosus* (lavatory creeper)**
Study rating: 4
Regional distribution: Isolated
Local density: Isolated

Photo: R. Sandercock

***Juncus acutus* (sharp rush)**
Study rating: 4
Regional distribution: Localised
Local density: Common

Photo: R. Sandercock

***Mesembryanthemum crystallinum* (common iceplant)**
Study rating: 4
Regional distribution: Common
Local density: Common

Photo: R. Sandercock

***Argyranthemum frutescens ssp. foeniculaceum* (teneriffe daisy)**
Study rating: 4
Regional distribution: Localised
Local density: Isolated

NO PHOTO

***Juncus capitatus* (dwarf rush)**
Study rating: 4
Regional distribution: Localised
Local density: Isolated

NO PHOTO

***Pennisetum clandestinum* (kikuyu)**
Study rating: 4
Regional distribution: Localised
Local density: Common

NO PHOTO

Early Warning

While assessing weeds as a key threat to the Eyre Peninsula coast, it was noted that a number of high priority environmental weeds are not currently present in the region. However, there is a strong likelihood for these weeds to become established from further a field in the future. It is imperative that land managers and communities are aware of these high priority weeds and are readily able to identify any new arrivals or outbreaks. Particular species of concern are detailed below:

***Cenchrus ciliaris* (buffel grass)**

Buffel grass is a perennial bunch *grass* with erect culms to waist high. *Leaf* blades are bluish-green in colour with soft hairs on the upper surface. *Flower* is generally cylindrical in outline, 2-14 cm long, and can be purple, grey or yellowish. The spikelets are solitary or clustered, and are surrounded by numerous bristles.
This invader forms dense thickets that displace native species. Spread by wind. It has the dramatic ability to carry fire in ecosystems where fire does not normally play a role. It is adaptable; it grows

Photo: R. Sandercock

well in heavy, limestone, and sand soils, can tolerate low pH, and is drought tolerant. Early warning status

Trachyandra divaricata (dune onion-grass)

Photo: R. Sandercock

Dune onion-grass is a tufted *herb* to knee high. Flat fleshy sticky *leaves*. *Flowers* white with a brown central stripe on petals. Flowers late winter–spring. *Seed* red–brown to black.

The flower stems detach and tumble with the wind and disperses numerous seed. It is possibly the coast's most serious potential weed threat. A probable introduction from ship ballast. Most prevalent on eastern Gulf St Vincent but recorded also at Tumby Bay (EP20).

*Retama raetam (*white weeping broom)

White weeping broom is large woody weeping *shrub* to over-head high. Grey-green with slender, drooping *branches*. The *leaves* are small and narrow and are quickly dropped and the plant remains leafless for most of the year. *Flowers* are white and pea like appearing close to the stem in clusters. Flowers from late winter to mid spring, shedding *seed* pods late spring/early summer.

Photo: R. Sandercock

On the *Alert List of Environmental Weeds*. Thrives in alkaline soils and very adapted to arid conditions. Rapidly colonises and is emerging in coastal areas. Has been recorded north of Tumby Bay and in the Lipson Cove area (EP18). Sold from nurseries.

Non-rated Weeds of Importance

Some weed species were not rated as high priority environmental weeds during the threat evaluation process, although were still noted as being of importance due to other benefits to the coast.

Cakile maritima ssp. *maritima* (two-horned sea rocket)

Sea rocket was first recorded in South Australia in 1918, thought to be introduced from ship ballast. A widespread cosmopolitan plant that is found at the back of the beach and any extremely disturbed dune site. A niche plant co-existing contentedly, rarely invasive, a good soil and dune stabiliser and doesn't appear to be colonising any space at the expense of local indigenous species.

Photo: R. Sandercock

4.6.5 Managing Weeds

Despite longstanding control measures administered by a wide range of natural resource managers, there is evidence of an increasing rate of weed encroachment towards every ecosystem of immediate conservation value within Australia (Agriculture and Resource Management Council of Australia and New Zealand Environment and Conservation Council, 1999). The public ownership and linearity of the coast make the recognition of the weed disturbance problematic. More needs to be done as weeds are having an impact on the coast and no adequate baseline data or monitoring is in place. As weed flora is constantly changing with new introductions the collection of specimens and mapping can be vitally important. More resources and developing a centralised weed database with GIS capability could reverse the lack of environmental weed mapping.

A serious weed often appears after it has naturalised and the earlier the awareness of a widening distribution, the greater chance of timely control measure being implemented. With efficient weed risk assessment and rapid response to weed outbreaks, future environmental damage can be minimised.

While it would be desirable to consider the control of weeds on the coast as a high priority, funds will be a limiting factor and weed management strategies should subsequently aim to reduce or eliminate physical disturbance to native vegetation. Strategies and funding should also consider the ability to control weed species beyond seed viability.In addition, targeting the control of weeds and preventing new incursions in areas of high biodiversity value and large areas currently relatively free of weeds is vital.

Actions

A number of land management practices can be enacted which could decrease weed ingress, including: rationalising access tracks, restricting fire breaks to only where required, controlling introduced grazing animals, maintaining both weed-free and fertilizer-free buffer zones around native vegetation. It is also imperative that potential introductions of plants for productive or amenity purposes are thoroughly vetted in terms of invasive characteristics. At a local level, many coastal weeds are readily available for purchase from commercial plant nurseries and local produce markets. Information on the risk of garden plants that are known coastal weeds needs to be made available to those who are likely to use these species in near-coastal situations.

4.7 Dune instability

Large areas of vegetated and unvegetated coastal dunes occur across Eyre Peninsula. Within the study area approximately 32% or 61,642ha is covered by dunes. These dunes range from huge unstable sand masses that extend over 9km inland, such as those at Coffin Bay, to small foredunes backed by agricultural land such as at The Knob, to cliff-top dunes such as those at Cape Wiles where the cliffs are over 100m high.

Blowouts, deflation and transgressive dunes are common around the sand dune coast of the Eyre Peninsula. The causes of dune instability are both natural and human induced. They include storm damage, fire, drought, plant disease, off road vehicle impact, feral species (e.g. rabbits), grazing and clearance. These causes, with regard to any one area, may be multiple and often interlinked. Also the de-vegetation of a dune may be linked to a single event, such as a fire or a storm; but the impact of such an event may be exacerbated by previous circumstances, such as years of drought, multiple vehicle tracks, or development within the dunes.

On high-energy sandy coasts, such as the western side of Eyre Peninsula, high tides and storm waves commonly damage the foredunes, and through natural causes, such as strong onshore winds, this damage may develop into a blowout. Primary colonising dune plants may, over time, reclaim this area resulting in a diversity of dune plant species, and habitat, within the dune complex as a whole. Diversity of dune plant species is a consideration in decisions to act or not act over dune stabilisation and also in what actions to undertake.

FIGURE 4.10 Large mobile transgressive dune system extending inland over salt marsh and threatening Fowlers Bay settlement (which has been partially covered in the past). Photo: Coast Protection Board, 2007.

However, if there is widespread destabilisation, creating an extensive transgressive dunefield, natural re-vegetation may be slow, and over time large quantities of sand may be transported by the wind and subsequently lost to the active beach/dune system. Where large quantities of sand are blown landwards, damage to native vegetation, roads, buildings or farmland may occur through burial. In addition, in extreme cases, coastal recession may result from transport of sediment inland from the beach. It is clear that with ongoing and accelerated sea level rise storm damage to foredunes will increase, and vegetation recovery may well be slow, increasing dune instability.

Many of the cliffs around the Eyre Peninsula coast have cliff-top dunes, few of which are still receiving sand. Therefore, where these dunes become unstable and mobilised, they can be difficult to repair and quickly lost leaving a deflated, usually calcarenite, surface.

The Coastal Management Unit of DENR has documented coastal sand dunes and their vegetation cover around the state, and this GIS layer is the basis of this threat variable within the analysis. Data on unstable dunes was obtained from the existing layer ‘coastal hazards’, based on recent aerial photography. High values were given where dunes were de-vegetated, ‘actual drift hazard’; medium threat values were given to vegetated dunes, as ‘potential drift hazard’.

The Science Resource Centre and Coastal Management Unit of DENR have also contributed to understanding coastal processes by examining change in position and vegetation cover of selected dunes, as shown on a time series of aerial photographs. Some of these results are illustrated in

Figures 4.11 – 4.13. The values for mean annual sand movement range from 9.8 metres per year (m/yr) in Sleaford Bay, to 3.5 m/yr at Point Peter near Ceduna, to 0 m/yr and a nett increase in vegetation cover at Port Neill. These values are not unusual, with other dunes around the state recording similar rates of movement. Nor is this a consistent movement. Dunes may be released by a series or events, as outlined above, or quickly colonised by vegetation and stabilised.

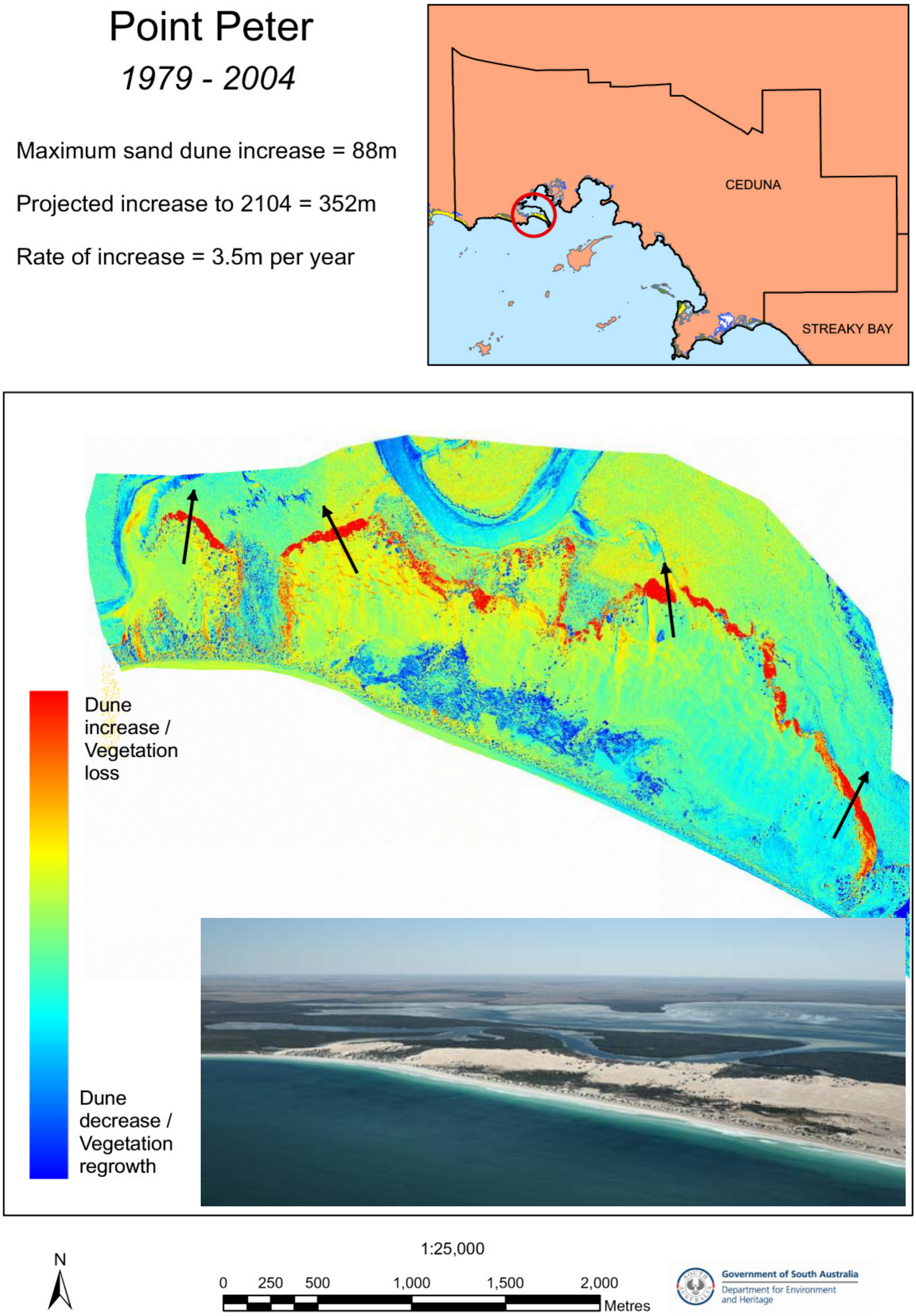

FIGURE 4.11 Change in position and vegetation of Point Peter dunes between 1979 and 2004

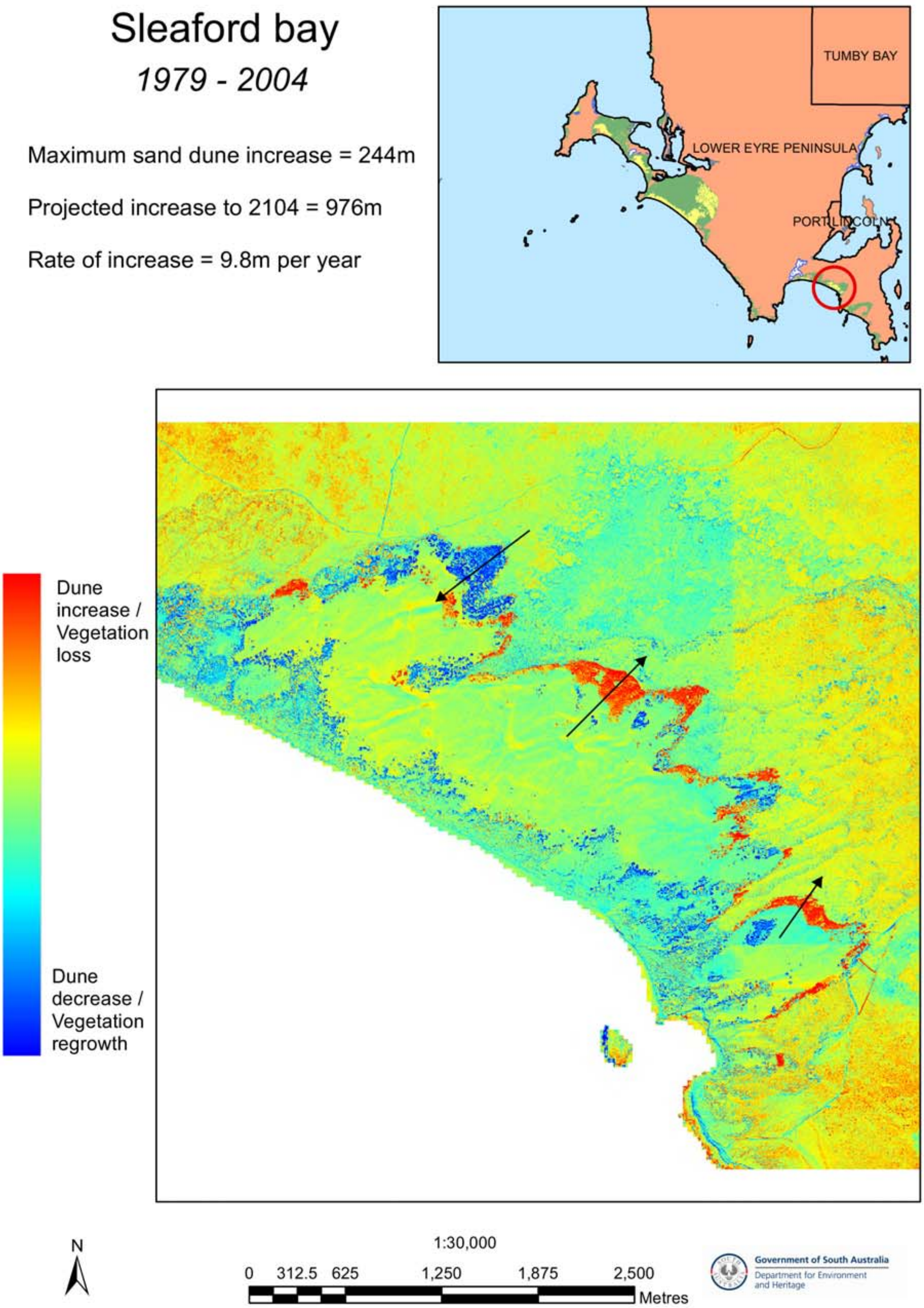

FIGURE 4.12 Change in position and vegetation of Sleaford Bay dunes between 1979 and 2004

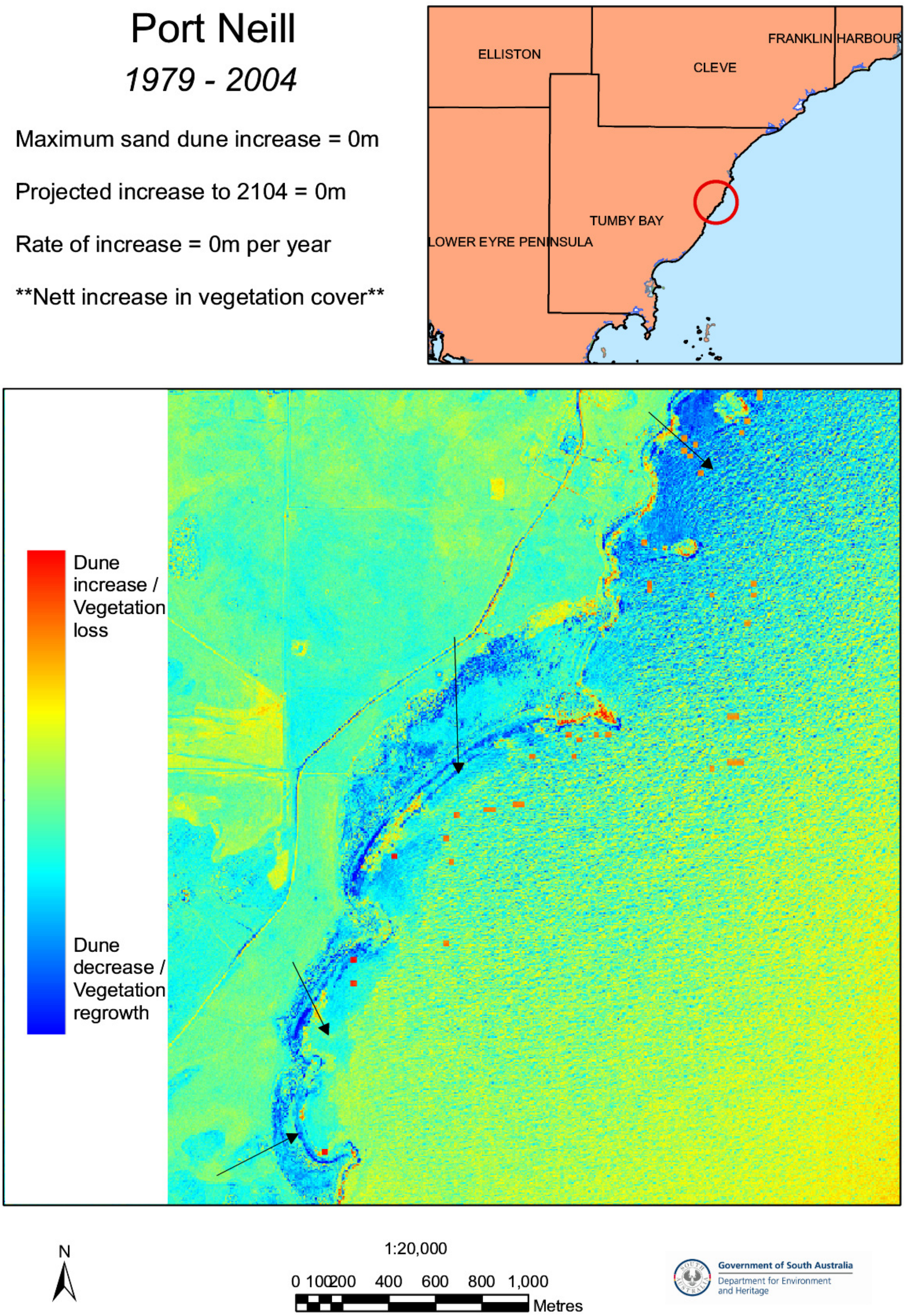

FIGURE 4.13 Change in position and vegetation of Port Neill dunes between 1979 and 2004

4.8 Cliff instability

Cliffs are inherently subject to change, because of the effects of gravity and water on steep slopes. However, these changes are episodic, often with intervals of decades between major events. Where changes occur more frequently, cliffs are often referred to as unstable.

In this study, cliffs are defined as unstable if they are steep, with visible signs of mass movement (rock fall, slump, slide, soil creep) or sub-aerial erosion (rills, gullies, sheet flow erosion). Frequently the signs of these processes may be debris at the toe of the cliff, or scars on the cliff face. Solution features may contribute to instability, where these have weakened the structural coherence of the rock. The cliffs were also divided into categories based on if they were less than, or greater than, 50 m in height.

Because of variation in rock coherence, porosity, local groundwater movement and solution rates, there is great variation in cliff instability across the region. Wave energy plays a part in cliff erosion, but its main role is in removing talus at the cliff base that is the result of weathering and mass movement on the cliff face. There are contrasts in rock materials around the region: for example unconsolidated conglomerates and brecchias forming low cliffs near North Shields are unstable and offer little resistance to storm removal of these loose materials. There are many soft limestone calcarenite cliffs from Port Lincoln west to Cape Adieu, with relative rapid rates of recession; for example at Point Labbatt and neighbouring headlands there are clear signs of rapid cliff failure (Figure 4.14). There are a small number of sites where ancient indurated basement rocks exhibit much lower rates of instability.

FIGURE 4.14 Relatively recent cliff collapse near Cape Radstock. Photo: Coast Protection Board, 2007

Around the Eyre Peninsula long term records of cliff recession are not available. However, field observation and informal records gives indications: in some cases these observations may be useful to land managers where paths, car parks, and roads are close to a receding cliff edge.

Cliff instability can impact on conservation values since on the land it is associated with accelerated run-off, mass movement (rock slide, slump, and rock fall), as well as loss of soil and habitat both on and adjacent to the cliffs. In the nearshore, it can increase the turbidity and nutrient load on reef and seagrass habitats. Cliff instability is also a potential safety hazard where tracks, paths, roads or buildings are too close to the cliff edge, either on the top of the cliff which may be at risk of collapse or at the base which has the potential risk of rock falls or slumping.

This variable does not attract high threat score totals because of its limited aerial extent, but may be very significant locally, demanding urgent action. As a result, most comment on this threat variable within the cell descriptions is sourced from the detailed cliff instability layer, rather than the cell statistics.

4.9 Coastal acid sulfate soils

Acid sulfate soils are naturally occurring soils with significant percentages of iron sulfide. These soils commonly occur in low-lying coastal areas where the water table is at or close to the surface. They were formed during or after marine inundation, when seawater containing dissolved sulfate covered organic rich environments, such as coastal wetlands, mangroves, salt marshes or tea-tree thickets. Nearly all saturated coastal soils below five metres Australian Height Datum (AHD) have the potential to develop coastal acid sulphate soils. While these soils are below the water table they remain relatively stable, simply being slowly processed by anaerobic bacteria; iron present within the soil combines with sulfur from the sulfate to form iron sulfides.

However, when these soils are exposed to the air, oxidation occurs and sulfuric acid is formed. The acid may simply react with carbonates and clay within the soil, but if a build up of acidic soil water occurs or is flushed to a waterway, damage to life forms may occur. The release of acid and metal ions into the environment can cause major habitat degradation and loss of biodiversity. In NSW for example, fish kills have been reported following disturbance to swampy areas near estuaries and coastal lakes.

Coastal acid sulfate soils have been mapped by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in South Australia (Fitzpatrick et al. 2003) and the results included as digital layer within the threats analysis. Table 4.2 details the acid sulfate soil map classes used.

The Coast Protection Board Policy on Coastal Acid Sulfate Soils (see Coast Protection Board, 2003, Coastline 33) relates to avoiding or minimizing the risk of development in high and moderate risk areas. The Board advises on development applications within coastal zones (as defined in the Development Regulations 2008), including advice over PCASS. Potential coastal acid sulfate soils development have been mapped for the Eyre Peninsula region, and are available on the DENR website, 'Naturemaps' http://www.naturemaps.sa.gov.au. The mapping of potential CASS in the region included a number field sample sites.

Within the Eyre Peninsula coastal region there are significant areas of moderate to high risk PCASS. 40 of the 85 cells contain some risk of PCASS, with the most extensive areas being on the upper eastern Eyre Peninsula and within embayments, such as Coffin Bay, Venus Bay and Tourville Bay. These areas are generally the low lying salt marsh and/or mangrove areas, a number of which have already been developed or are proposed to be developed (eg. Port Lincoln and Tumby Bay marinas – developed, Arno Bay and Ceduna proposed marinas). Development in these locations need to be assessed for CASS risk. If ASS soils are detected a CASS management plan needs to be prepared, otherwise the development may result in acid leaching into the infrastructure and/or the environment, thus putting both the development and native flora and fauna at risk.

TABLE 4.2 CSIRO acid sulfate soil map classes for South Australia

Map Legend	Class Description
(a) Actual CASS (disturbed).	Actual coastal acid sulfate soils. Very high risk.
(b) Potential CASS (disturbed)	Potential coastal acid sulfate soils (PCASS) in subsoil below 20cm (up to 1 metre thick) with surface monosulfidic black ooze (MBO), intertidal (mainly in samphire). Moderate risk because carbonate layers usually occur above and below.
Potential CASS (mangrove)	Thick PCASS – mangrove soil. Mainly in mangroves, with high risk
Potential CASS (tidal stream)	PCASS of tidal streams (CPASS underlying, not extensive laterally). Moderate risk.
Potential CASS (intertidal tidal)	PCASS in subsoil below 20cm (up to 1m thick) with surface monosulfidic black ooze (MBO), intertidal (mainly in samphire). Moderate risk because carbonate layers usually occur above and below.
Potential CASS (supratidal)	PCASS in subsoil below 50cm (up to 1m thick) with some surface MBO – supratidal. (Mainly in samphire, salt bush, blue bush or saltpan associated with hypersaline soils where there is less frequent tidal inundation). Moderate to low risk.
Sand	Soils of sand dunes and ridges. (No PCASS or CASS within 1 metre of the surface). Low risk of PCASS below water table.
Calcarenite/ Aeolianite	Calcareous soils and hardpans. (No PCASS, highly neutralising). No risk or very low risk.
Marine soils	Marine soils – subtidal and intertidal marine. (PCASS may be present, CASS neutralised by tides and carbonates). No or very low risk.
Other soils	Soils associated with other land uses within coastal landforms. Risk requires individual investigation; guided by adjacent mapped units.

CASS = Coastal acid sulfate soils

PCASS = Potential coastal acid sulfate soils

FIGURE 4.15 Franklin Harbour dieback area, Pyrites showing iron ring. Photo: D. Fotheringham.

4.10 Feral species

The European Rabbit, Red Fox, feral deer and feral goat are declared pest species under the *Natural Resources Management Act 2004*. In addition to the feral cat, these introduced species have all been recorded within the Eyre Peninsula coastal boundary. Rabbits, deer and goats primarily threaten native vegetation and by association, fauna species dependent upon this vegetation. These animals are a major threat to the natural environment and have contributed to the loss or decline of many flora and fauna species. They threaten the natural conservation assets of the region by:

- Out-competing native wildlife for food and shelter ;
- Browsing and grazing native vegetation to low levels ;
- Causing soil erosion and contributing to land degradation;
- Ring-barking trees and shrubs and causing die-back;
- Preventing natural regeneration of native plants and frustrating replanting efforts by eating seedlings; and
- Promoting and spreading weeds.

In addition, the huge numbers of rabbits support populations of introduced predators such as foxes and feral cats that also prey on native wildlife. Foxes in particular are the major predator threatening the survival of native wildlife and many currently threatened species. Both of these animals are a threat to native fauna by:

- preying on native wildlife - foxes are implicated in the decline and extinction of many ground-dwelling mammals,
- threatening ground-nesting birds, small-medium sized mammals and island fauna;

- hindering threatened species recovery and re-introduction programs;
- spreading diseases that affect native fauna; and
- promote and spread weeds that adversely affect ecological communities.

Within the analysis, only rabbits were included. This is due to having very limited information on the current population and distribution of feral species across the whole study area. The information on rabbit activity used in the analysis was created using knowledge of EP NRM staff and other local members. The analysis found that the area from Gibbon Point (EP12) to North Shields (EP26) and Venus Bay (EP54) to Perlubie (EP67) were the two areas of highest activity (although with some areas of low activity within them). However, like native species, the population and distribution of feral species can change from season to season, and therefore regular monitoring of population, distribution and impacts is important to ensure effective and adaptive management actions are undertaken in response to current feral species threats.

4.11 Climate change

"Coastal regions are vulnerable to sea level rise, increased sea surface temperature, increased storm intensity and frequency, ocean acidification and changes to rainfall, run-off, wave size and direction and ocean currents." (National Climate Change Adaptation Framework, COAG, April, 2007)

Climate change is treated within this report as a threat, however, there is no detailed local data to be analysed through the GIS approach used in this project. Rather, the best available projections of change for this region are used to identify potential impacts in the coastal zone, and this is compiled at the local level within the cell descriptions, section 6.3.

The Intergovernmental Panel on Climate Change (IPCC) published its Fourth Assessment Report (AR4) on global climate change, in 2007. An update of AR4 for the December 2009 Copenhagen Climate Change Conference has been published by a large group of atmospheric scientists from published refereed work in 2007 and 2008 (The Copenhagen Diagnosis 2009).The CSIRO has elaborated statewide projections of change (McInnes et al, 2003 and Suppiah et al, 2006) and, most recently, an updated technical report and series of regional scale maps (CSIRO, 2007). Currently, the South Australian Coast Protection Board is in the process of reviewing the state policy on coastal flooding and erosion.

Hennesey 2006, has used projections for the years 2030 and 2070 for initial assessments of risk at a national scale, and CSIRO 2007 uses these dates for maps of detailed local projections. Consequently these dates are employed in the climate change scenario below, which acts as the basis for the impacts and possible adaptations in the cell descriptions.

Set out below is a brief summary of the most reliable accounts of climate change within the region. In Chapter 6 local impacts and adaptations within the coastal region have been placed into cell descriptions, together with possible management actions. The context (alerting decision makers to changes likely to relate to the objectives of this project) outlined in this section, and the risk identification (likely impacts of climate change on the local areas described in the cell descriptions) constitute the first two stages of a risk management framework. Important future work on event and impact probability is beyond the scope of this study.

4.11.1 Projected climate scenario for the Eyre Peninsula coastal region

Below is a summary of climate change projections applied to coastal cells in the EP NRM region. The figures relating to climate are taken from CSIRO 2007 maps; the figures for sea level rise are from discussion of the Copenhagen Diagnosis (2009) below.

1. Sea level rise, storm magnitude and frequency

The current mean sea rise of 4.2mm/yr for the region will accelerate[1].

Sea levels in the region will be 20cm higher by 2030, 80cm higher by 2070.

Rare intense storms could add a surge comparable to todays surges of the order of 0.5m (open ocean coast) to 1.5m (upper gulf coast).

Although storm frequency may vary greatly over decades, flood heights considered rare today will become much more frequent due to sea level rise.

2. Increasing average temperature

Mean annual temperatures are projected to increase to between +0.3 to 0.6^{0}C by 2030, and to between $+1.5^{0}$C to 3.0^{0}C by 2070[2].

3. Drier average conditions

Total annual rainfall will fall by 2% to 5% by 2030, and by 10% to 20% by 2070. The most marked decrease is indicated in winter and spring.

An increase in potential evapo-transpiration varying from +4% to +8%, adds to increasing aridity.

Groundwater levels will fall and saltwater incursion near the coast will increase.

4. Run-off regime change

Increased aridity will be reflected in reduced run-off.

Rare, intense rainfall events will see flash floods in creeks and storm drains, taking sediment and solutes to coastal wetlands and nearshore waters.

5. Ocean and Gulf waters change

Ocean waters will become more acid, making calcium carbonate less available for the growth of crustaceans and plankton.

Sea surface temperatures are projected to rise to $<1.0^{0}$C to 2.0^{0}C by 2070.

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[1] The National Tidal Centre of the Bureau of Meteorology has reported that current (2008) annual sea level rise in the Australian region is 4.5mm, (communication to the Sea Level committee of the Coast Protection Board South Australia). This is tracking a little above the IPCC projections. The trend at Thevenard baseline tidal recording station reported in 2009 was 4.2mm/yr; see: http://www.bom.gov.au/ntc/IDO60202/IDO60202.2009.pdf.

[2] Values quoted are from the maps within the CSIRO website at http://www.climatechangeinaustralia.gov.au/. The figures are of the 50th percentile, i.e. mid-range, and varying from a low emission to a high emission future.

Local coastal winds may fall slightly in average speed; long period swell (generated well south in the Southern Ocean) may increase slightly in strength.[3]

4.11.2 Scenario for climate change and impact on habitats, for use in Chapter 6

From the sources noted above, projected conditions in 2030 and 2070 are summarised below; impacts of the changes on habitats within the region are then outlined in bold.

a) Sea level rise and change in storm magnitude and frequency

Sea levels in the region are projected to be higher in 2030 by + 20cm and in 2070 by + 80cm. The current mean sea level rise of c.4.2mm/year for the region will accelerate. From 1992 until September 2010, measured sea level rise at Port Stanvac has averaged 4.7mm per year, and 4.1mm per year at Thevenard. While sea level rise of 4mm per year may not seem significant in itself, a general rule of thumb is that sandy coastlines will typically recede by about 50 to 100 times the amount of sea level rise. Thus, current mean sea level rise of c.4mm per year (73mm in the 18 years since 1992) translates to potential coastal recession of 3.7 to 7.4 metres over that period. Sea levels in the region are projected to be higher in 2030 by + 20cm and in 2070 by + 80cm: these would lead to erosion of 10 to 20m of sandy beaches by 2030, and 40 to 80m recession by 2070.

Rare intense storms could add a surge height comparable to today's surges of + 0.5m (open ocean coast) to 1.5m.(head of Gulf); salt marsh and low ground are inundated throughout the northern part of the Gulf in major storms, due to the funnelling effect of the shape of the Gulf, exacerbating the storm tide height. Although storm frequency may fall, flood heights considered rare today will become much more frequent, because of sea level rise. For example, following a 50cm sea level rise, the elevation of today's 100 year flood at Adelaide, could become the 2 year flood. Sea level rise therefore affects not only the extent of an area that gets flooded, but greatly increases the frequency of flooding for areas already at risk of flooding.

The impact of such changes will lead to beach recession, foredune damage and loss, and dune de-stabilisation; large barrier systems, such as Coffin Bay NP and the Lake Newland CP will continue to retreat, increased foredune damage will accelerate the existing transgression and transfer of sediment from the foreshore to the back dune. Low dune ridges in front of flood-prone land will be subject to storm overtopping and very rapid recession, as dune sediments are simply moved as overwash deposits across the back barrier swamp[4]. Dune de-stabilisation is a threat to reptile habitat, notably the two focal species for this project, the Beach Slider and the Bight Coast Skink.

Erosion of the many calcarenite cliffs will accelerate, many shorelines will become more indented as pocket beaches are lost, shore platforms and reefs will be flooded; some reef habitats will profoundly change.

The more frequent and extensive inundation of coastal wetlands, including salt marshes, and changes to estuarine salinity regimes, will all have terrestrial habitat implications; these changes on

[3] Hemmer et al 2008.

[4] Because of the topography and raised surge levels within the Gulf, this scenario is especially a concern on the eastern coast of the region. For example, at Arno Bay, rapid landform change in response to sea level rise is a threat to salt marsh and dune conservation values, and also constitutes a risk to the homes on Creek Road and Sunrise Drive.

the land will also have implications for the marine environment as transfer of sediment and nutrients from land to sea is altered and fish nurseries changed. Recession of mangroves will reduce the habitats of many birds – including migratory species - using the salt marsh and its lakes; loss of sand spits and some pocket beaches will be a particular challenge for shorebirds. Coastal wetlands and estuaries will not only suffer more frequent storm tidal inundation, but also slow salt water intrusion through surface waterways and sub-surface seepage. Profound habitat change in coastal wetlands and salt marsh will impact on feeding and nesting opportunities for many bird species

b) Increasing average temperatures and aridity

Mean annual temperatures are projected to increase to between 0.6^{0}C to 1.0^{0}C by 2030 and between 1.5^{0C} to 2.0^{0}C and 2.5^{0}C to 3.0^{0}C by 2070. Annual rainfall: changes of -2% to -5% by 2030, and -10% to -20% by 2070 are projected for areas near the coast; greatest decrease is indicated in spring. An increase in potential evapo-transpiration of up to 8% adds to the effect of increasing aridity.

While coastal plants are already adapted to a hostile salty and windy environment, these changes will have an impact: vegetation will be slower to recover following damage, and this may well allow weed invasion. This is especially significant for many dune areas that will be mobilised by reduction in stabilising vegetation cover. Fragmentation of habitats reduces the ability of species to adapt through migration. The response of individual plant and animal species to the whole range of changed climate conditions is uncertain. Response to drier conditions will be felt throughout the hydrologic cycle. Groundwater levels will drop, and at the coast saltwater incursion into areas formerly sustained by fresh groundwater is a significant potential issue. (Where in the past groundwater has been lowered by pumping, eg. Willunga Basin, district of Marion and Brighton, wells have become salinised as groundwater pressure has fallen.) Coastal freshwater lakes will be reduced, with longer periods of lower water or desiccation.

c) Run-off regime change

Increasing aridity will be reflected in reduced run off: some seasonal streams will flow for fewer months, others will not flow. The intensity of rare extreme rainfall events will increase, and this will be reflected in flash floods in creeks and storm drains. What are now semi arid creeks will behave more as arid land creeks.

The intensity of rare rainfall events may be expected to increase soil erosion, both through sheet flow and gullying: coastal slopes and soft rock cliffs may be impacted by this, although this is considerably affected by land and drainage management. Nearshore waters, coastal wetlands and lakes will receive irregular pulses of sediment from these events. The balance of sediment accretion, sediment compaction and sea level rise will determine the changes in mangroves and salt marsh (Saintilan, 2009, pp. 60-69): plentiful sediment supply (both from land and sea) may allow mangrove and salt marsh to maintain elevation with regard to sea level. Contemporary study (Saintilan & Williams 1999) demonstrates salt marsh loss to mangrove encroachment throughout SE Australia; in the balance of sediment accretion and contemporary sea level rise there appears to be an accretion deficit. Salt marsh survival appears to depend on planned habitat retreat in the face of sea level rise and sediment deficit.

d) Ocean waters change

Ocean waters will become more acid as carbon dioxide is absorbed into sea water. Surface ocean temperatures are projected to rise by 0.3^0 C to 0.6^0 C by 2030, and 1.0^0 C to 1.5^0 C by 2070, although there is great variation between models for the latter date. Global changes in ocean circulation may result from movement of the climatic belts; notably this may impact on ocean upwellings. Wind speed changes are slight; with small average falls. Weather systems over the Southern Ocean are expected to continue to supply considerable swell wave energy from the south.

The response of individual marine plant and animal species to the whole range of changed climate conditions is uncertain. In response to increasing ocean acidity marine organisms will produce smaller and thinner shells; however the timing is uncertain. Southern Ocean foraminifera have recently been reported as showing reduced calcification, (Moy, 2009). Supply of nearshore calcareous sands to beaches will decrease, although timescale and quantity are uncertain. Ocean warming may well result in loss of cold water species and gain in tropical species. Modification of ocean circulation has the potential to alter upwellings, in timing and occurrence. Swell wave climate under Greenhouse conditions are expected to continue to drive shoreline littoral drift sand movement in direction and strength similar to today within the region.

4.11.3 Projections of sea level rise, coastal storms and changing wave conditions

The CSIRO 2007 review quotes the IPCC 2007 projections of sea level rise, noted above:

> *"Global sea level rise is projected by the IPCC to be 18-59 cm by 2100, with a possible additional contribution from ice sheets of 10 to 20 cm. However, further ice sheet contributions that cannot be quantified at this time may increase the upper limit of sea level rise substantially. However, further ice sheet contributions that cannot be quantified at this time may increase the upper limit of sea level rise substantially." (CSIRO, 2007, p.92).*

Variations in the projected rate of sea level rise around the global mean along the coast of Australia show (p.93) that South Australia is projected as changing close to the mean; variations are due to mean atmospheric pressure and varying strength of ocean currents.

Currently, storm surges of at least 0.5 to 1.5 metres occur along the South Australian coast[5]; they are caused by west to south-westerlies following the passage of fronts and their associated low pressure systems further south (McInnes,2003). The frequency of winter lows and therefore the frequency of surges decreases by about 20% in the vicinity of SA under enhanced greenhouse conditions, however, the largest storms show an increase in intensity. It should be remembered though that when storm frequency is combined with sea level rise, the probability of a surge at heights within the present range, would increase.[6] The magnitude of the highest floods also increases: modelling of the combined effect of sea level rise and storm surge on parts of the Victorian coast "demonstrate the potential for significant increases in inundation due to higher mean sea level and much more intense weather systems" (CSIRO 2007, p.11).

Whilst local wave conditions depend on local winds and local storm frequency, underlying swell depends on synoptic conditions in the Southern Ocean. JL Davies (1980) has demonstrated that swell affecting the south coast of Australia is generated in the 'roaring forties'. CSIRO 2007, p.106, indicates that "The Southern Annular Mode is likely to shift towards its positive phase (weaker westerly winds over southern Australia, stronger westerly winds at higher latitudes)." This would result in some increase in the preponderance of long period swell, predominantly

[5] Storm event records show that surge near to 0.5m. above the forecast tide may be expected on the open Southern Ocean coast, due to combination of strong onshore winds and low atmospheric pressure.
[6] For example, from the tidal record held at DENR, if the current coastal flood risk curve for Port Adelaide is re-drawn 50cm higher, the present 100 year flood level becomes the 2 year ARI flood. Port Adelaide has been chosen for this example because of its relatively long tide record.

from the south-west; locally generated waves would become less significant. Under greenhouse conditions littoral movement of sand from south and west to north and east within the bays and within Spencer Gulf appears likely to continue, because of the continued energy input of the long period swell.

4.11.4 The Copenhagen Diagnosis, 2009

This summary of research, prepared for the Copenhagen Conference of December 2009, is a survey of worldwide trends (see reference The Copenhagen Diagnosis 2009). The report was prepared by 26 leading climate scientists, including a number of Intergovernmental Panel on Climate Change (IPCC) Lead Authors, and seeks to synthesise the most policy-relevant climate science published since the close-off of material for the last (2007) IPCC report. It updates the discussion above in this section.

The warming trend is confirmed by more recent observations, as summarised in The Copenhagen Diagnosis 2009, p.17 "the IPCC gave the 25-year trend as 0.177 ± 0.052 °C per decade for the period ending 2006. Updating this by including the last two years (2007 and 2008), the trend becomes 0.187 ± 0.052 °C per decade for the period ending 2008. The recent observed climate trend is thus one of ongoing warming, in line with IPCC predictions". This atmospheric warming trend is further supported by recent reports on current ocean warming, The Copenhagen Diagnosis 2009, p.37: "Increases in oceanic heat content in the upper ocean (0-700m) between 1963 and 2003 have been found to be 50% higher than previous estimates (Domingues et al. 2008, Bindoff et al. 2007). The higher estimates of heat content change are now consistent with observations of sea-level rise over the last 50 years, resolving a long standing scientific problem in understanding the contribution of thermal expansion to sea-level (Domingues et al. 2008). Observations also show deep-ocean warming that is much more widespread in the Atlantic and Southern Oceans (Johnson et al. 2008a, Johnson et al. 2008b) than previously appreciated."

Ocean trends towards greater acidity have been further detailed in The Copenhagen Diagnosis 2009, p. 38, "The increase in ocean CO_2 has caused a direct decrease in surface ocean pH by an average of 0.1 units since 1750 and an increase in acidity by more than 30% (Orr et al. 2005: McNeil and Matear 2007; Riebesell, et al. 2009). Calcifying organisms and reefs have been shown to be particularly vulnerable to high CO_2, low pH waters (Fabry et al. 2008). New in-situ evidence shows a tight dependence between calcification and atmospheric CO_2, with smaller shells evident during higher CO_2 conditions over the past 50,000 years (Moy et al. 2009). Furthermore, due to pre-existing conditions, the polar regions of the Arctic and Southern Oceans are expected to start dissolving certain shells once the atmospheric levels reach 450ppm (~2030 under business-as-usual scenario); McNeil and Matear 2008: Orr et al. 2009)."

With regard to sea level rise, the Copenhagen Diagnosis points out that the papers published since 2007 show loss of ice sheet mass from the polar regions, and, assuming this to continue in line with temperature change, would lead to a doubling of the IPCC AR4 estimate by 2100.

> *"Satellite measurements show sea-level is rising at 3 to 4 millimeters per year since these records (satellite) began in 1993. This is 80% faster than the best estimate of the IPCC Third Assessment Report for the same time period. Accounting for ice-sheet mass loss, sea-level rise until 2100 is likely to be at least twice as large as that presented by IPCC AR4, with an upper limit of ~2m based on new ice-sheet understanding."*
> (The Copenhagen Diagnosis 2009, p.37, summary points)

Anthropogenic warming and sea level rise would continue for centuries due to the timescales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilised now.

4.11.5 Discussion of Sea Level Rise Scenarios

There is considerable uncertainty over future global sea level rise amongst published scenarios, due mainly to incomplete understanding of change of mass balance of the huge ice sheets of Greenland and Antarctica. It seems likely that future projections of sea level will change with improved knowledge of the behaviour of the continental ice sheets in the face of temperature and precipitation changes, and also as measurement of speed of contemporary sea level rise continues. However, most of the uncertainty is on the side of larger rises, and it appears that future estimates are likely to rise.

In order to take a precautionary approach, and bearing in mind recent reports of accelerated speeds of movement of Greenland and Antarctic land-based ice, the top of the range of the Copenhagen Diagnosis (Figure 17, p.40) projection has been chosen for the local scenario: i.e. a 140cm rise by 2100. Values for 2030 of + 20cm and 2070 + 80cm, have been interpolated to give an **indication** of the order of change likely for the scenario. In view of the range of modelled projections and the uncertainty over continental ice melting, these figures are simply indicative of thinking based on current knowledge.

Uncertainty and mis-understanding over projected sea level rise are compounded by regional variation around global projections due to changes in winds and ocean currents, as well as local tectonic effects, but for the Eyre Peninsula relevant research suggests sea levels is changing in line with global average figures. *[It should be noted that current SA policy on coastal flooding and erosion applying to development control in South Australia currently envisages a sea level rise of 1 metre by 2100; the Coast Protection Board is currently reviewing its policy]*.

A linked issue to mean sea level rise is frequency of storm and surge heights at any given location: as mean sea level rises the frequency with which maximum surge and storm elevations are reached increases rapidly. As noted by Church et al 2009 (p. 8):

> "*For many locations, a 0.5 m sea-level rise would result in the present one-in a-hundred-year event becoming an annual or more frequent event by the end of the 21st century*".

This drastic increase in the frequency of sea flooding would not only have clear hazard potential, but in the context of this report, important implications for coastal wetlands, salt marsh and estuaries.

Glossary of Terms

Definitions

Accretion
Growth of coastal shorelines by steady addition of sediments.

Adaptation
System adjustments (tactical) or transformations (strategic) that contribute to a system being less vulnerable to the effects of climate variability and climate change. Adaptations may target either biophysical or social and current or future vulnerabilities. Adaptation moderates harm or exploits beneficial opportunities.

Adaptive Capacity
The ability or potential of a system to adapt to climate variability and change in a manner that reduces vulnerability.

Aeolianite
A rock formed from calcareous dune sands; usually a soft rock, but containing hard calcrete or kunkar layers. Also called calcarenite.

Alien
Species from outside the region.

The Average Recurrence Interval (ARI)
This is a measure of the rarity of a natural event, such as a storm tide height, or total rainfall within a given length of time. ARI may be expressed as: *The average, or expected, value of the periods between exceedances of a given tide height.* This is expressed as a probability or in years:
A storm surge as big or bigger than the 100-year ARI storm surge event will occur on average once every 100 years.

Barrier
Wave deposited ridge or ridges of sand, usually capped by aeolian material and often backed by a wetland. A *Barrier Spit* is unattached at one end; a *Barrier Island* is unattached at both ends, usually terminating at inlets; *Bay Barriers* are built across an embayment, (Short, Fotheringham & Buckley, 1986, p.148).

Base GIS layer
The original GIS (Geographic Information System) layers stored within databases which are used as the basis for analysis. The Base GIS layers are represented as vector datasets within databases, with these vector datasets representing a wide range of real world features (with a geographic location). These GIS features are of three types:

- *Points* (e.g. the location of Biological Survey Sites),
- *Lines* (e.g. the location of an unsealed roads or tracks), and
- *Polygon* (e.g. the location of Mangrove Habitat or the location of Conservation Parks).

Each base GIS layer may be an accumulation of many occurrences of the same type and theme – for example the 'Biological Survey Flora Points' will include thousands of individual survey sites each containing a number of plant types at each site.

Beach
A beach is the accumulation of unconsolidated sediment that is limited by low tide on the seaward margin and the limit of highest astronomic tide on the landward side. Beach sediments are texturally within the sand to gravel range, made usually of quartz or shell fragments and are constantly re-worked by wave and wind action.

Beach Ridge
A very long, nearly straight low ridge, built up by waves and usually modified by wind. A beach ridge is often a relict feature remote from the beach (McDonald *et al.* 1990), formed of shingle or shell debris, (Short & Fotheringham, 1986*),* see foredune ridge.

Beach Ridge Plain
Level to gently undulating landform pattern of extremely low relief on which stream channels are absent or very rare: it consists of relict parallel beach ridges (McDonald et al, 1990), beach ridges are linear, symmetric or asymmetric, convex ridges formed of shingle or shell debris*,* storm or swash wave derived (Short & Fotheringham, 1986*).*

Biodiversity
Number, relative abundance and genetic diversity of organisms from all habitats including terrestrial marine and other aquatic systems, and the ecological complexes and processes of which they are a part. This includes diversity within species, between species and of ecosystems (Burgman and Lindenmayer 1998).

Blowout
Erosional trough generally initiated through vegetation loss within a coastal dune by natural (e.g. wave erosion, fire) or other causes (e.g. impact of vehicle or foot traffic).

Calcareous Sands
Beach or dune sands that contain high carbonate content; usually derived from the fragmented shells of marine organisms.

Calcarenite
A rock formed by the percolation of water through a mixture of calcareous shell fragments and sand causing the dissolved lime to cement the mass together. The calcarenite material is often a conglomerate varying from little shell material to nearly all fossil shells with little sand.

Cell
A term used in this report to indicate a small coastal area, defined on landform grounds, for the purpose of description within the coastal boundary. [The Limestone Coast and Coorong coastal boundary is divided into 17 cells].

Chenier
Long low ridges composed of wave washed sand-shell material. Commonly occur within saltmarsh supra-tidal areas, marking the limit of a storm surge induced flood episode.

Cliff
Steep, vertical or overhanging slope, usually over 5 metres high, at the coast. Cliffs are eroded by a variety of processes, and over time the steepness is maintained by wave removal of debris from the cliff base. If marine processes are excluded from the base, debris will slowly accumulate and the cliff slope reduced.

Climate model
A numerical representation (typically a set of equations programmed into a computer) of the climate system. The most complex and complete climate models are known as General Circulation Models.

Climate projection
A projection of future climate based upon simulations by climate models.

Climate scenario
A plausible and often simplifi ed representation of the future climate, based on an internally consistent set of climatologically relationships.

Climate variability
Variability around climate trend.

Coastal Boundary / Zone
Defines the study area (124567.8 ha in total).

Consolidated Dunefield
Level or rolling landform pattern of very low or extremely low relief without stream channels, built up or locally excavated, eroded or aggraded by wind and consolidated by stabilising effects of vegetation (modified from McDonald *et al.* 1990), not lithified.

Data Theme/ Data Layer
One type of GIS data which will always be of the same geographic type e.g. points. On some occasions numerous data sources with the same type of information can be combined to form one Data Theme or Layer.

Dune / Consolidated Dune
Moderately inclined to very steep ridge or hillock built up by wind. This element may comprise dunecrest and duneslope. May also be consolidated due to stabilising effects of vegetation (modified McDonald et al, 1990), includes hind dunes.

Dunefield
Level to rolling landform pattern of very low or extremely low relief without stream channels, built up or locally excavated, eroded or aggraded by wind (McDonald et al, 1990), *not lithified.*

Dunefield Lithified; Dune Calcarenite / Dune Rock
Whole or portion of a sand dune that has been lithified to some degree, lithification is usually associated with partial solution and precipitation of calcium carbonate which cements the sand grains (Short & Fotheringham, 1986).

Ecosystem services
Ecological processes or functions having monetary or non-monetary value to individual or society at large.

Ecosystem Resilience

A measure of the ability of an ecosystem to withstand and recover from environmental stresses and perturbations. Within the context of climate change resilience includes the capacity to migrate to other localities.(Commonwealth of Australia, 2004, p.40).

El Niño Southern Oscillation
El Niño Southern Oscillation (ENSO) refers to widespread c.2–7 year oscillations in atmospheric pressure, ocean temperatures and rainfall associated with El Niño (the warming of the oceans in the equatorial eastern and central Pacific) and its opposite, La Niña. Over much of Australia, La Niña brings above average rain, and El Niño brings drought. A common measure of ENSO is the Southern Oscillation Index (SOI) which is the normalised mean sea level pressure difference between Tahiti and Darwin. The SOI is positive during La Niña events and negative during El Niño events.

Endemic
Confined to a certain region where it is native.

Environmental Weed
Naturalised plant species that has invaded areas of native vegetation and is presumed to impact negatively on native species diversity or ecosystem function, usually non-native species, but includes native plants species that are invasive beyond their indigenous range are also included.

Escarpment
Steep to precipitous landform pattern forming a linearly extensive, straight or sinuous inclined surface, which separates terrains at different altitudes, that above the escarpment commonly being a plateau. Relief within the landform pattern may be high (hilly) or low (planar). The upper margin is often marked by an included cliff or scarp (McDonald *et al.* 1990).

Exotic
Species from outside the region.

Floristic
Of or relating to flowers or flora.

Floristics
The scientific study of the distribution of plants, especially on the regional level.

Foredune
Very long, nearly straight, moderately inclined to very steep ridge built up by the wind from material from an adjacent beach (McDonald *et al.* 1990). Formed by vegetation trapping aeolian sand on the backshore zone, above the tide line, range from quite small (approximately 2 m) to very large (over 30 m), very stable to very unstable, varied vegetation cover may be morphologically diverse, generally comprise a frontal or stoss slope, crest and lee or landward slope (Short and Fotheringham, 1986).

Foredune Ridge
Foredune ridges are dune ridges which were initiated as foredunes and then later were removed from the influence of beach processes by seaward secretion, and the formation of a new foredune, (Short & Fotheringham, 1986), they are aeolian in origin in contrast to beach ridges which are wave derived.

Georeferenced
The state in which a raster dataset is positioned in space using map coordinates. Each feature within the GIS layer will have a corresponding real-world feature on the ground at the same geographic location. Geo-referencing data allows it to be viewed, queried, and analysed with other geographic data.

GIS (Geographic Information System)
An organised collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse, and display all forms of geographically referenced information, may be used for a project (project GIS, or single-user GIS), by a department of an organisation to support a key function of that department (called departmental GIS), or by an organisation to support daily activities and strategic decision making (called enterprise GIS).

Greenhouse effect
An increase in the temperature of the earth's surface caused by the trapping of heat by greenhouse gases.

Greenhouse gases
Gases in the earth's atmosphere that absorb and re-emit infrared (heat) radiation.

Grid
A geographic representation of the world as an array of equally sized square cells arranged in rows and columns. Each grid cell is referenced by its geographic X,Y location.

Grid Cell: See Raster Cell

Gully
Open depression with short, precipitous walls and moderately inclined to very gently inclined floor or small stream channel, eroded by channelled stream flow and consequent collapse and water-aided mass movement (McDonald *et al.* 1990).

Habitat Fragmentation
Habitat fragmentation is the separation of a landscape into various land uses (e.g. development, agriculture), resulting in numerous small, disjunct habitat patches left for use by wildlife.

Hazard
Is a source of potential harm or a situation with a potential to cause loss. It may also be referred to as a potential or existing condition that may cause harm to people or damage to property or the environment.

Hind Dune
Any dune or dune system lying landwards of the foredune (Short & Fotheringham, 1986).

Incipient Foredune
Newly forming foredunes occupying a primary beach location behind the spring tide swash limit, and vegetated by pioneer colonisers, semi-erect and erect grasses and prostrate herbaceous plants, incipient foredunes are formed by vegetation trapping aeolian sand on the backshore zone, above the tide line, 0nce secondary (woody) plant species colonise the incipient foredune, it may be simply termed foredune. (Short and Fotheringham, 1986).

Interdune Corridor
Generally wide, linear, level floored open depression between parallel dunes (modified McDonald *et al.* 1990).

Intertidal Flat
An area of low relief that lies within the range of the astronomical tides. If the area lies on the seaward side of the saltmarsh it may also be influenced by wave action.

Intertidal Saltmarsh
The area that is regularly (daily) flooded by the astronomical tide.

Introduced Species
Species from outside the region.

Invasive Plants
Naturalised species that are spreading.

Levee Bank
An artificial bank built to limit the area of flooding.

Limestone
A class of rock that is made of at least 80% of the carbonates of calcium or magnesium.

Limestone Plain
Large, very gently inclined or level element of hard almost horizontally bedded limestone.

Lithified
The state of having been cemented or compacted so as to form solid rock.

Longitudinal Dunefield
Dunefield characterised by long narrow sand dunes and wide flat swales. The dunes are orientated parallel with the direction of the prevailing wind, and in cross section one slope is typically steeper than the other (McDonald *et al.* 1990).

Mangrove
Forest plant community that occupies the narrow intertidal zone between the land and the sea. South Australia has only one species of mangrove *Avicenna marina* ssp. *marina,* the Grey Mangrove.

Naturalised Species
Species from outside the region in question that can maintain populations in the wild without cultivation.

Parabolic Dunefield
Dunefield characterised by sand dunes with a long scoop-shaped form, convex in the downwind direction so that its trailing arms point upwind (McDonald *et al.* 1990).

Plain
Level to undulating or, rarely, rolling landform pattern of extremely low relief (less than 9 m) (McDonald *et al.* 1990).

Plateau
Level to rolling landform pattern of plains, rises or low hills standing above a cliff, scarp or escarpment that extends around a large part of its perimeter. Includes or excludes a bounding scarp or cliff landform element. A bounding escarpment would be an adjacent landform pattern (McDonald *et al.* 1990).

Projection
A description of the future.

Ramsar
The Convention on Wetlands, signed in Ramsar, Iran in 1971 is an international intergovernmental treaty dedicated to the conservation and "wise use" of wetlands.

Raster
Any data source that uses a grid structure to store geographic information.

Raster Cell
A discretely uniform unit (square or rectangle) that represents a portion of the earth such as a square metre or square mile, each pixel has a value that corresponds to the feature or characteristic at that site such as a soil type, census tract, or vegetation class.

Rasterisation
Process by which base vector GIS layers are modified and stored as a raster layer.

Resistance
The ability of an ecosystem to withstand disturbance without undergoing a phase shift or losing neither structure nor function (Odum, 1989). For example, a swamp paperbark's ability to withstand groundwater salinity change and mortality.

Return period
A measure of risk used by engineers and insurers describing the average time between events of a given magnitude. For example, a one-in-100-year event has a 1% probability of occurring in any given year. (See also Average Recurrence Interval).

Relative sea level
Sea level measured by tide gauge with respect to the land upon which it is situated.

Resilience
The ability of a social or ecological system to absorb disturbances while retaining the same basic infrastructure and ways of functioning, the capacity for self organisation and the capacity to adapt to stress and change.

Risk
Product of vulnerability and likelihood.

Sabkha
The transliteration of the Arabic word for salt flat. Low flat, bare or sparsely vegetated, coastal plain; it often has a salt-encrusted surface, where intertidal and supra-tidal evaporites are being deposited (Schwartz, 1982). Sediments are sand, silt and clay, with salt (from the evaporation of either saline ground water, or of very high tidal incursions). Salts within the sediments are commonly gypsum, anhydrite, halite, and aragonite.

Salt marsh
Saltwater wetland occupied mainly by dwarf shrubs and herbs, characteristically able to tolerate extremes of environmental conditions, notably water-logging and salinity.

Samphire
A community of halophytic plants either herbaceous or shrubby that occur to the landward side of the mangroves (and sometimes within).

Seagrass
Marine plant that colonises either the intertidal mudlats or sandflat to the seaward side of mangroves or saltmarsh, also extends to the subtidal.

Sea-level rise
An increase in the mean level of the ocean. (Eustatic sea level rise is a change in global average sea level brought about by an increase in the volume of the world ocean). Relative sea level rise occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence. In areas subject to rapid land-level uplift, relative sea level can fall.

Scarp
Very wide steep to precipitous maximal slope eroded by gravity, water-aided mass movement or sheet flow (McDonald et al, 1990).

Scenario
A coherent, internally consistent and plausible description of a possible future state of the world.

Sensitivity
Degree to which a system will change or respond to a change in climatic condition.

Shore Platform or Rocky Reef
Exposed rocky substrate within the intertidal zone.

Storm surge
Elevated sea level at the coast caused by the combined infl uence of low pressure and high winds associated with a severe storm such as a tropical cyclone. Includes wave run up and wave set up.

Storm tide
The total elevated sea height at the coast above a datum during a storm, combining storm surge and the predicted tide height.

Stranded Tidal
An area formerly tidal, but which have since been isolated from tidal influence by dunal development, levee bank (road) construction, or by changes in sea level or landform uplifting.

Subtidal
Below the range of the astronomical tides.

Supra tidal
Drier area of a salt marsh, usually inundated only by spring (monthly) or storm tides.

Sustainability
Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Swale
Linear, level-floored open depression excavated by wind, or left relict between ridges built up by wind or waves, or built up to a lesser height than them (McDonald *et al.* 1990).

Swash
The final uprush of a wave, up the beach.

Terrestrial
Pertaining to, or living habitually on, the land or ground surface (Lincoln *et al.* 1998).

Tidal
Within the range of the astronomical tides.

Turbidity
The degree of cloudiness of water, usually caused by the suspension of fine particles in the water column. The particles may be inorganic (e.g. silt) or organic (e.g. single-celled organisms).

Vulnerability
Potential for, or susceptibility to, harm. Degree to which a system is sensitive to pressures and disturbances including climate change due to social, economic, political or cultural characteristics and/or processes. Degree to which climate change is expected to result in adverse outcomes, accounting for coping and adaptation strategies.

Weed
Species that adversely affect biodiversity, the economy or society.

Terms mentioned within the Geological Time Scale

QUATERNARY – 1.8 million years ago to today (includes Holocene and Pleistocene)

HOLOCENE – 10,000 years before present to present – rocks predominantly un-lithified.

PLEISTOCENE – 1.8 million years to 10,000 years before present.

TERTIARY – 65 to 1.8 million years before present.

PRECAMBRIAN – 4,600 to 542 million years before present - metasediments, granites etc. (includes Proterozoic, Neoproterozoic, Mesoproterozoic, Palaeoproterozoic, Archean)

PROTEROZOIC -2,500 to 542 million years before present

NEOPROTEROZOIC – 1000 to 542 million years before present

MESOPROTEROZOIC – 1,600 to 1,000 million years before present

PALAEOPROTEROZOIC – 2,500 to 1,600 million years before present

ARCHAEAN – 3,800 to 2,500 million years before present

Acronyms/ Abbreviations

AHD – Australian Height Datum

ARI – Average return interval

ASS – Acid Sulfate Soils

AWSG – Australasian Wader Studies Group

BDBSA – Biological Database of South Australia

BSG – Biological Survey Group

CDCS – Coastal Dune and Clifftop Survey

COAG - Council of Australian Governments

CP – Conservation Park

CPB – Coast Protection Board

CSIRO – Commonwealth Science and Industrial Research Organisation

DC – District Council

DEM - Digital Elevation Model

DENR – Department for Environment & Natural Resources

DFW – Department for Water

DPC – Department of Premier & Cabinet

DPLG – Department of Planning and Local Government

DTEI – Department of Transport, Energy & Infrastructure

EPBC Act– *Environment Protection and Biodiversity Conservation Act, 1999*

EP NRM – Eyre Peninsula Natural Resource Management Board

EP LGA – Eyre Peninsula Local Government Association

GIS – Geographical Information Systems

GSA – Geological Society of Australia Inc.

HA – Heritage Agreement

LGA – Local Government Association

IBRA – Interim Biogeographic Regionalisation of Australia

IMCRA – Integrated Marine and Coastal Regionalisation of Australia

IPCC - Intergovernmental Panel on Climate Change

IUCN – International Union of Conservation of Nature

NC – Name change

NCS – Nature Conservation Society of South Australia

NP – National Park

NPWSA – National Parks and Wildlife South Australia

NRM – Natural Resource Management

NVIS – Native Vegetation Information System

ORV – Off-road vehicle

PCASS – Potential Coastal Acid Sulfate Soils

PIRSA – Primary Industries and Resources South Australia

RNE – Register of the National Estate

SAOA – South Australian Ornithological Association

SAPOL – South Australia Police

SAM – South Australian Museum

SRC – Science Resource Centre, Client Services, Department of Environment and Natural Resources

Glossary of Terms – Acronyms/ Abbreviations

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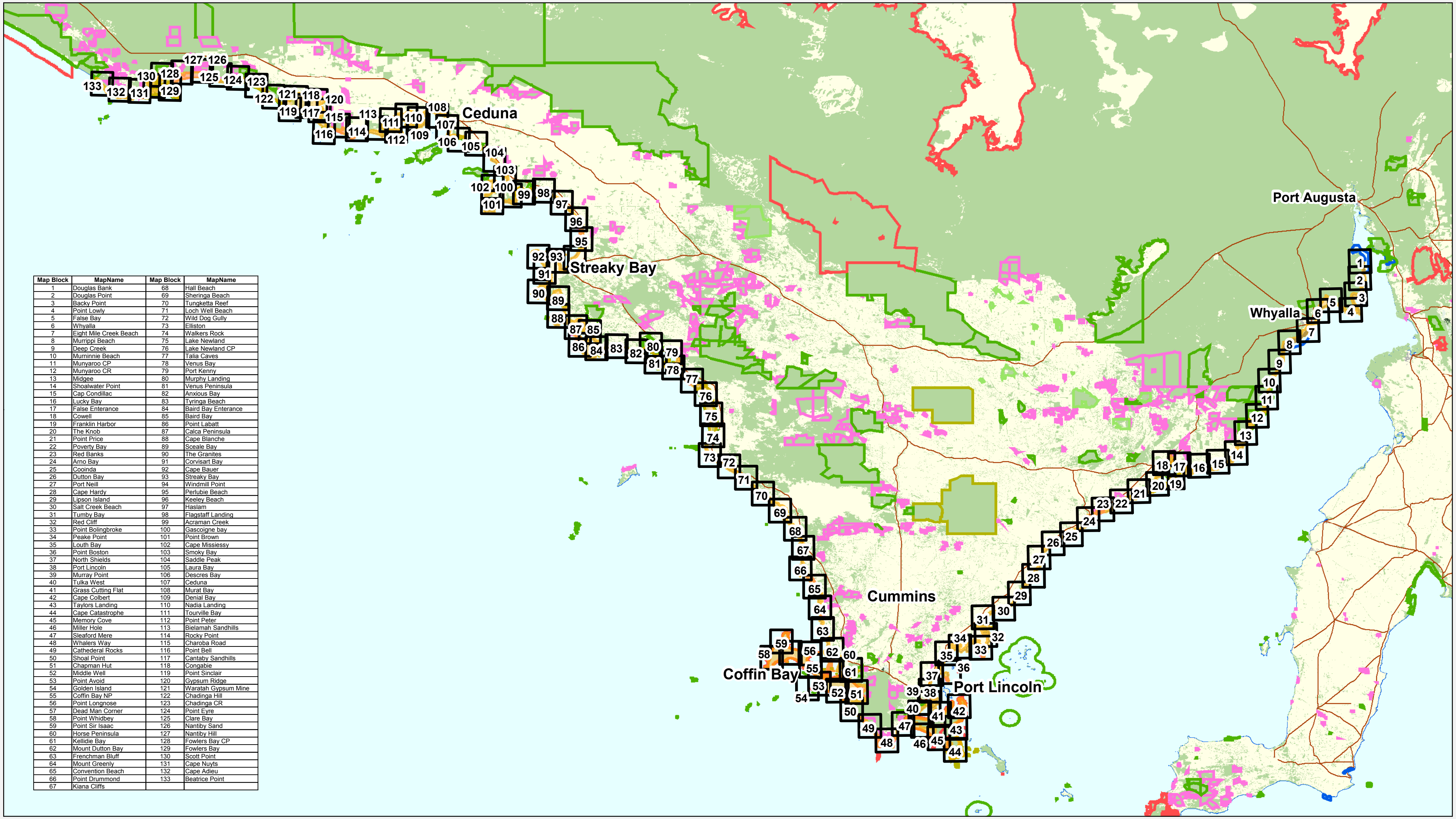
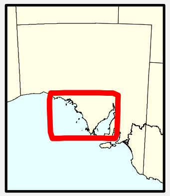
Appendix 1 Eyre Peninsula coast reference maps

Eyre Peninsula Coastal Action Plan - Base Maps Index



Map Block	MapName	Map Block	MapName
1	Douglas Bank	68	Hall Beach
2	Douglas Point	69	Sheringa Beach
3	Backy Point	70	Tungketta Reef
4	Point Lowly	71	Loch Well Beach
5	False Bay	72	Wild Dog Gully
6	Whyalla	73	Elliston
7	Eight Mile Creek Beach	74	Walkers Rock
8	Murrippi Beach	75	Lake Newland
9	Deep Creek	76	Lake Newland CP
10	Murninnie Beach	77	Talia Caves
11	Munyaroo CP	78	Venus Bay
12	Munyaroo CR	79	Port Kenny
13	Midgee	80	Murphy Landing
14	Shoalwater Point	81	Venus Peninsula
15	Cap Condillac	82	Anxious Bay
16	Lucky Bay	83	Tyringa Beach
17	False Enterance	84	Baird Bay Enterance
18	Cowell	85	Baird Bay
19	Franklin Harbor	86	Point Labatt
20	The Knob	87	Calca Peninsula
21	Point Price	88	Cape Blanche
22	Poverty Bay	89	Sceale Bay
23	Red Banks	90	The Granites
24	Arno Bay	91	Corvisart Bay
25	Cooinda	92	Cape Bauer
26	Dutton Bay	93	Streaky Bay
27	Port Neill	94	Windmill Point
28	Cape Hardy	95	Perlubie Beach
29	Lipson Island	96	Keeley Beach
30	Salt Creek Beach	97	Haslam
31	Tumby Bay	98	Flagstaff Landing
32	Red Cliff	99	Acraman Creek
33	Point Bolingbroke	100	Gascoigne bay
34	Peake Point	101	Point Brown
35	Louth Bay	102	Cape Missiessy
36	Point Boston	103	Smoky Bay
37	North Shields	104	Saddle Peak
38	Port Lincoln	105	Laura Bay
39	Murray Point	106	Descres Bay
40	Tulka West	107	Ceduna
41	Grass Cutting Flat	108	Murat Bay
42	Cape Colbert	109	Denial Bay
43	Taylors Landing	110	Nadia Landing
44	Cape Catastrophe	111	Tourville Bay
45	Memory Cove	112	Point Peter
46	Miller Hole	113	Bielamah Sandhills
47	Sleaford Mere	114	Rocky Point
48	Whalers Way	115	Charoba Road
49	Cathederal Rocks	116	Point Bell
50	Shoal Point	117	Cantaby Sandhills
51	Chapman Hut	118	Congabie
52	Middle Well	119	Point Sinclair
53	Point Avoid	120	Gypsum Ridge
54	Golden Island	121	Waratah Gypsum Mine
55	Coffin Bay NP	122	Chadinga Hill
56	Point Longnose	123	Chadinga CR
57	Dead Man Corner	124	Point Eyre
58	Point Whidbey	125	Clare Bay
59	Point Sir Isaac	126	Nantiby Sand
60	Horse Peninsula	127	Nantiby Hill
61	Kellidie Bay	128	Fowlers Bay CP
62	Mount Dutton Bay	129	Fowlers Bay
63	Frenchman Bluff	130	Scott Point
64	Mount Greenly	131	Cape Nuyts
65	Convention Beach	132	Cape Adieu
66	Point Drummond	133	Beatrice Point
67	Kiana Cliffs		



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SA Reference Roads
Protected Areas
Reserve Type
National Park
Conservation Park
Conservation Reserve
Wilderness Protection Area
Vegetation Heritage Agreement
Aquatic Reserves
Map Blocks
Coastal Boundary
Native Vegetation Cover
Built Up Area
Planted Veg
Type
Plantation (Hardwood/Softwood)
Orchard/Vineyard
Revegetation
Irrigated Land

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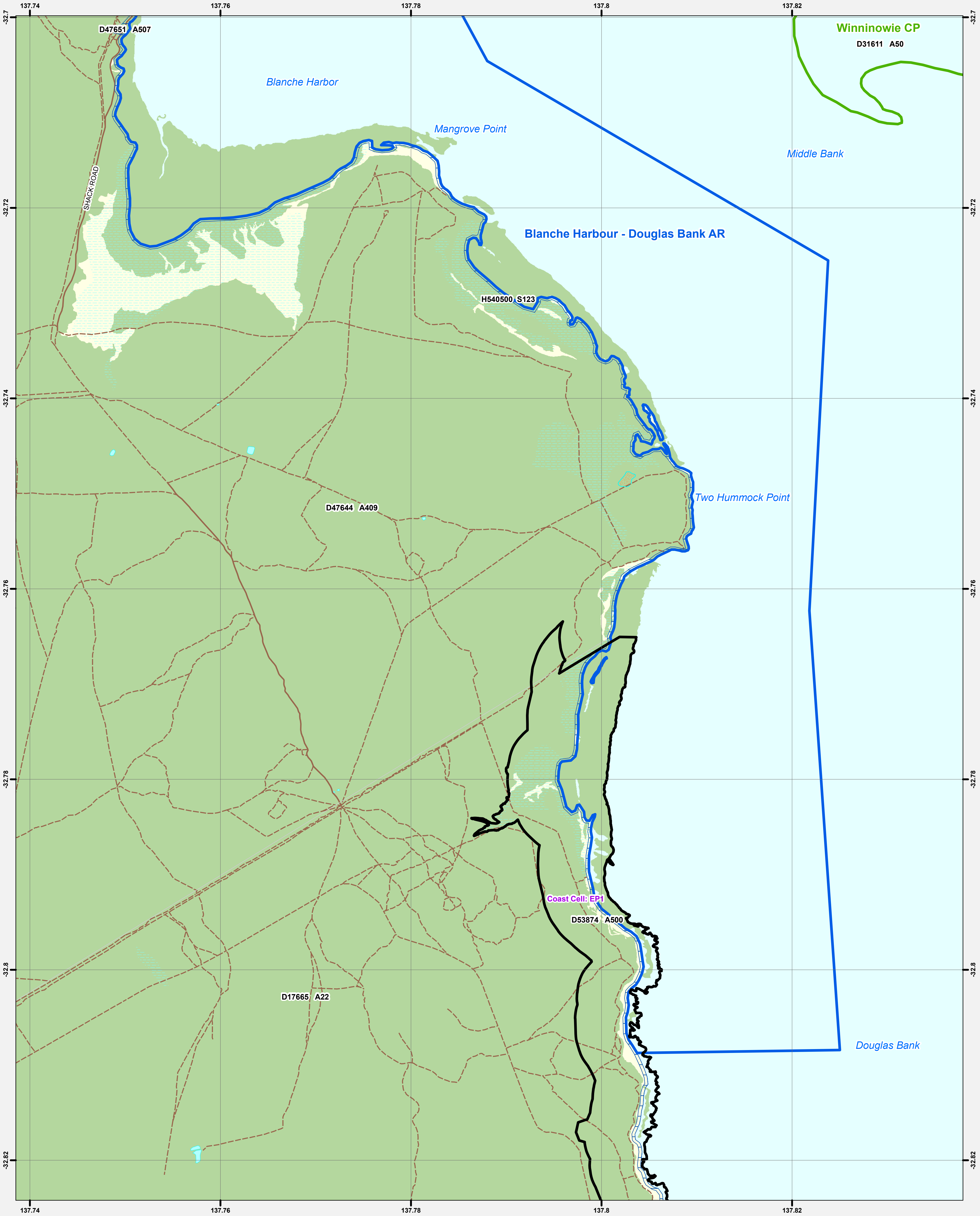
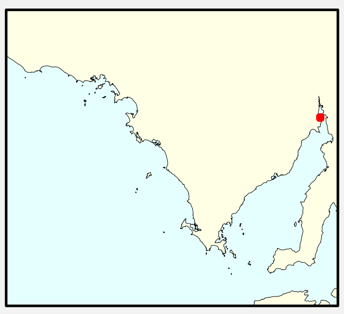
Eyre Peninsula Coastal Action Plan

Map Block 1





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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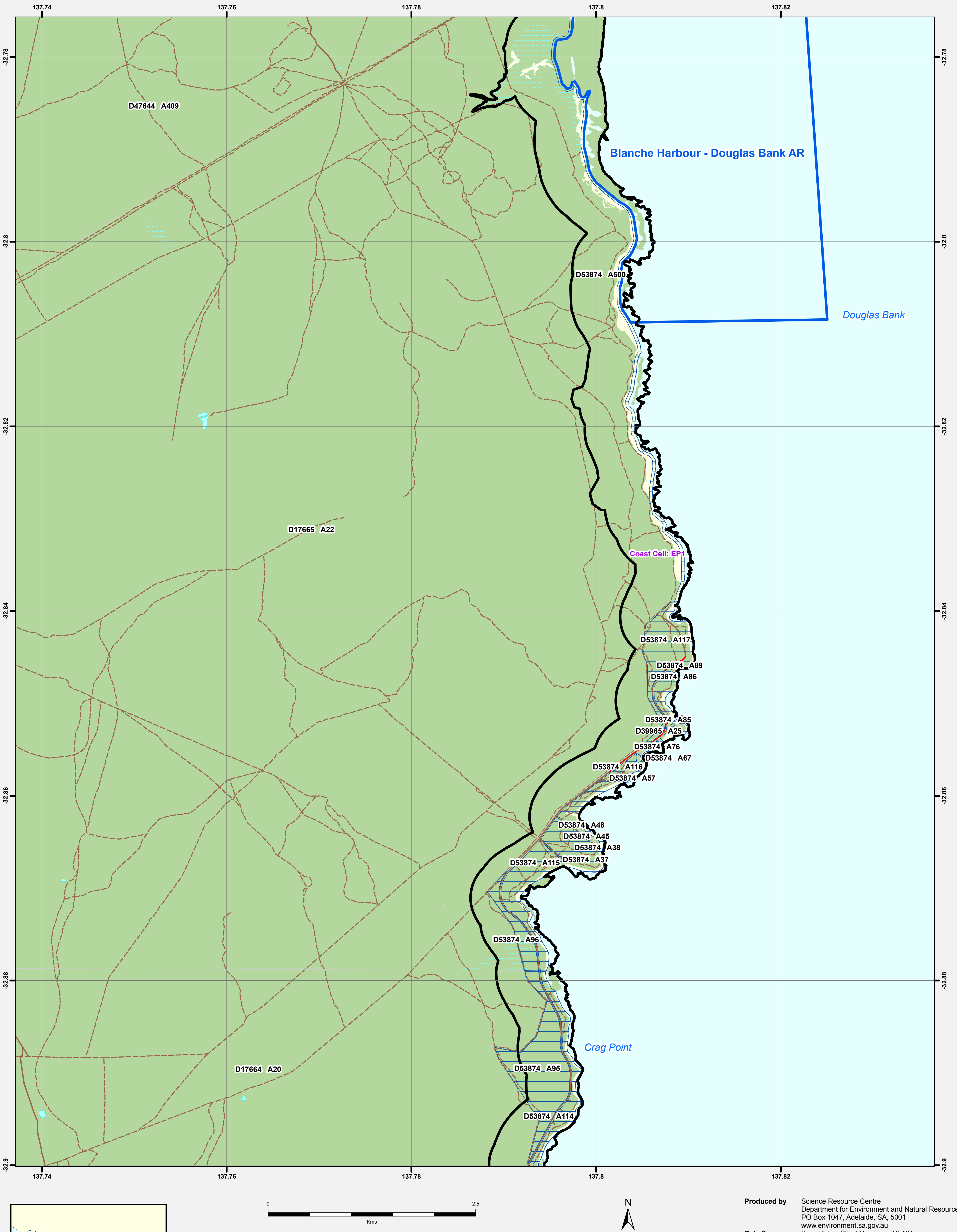
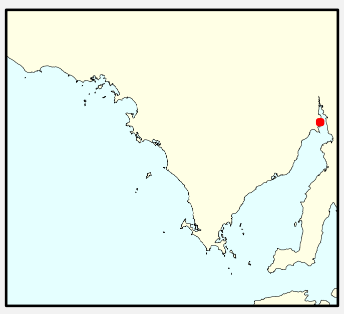
Eyre Peninsula Coastal Action Plan

Map Block 2





Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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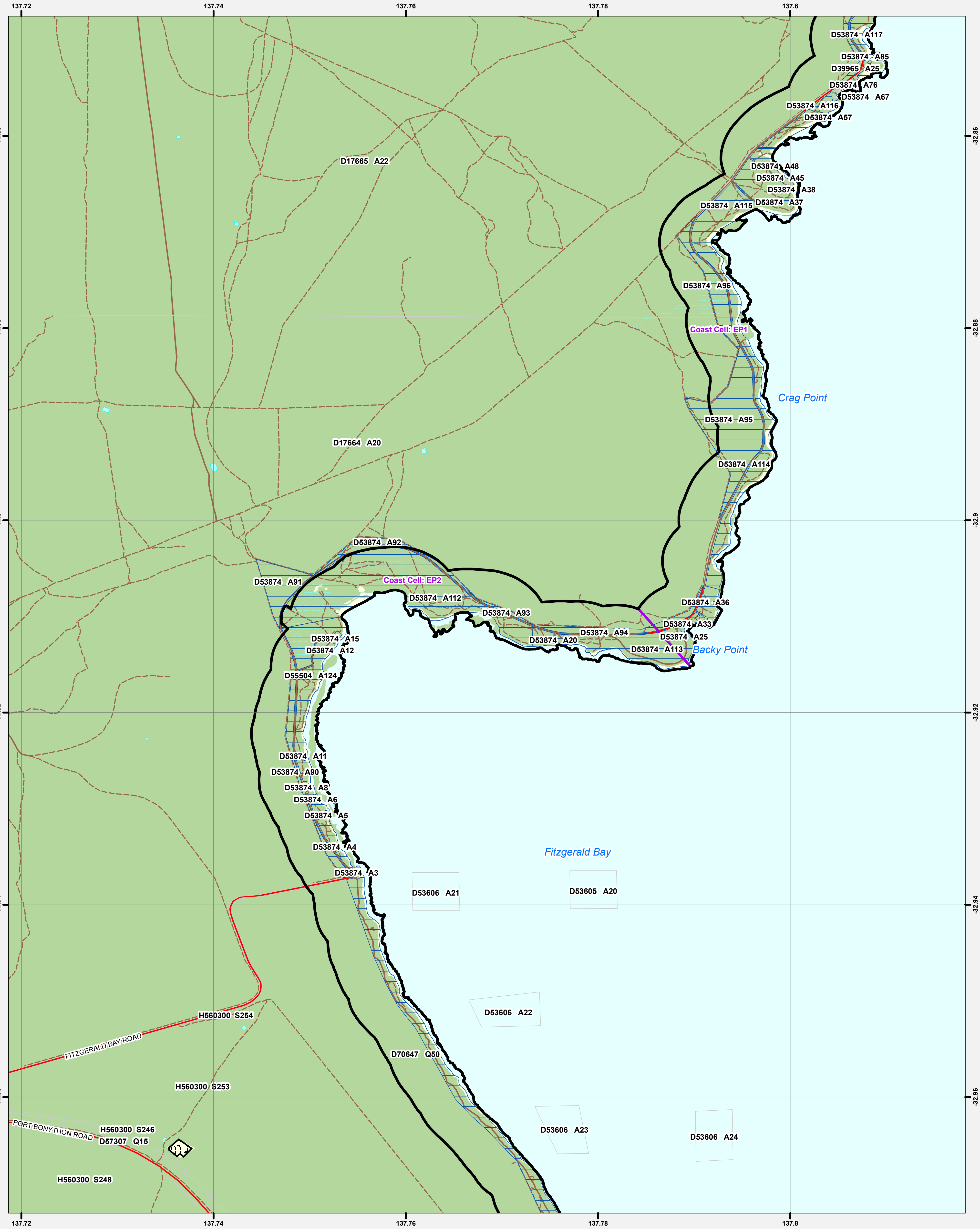
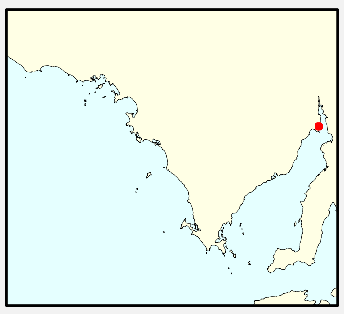
Eyre Peninsula Coastal Action Plan

Map Block 3





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Navigation Marks
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Roads
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Waterbodies
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- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
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- Quarries
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Eyre Peninsula Coastal Action Plan
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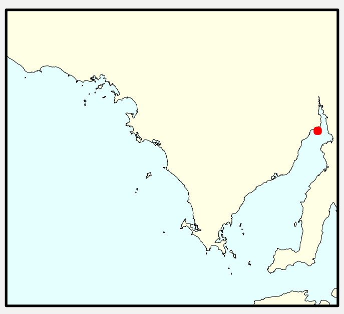

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Navigation Marks
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DCDB Parcels

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Eyre Peninsula Coastal Action Plan

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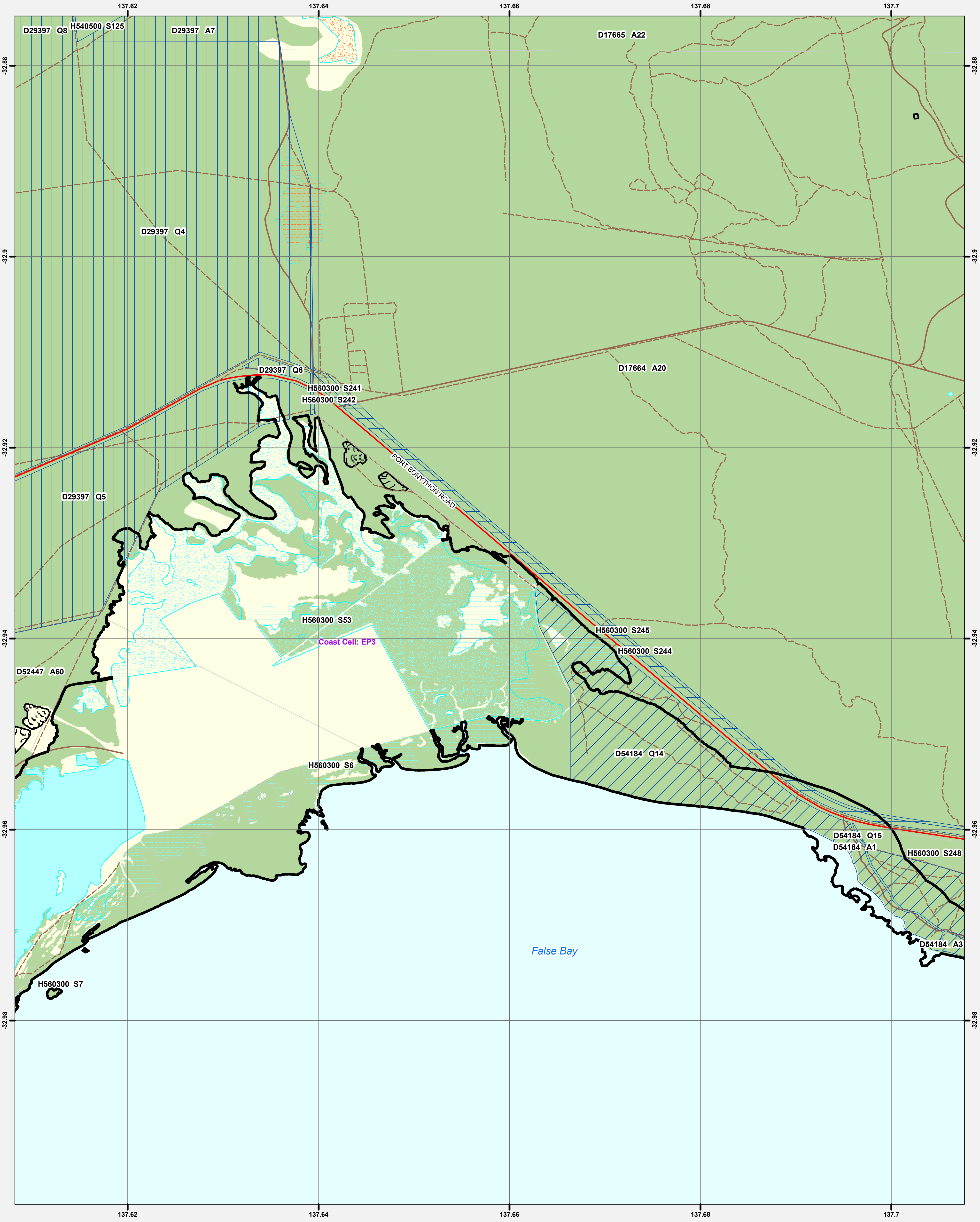

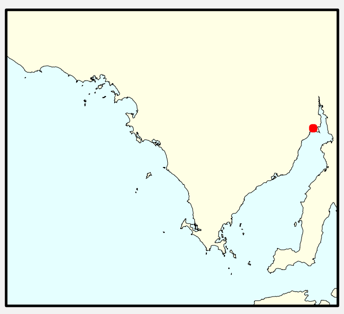

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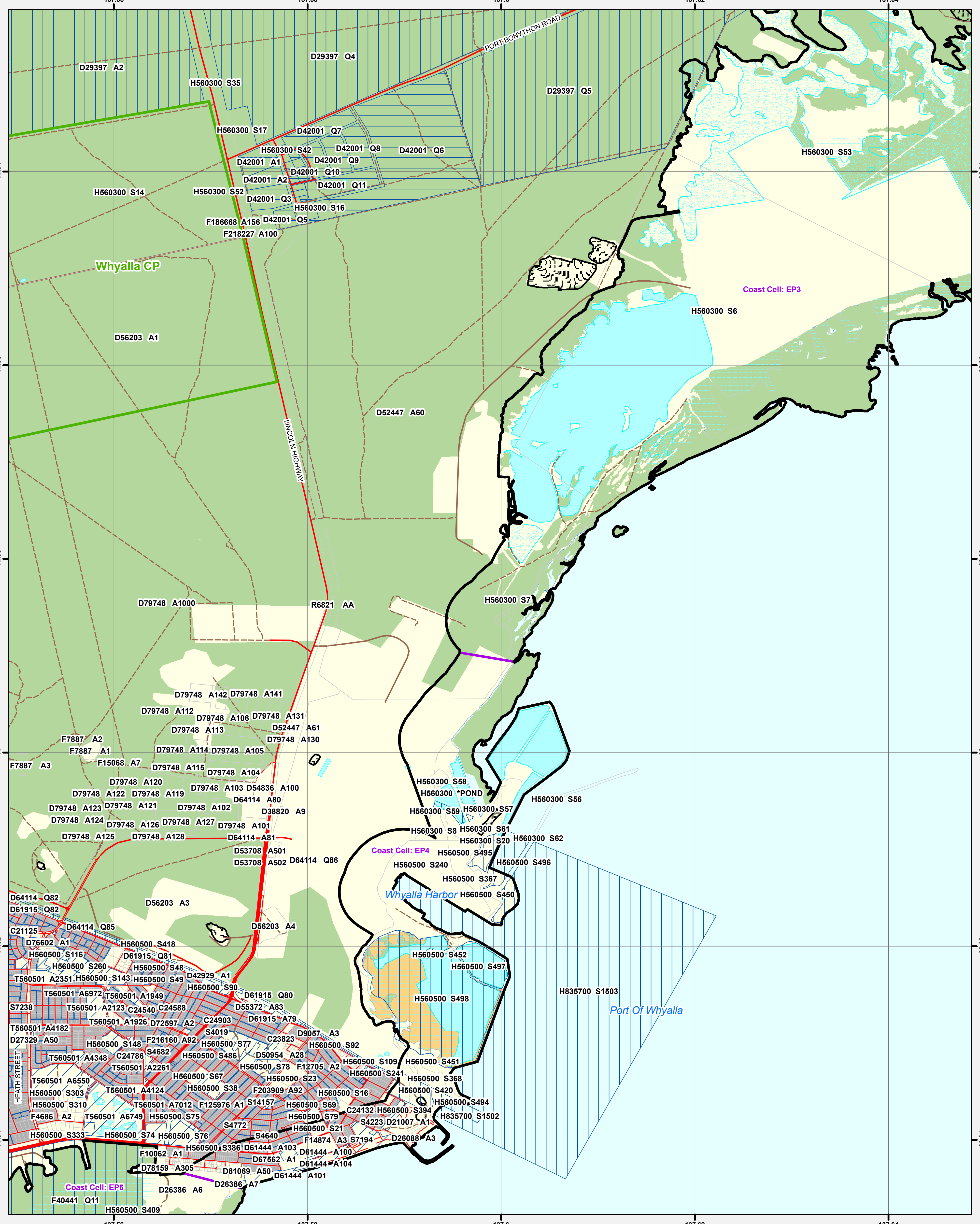
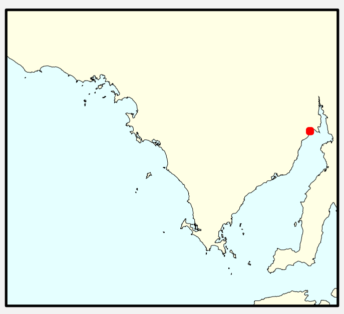
Eyre Peninsula Coastal Action Plan
Map Block 6





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DCDB Parcels

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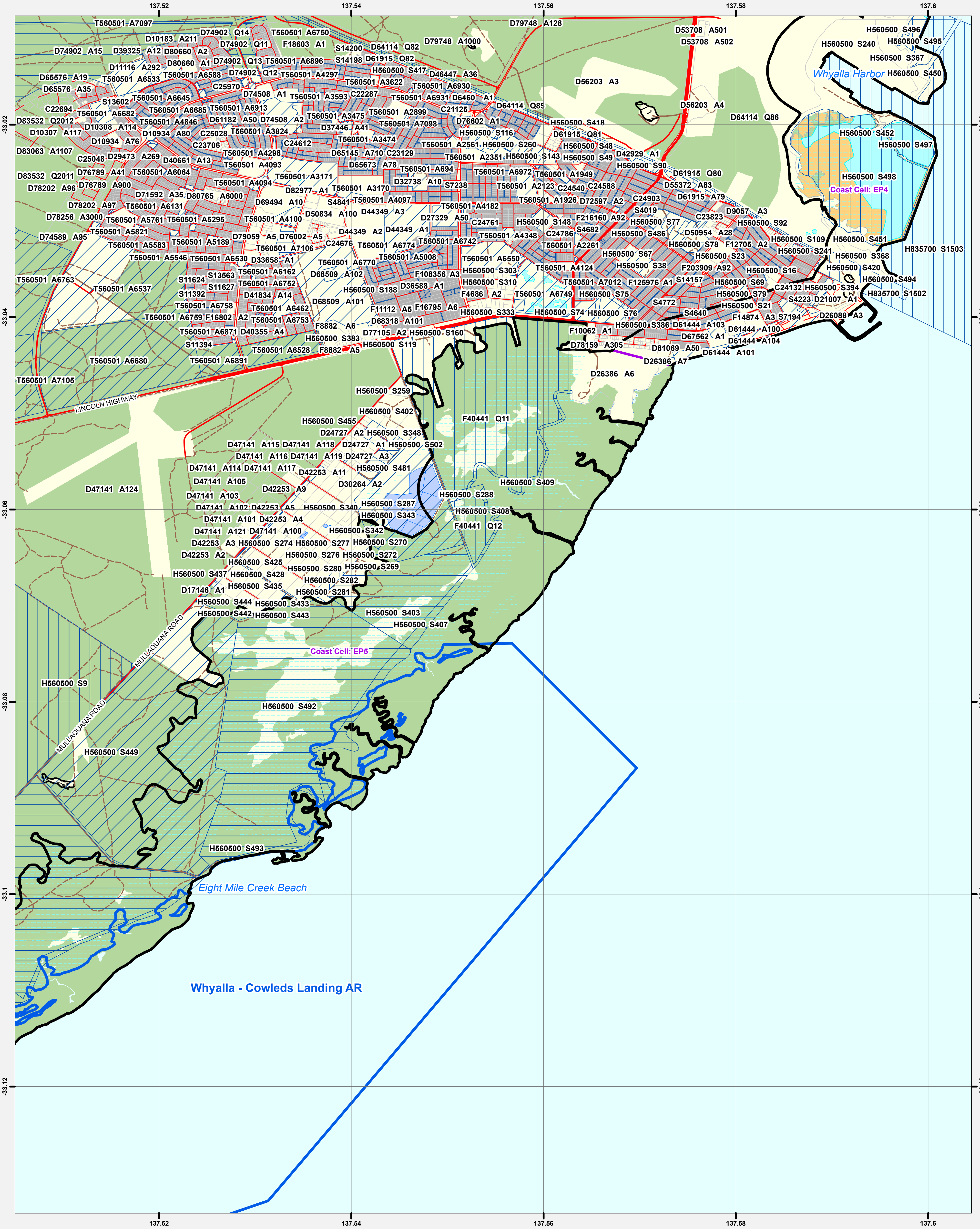
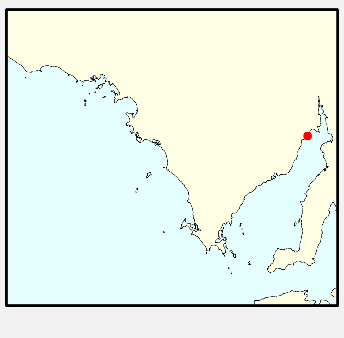
Eyre Peninsula Coastal Action Plan

Map Block 7





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- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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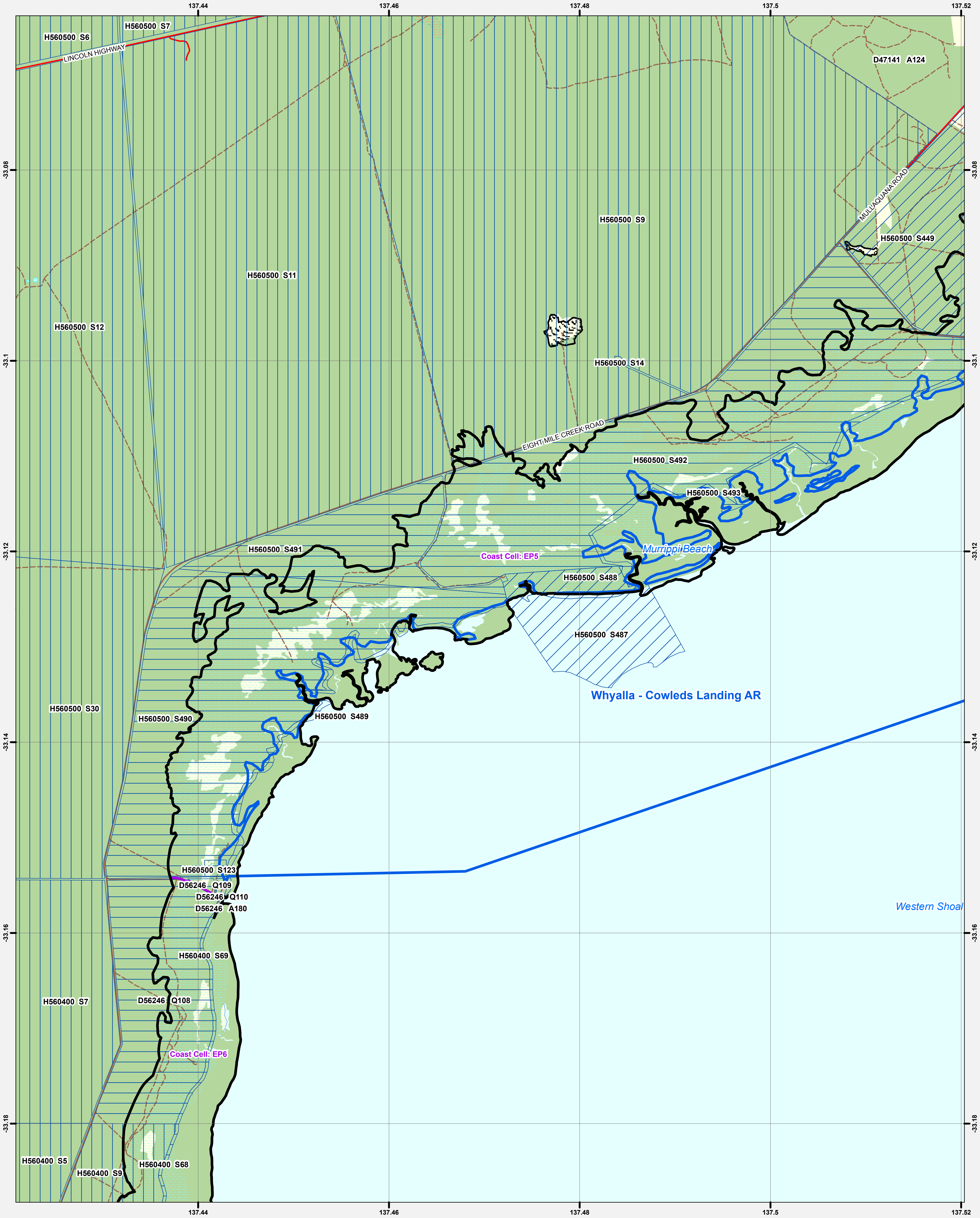
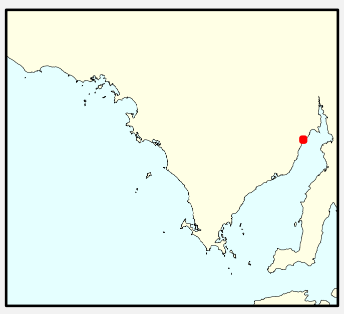
Eyre Peninsula Coastal Action Plan

Map Block 8





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
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- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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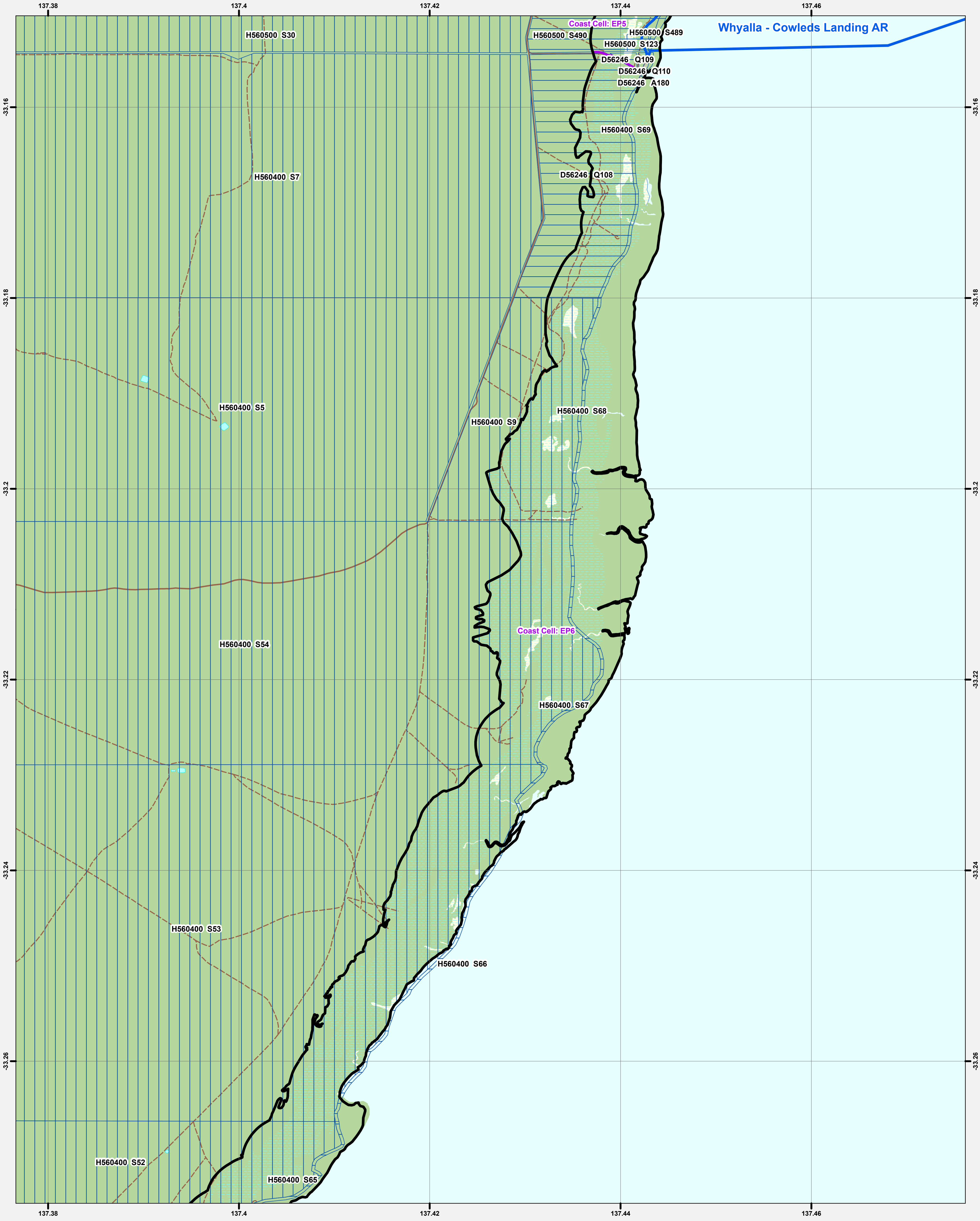
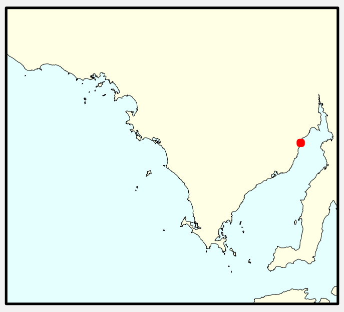
Eyre Peninsula Coastal Action Plan
Map Block 9





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
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- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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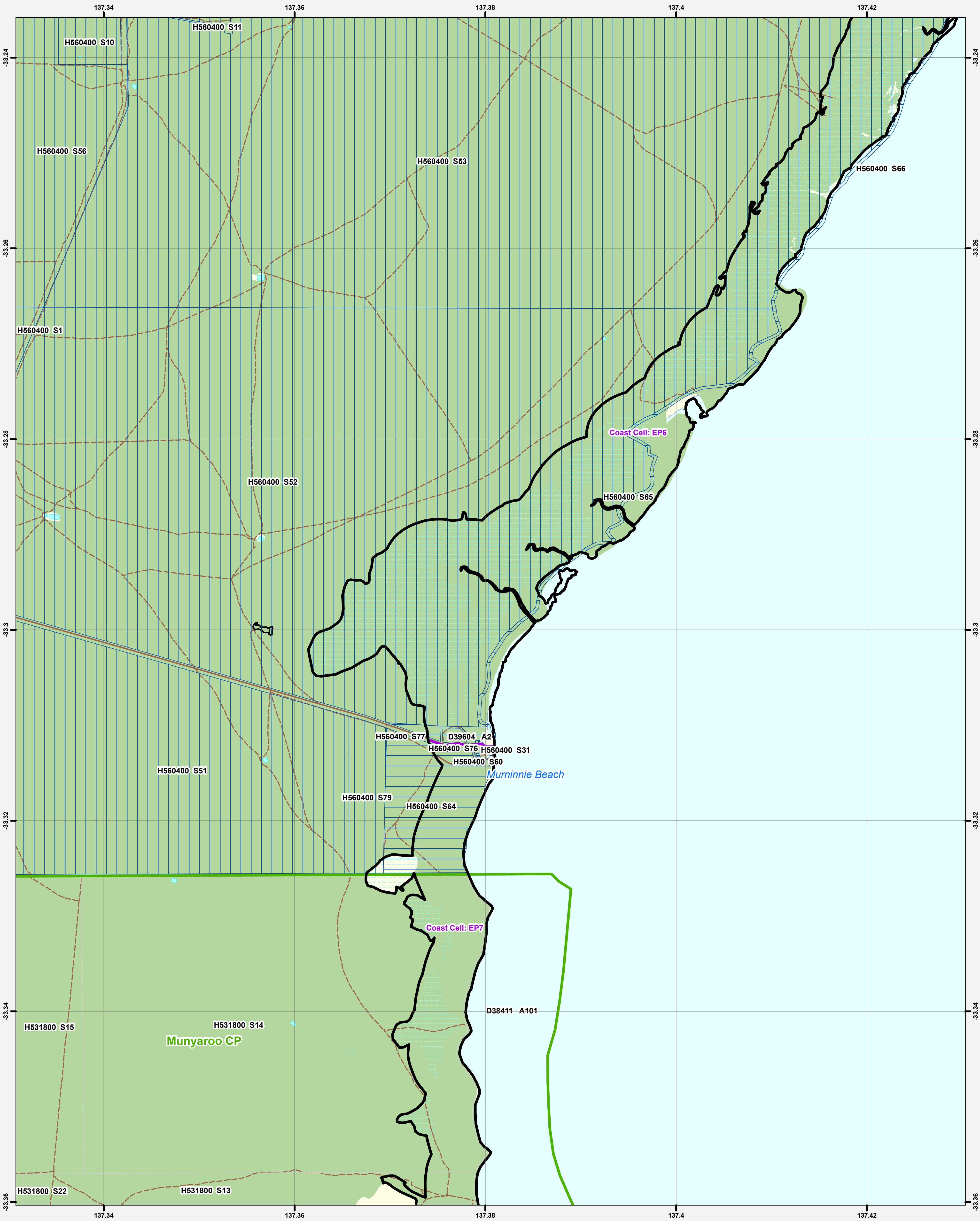
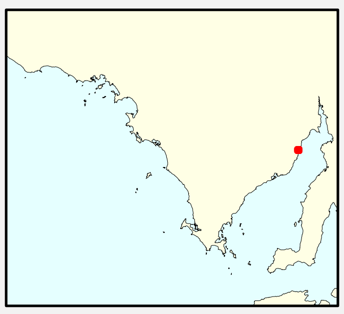
Eyre Peninsula Coastal Action Plan
Map Block 10





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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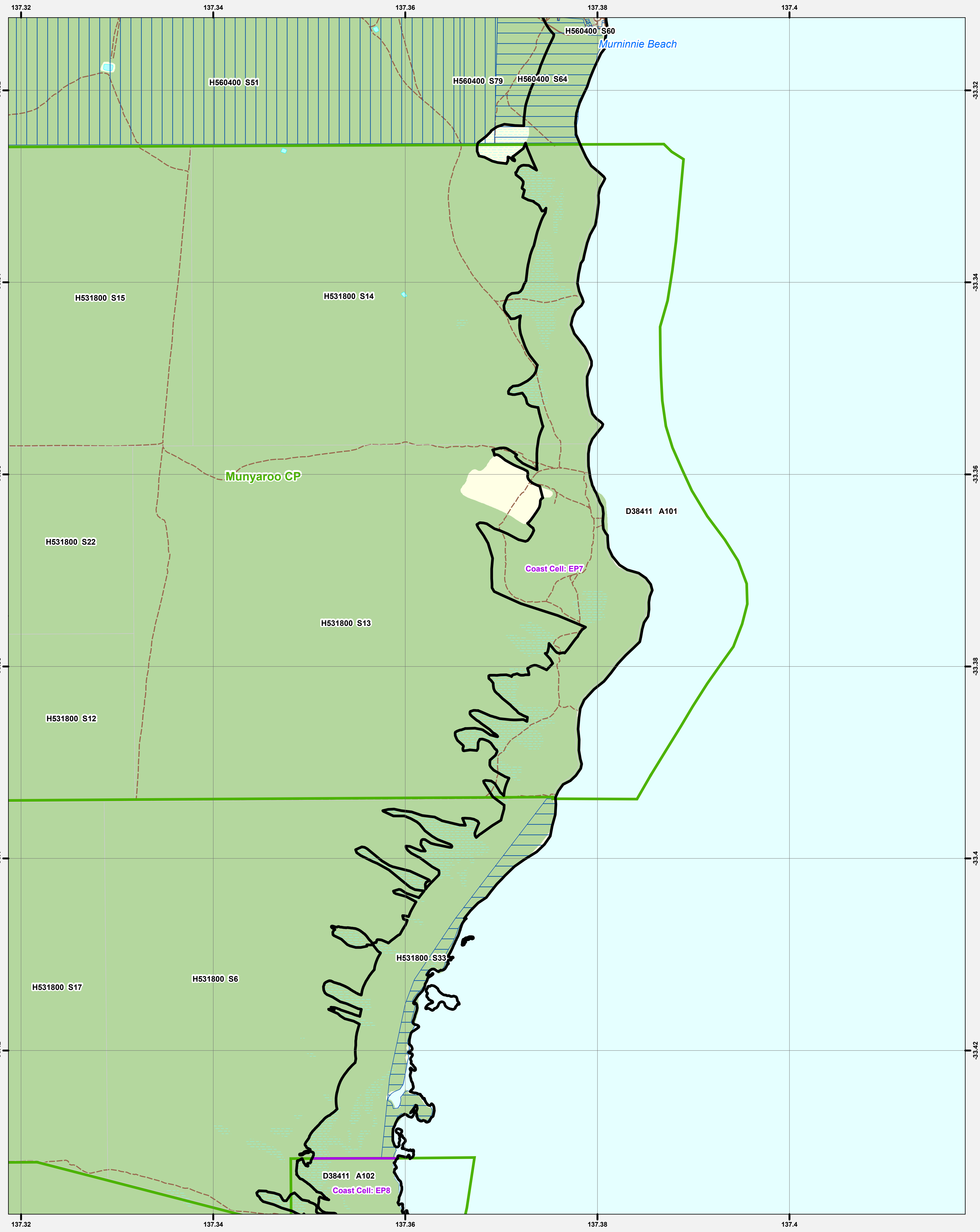
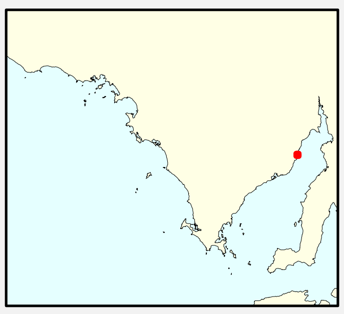
Eyre Peninsula Coastal Action Plan

Map Block 11





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
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- **Coastal Boundary**
- **Coastal Cells**
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- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
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- **Reefs**
- **Built Up Area**
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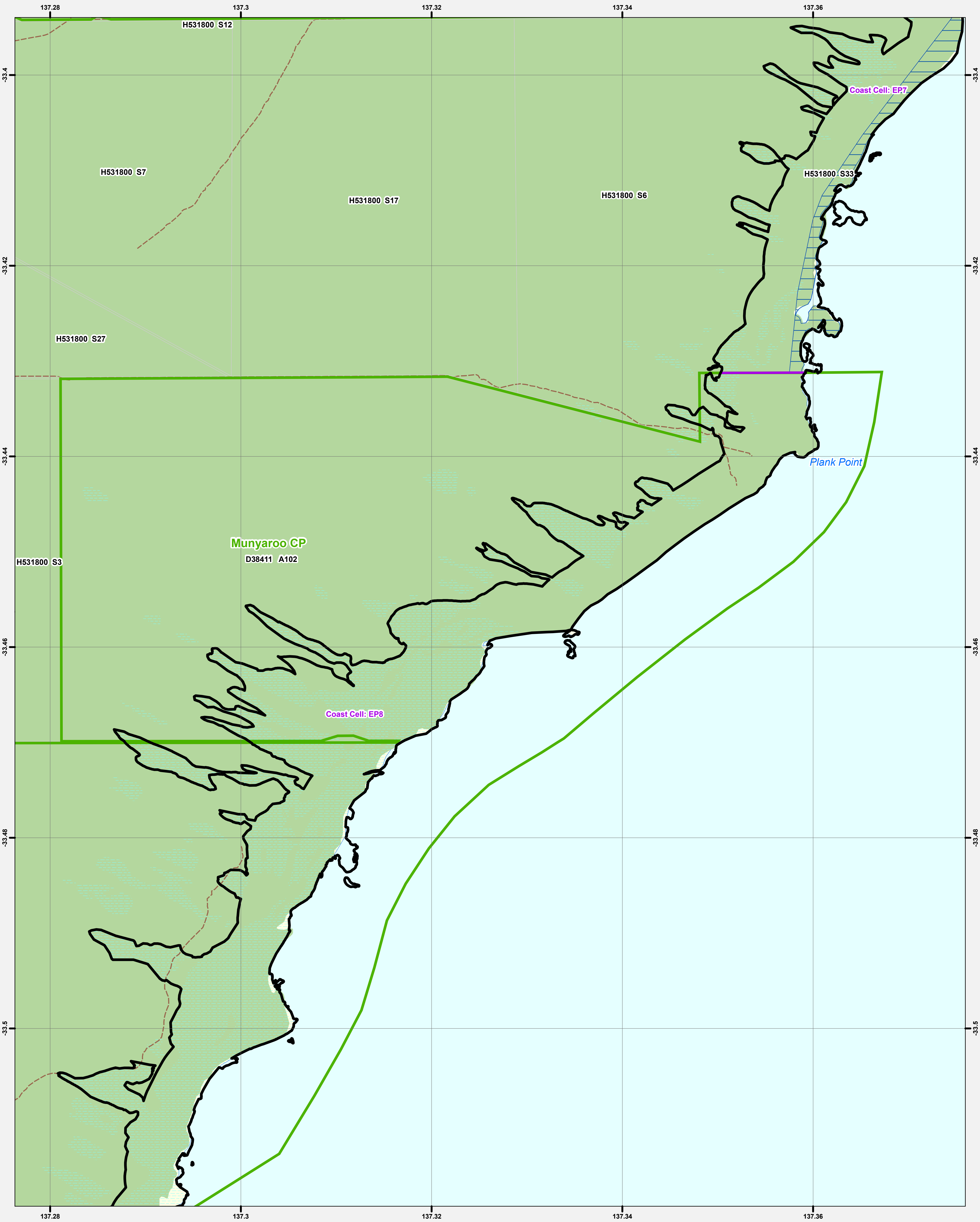
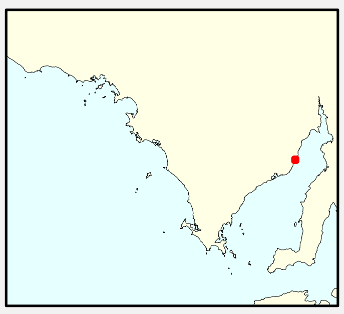
Map Block 12





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N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
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- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
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- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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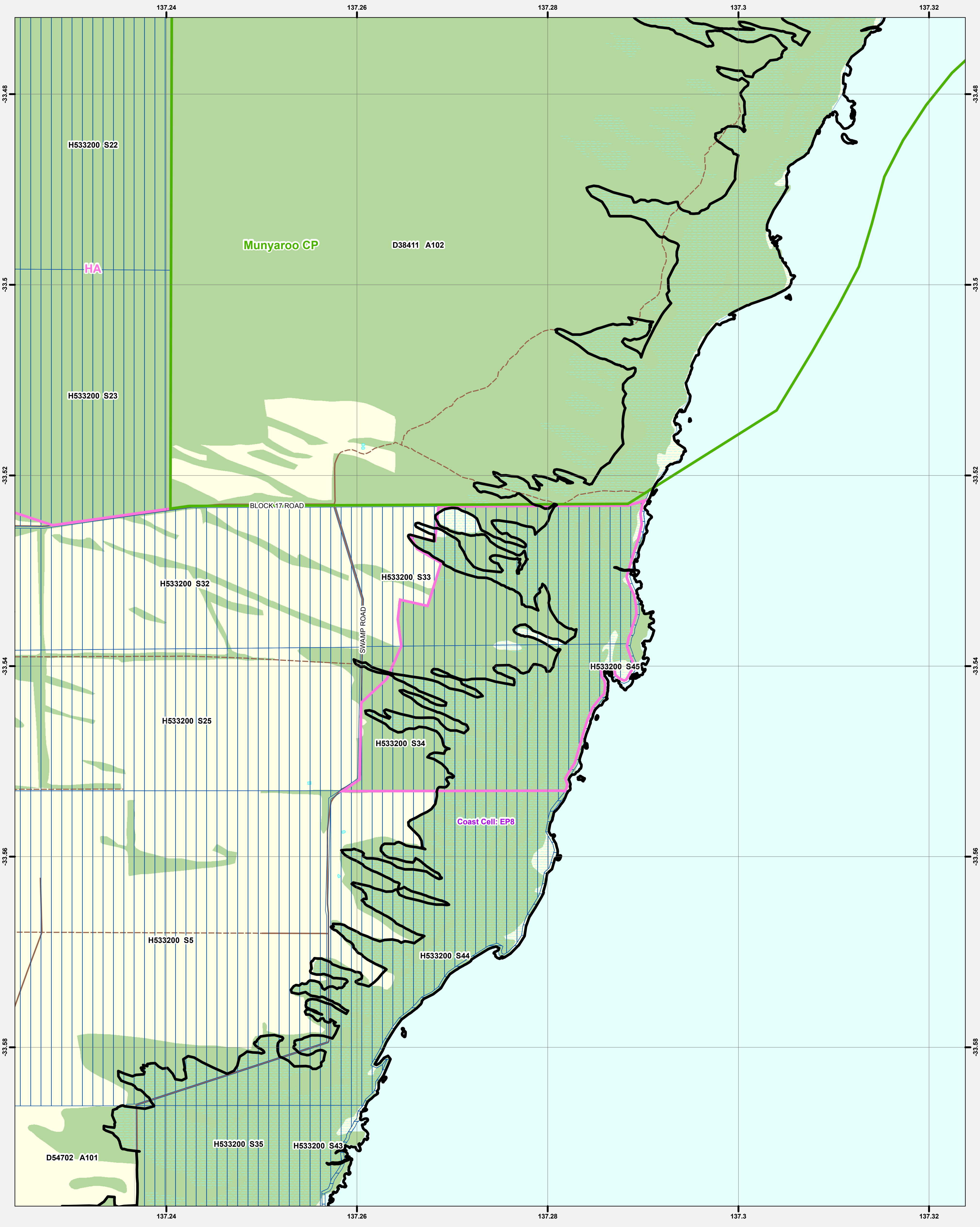
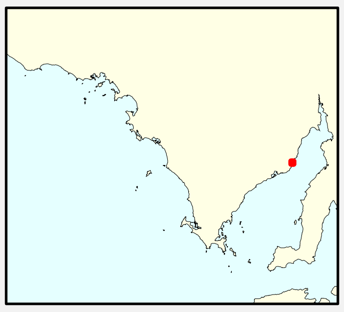
Map Block 13





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
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- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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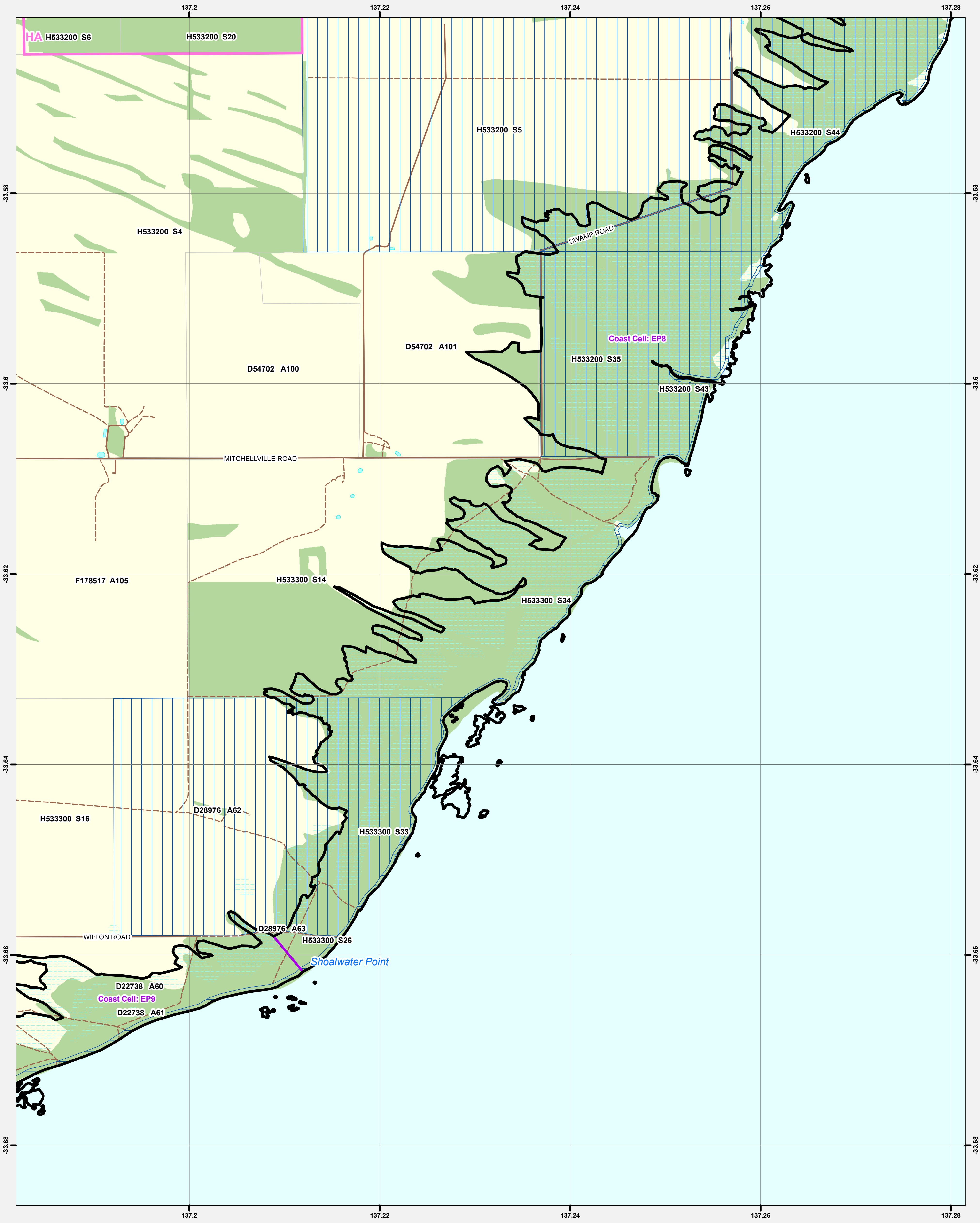
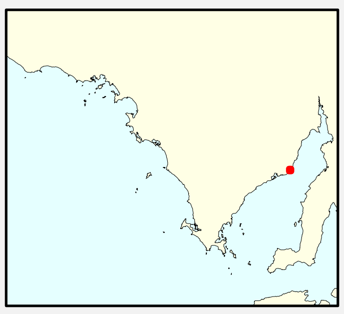
Eyre Peninsula Coastal Action Plan

Map Block 14





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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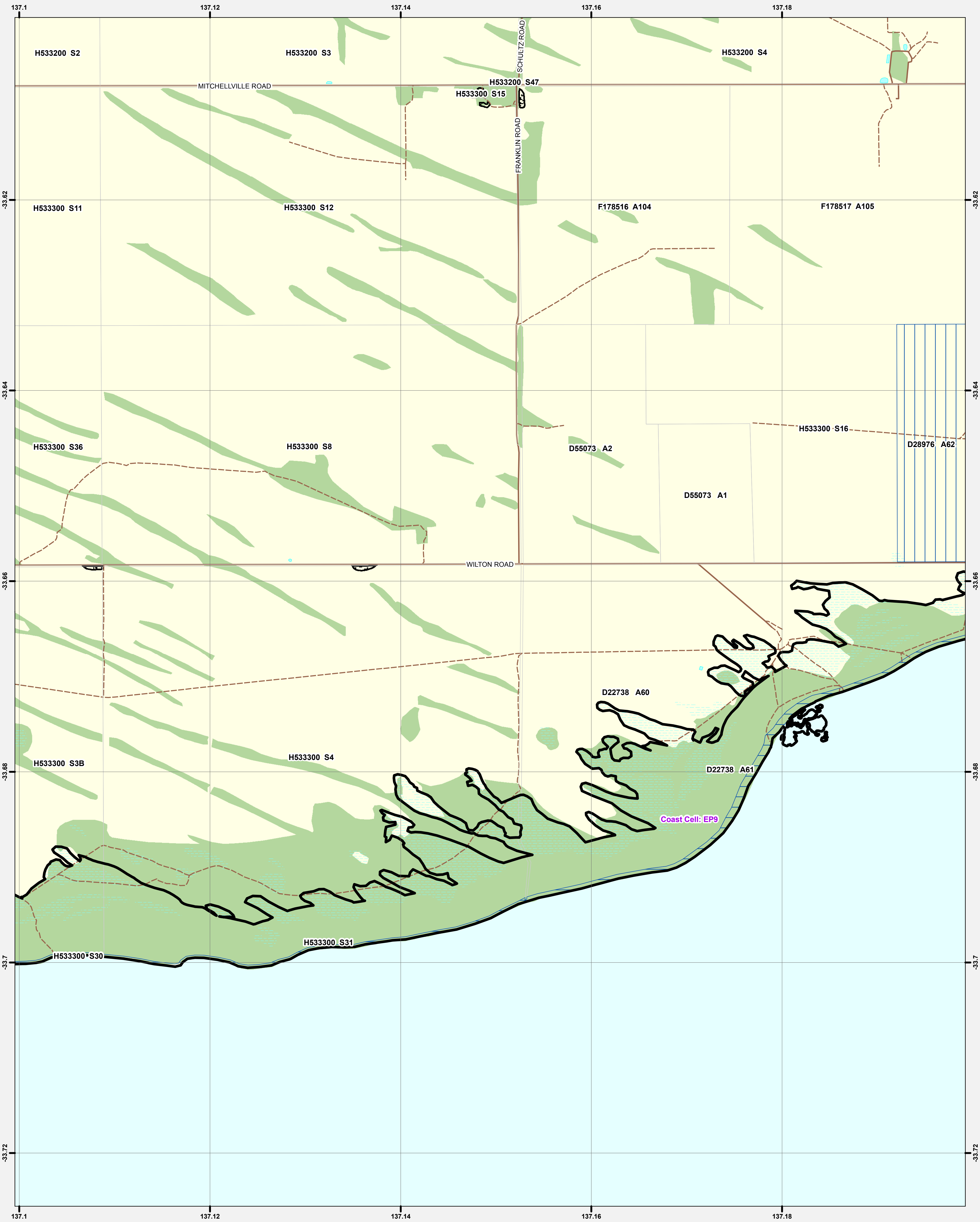
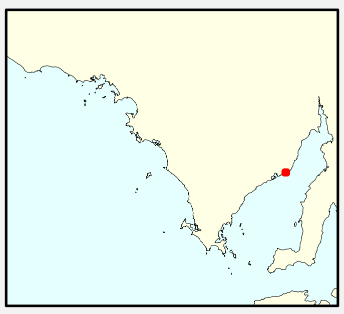
Eyre Peninsula Coastal Action Plan

Map Block 15





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Kms

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Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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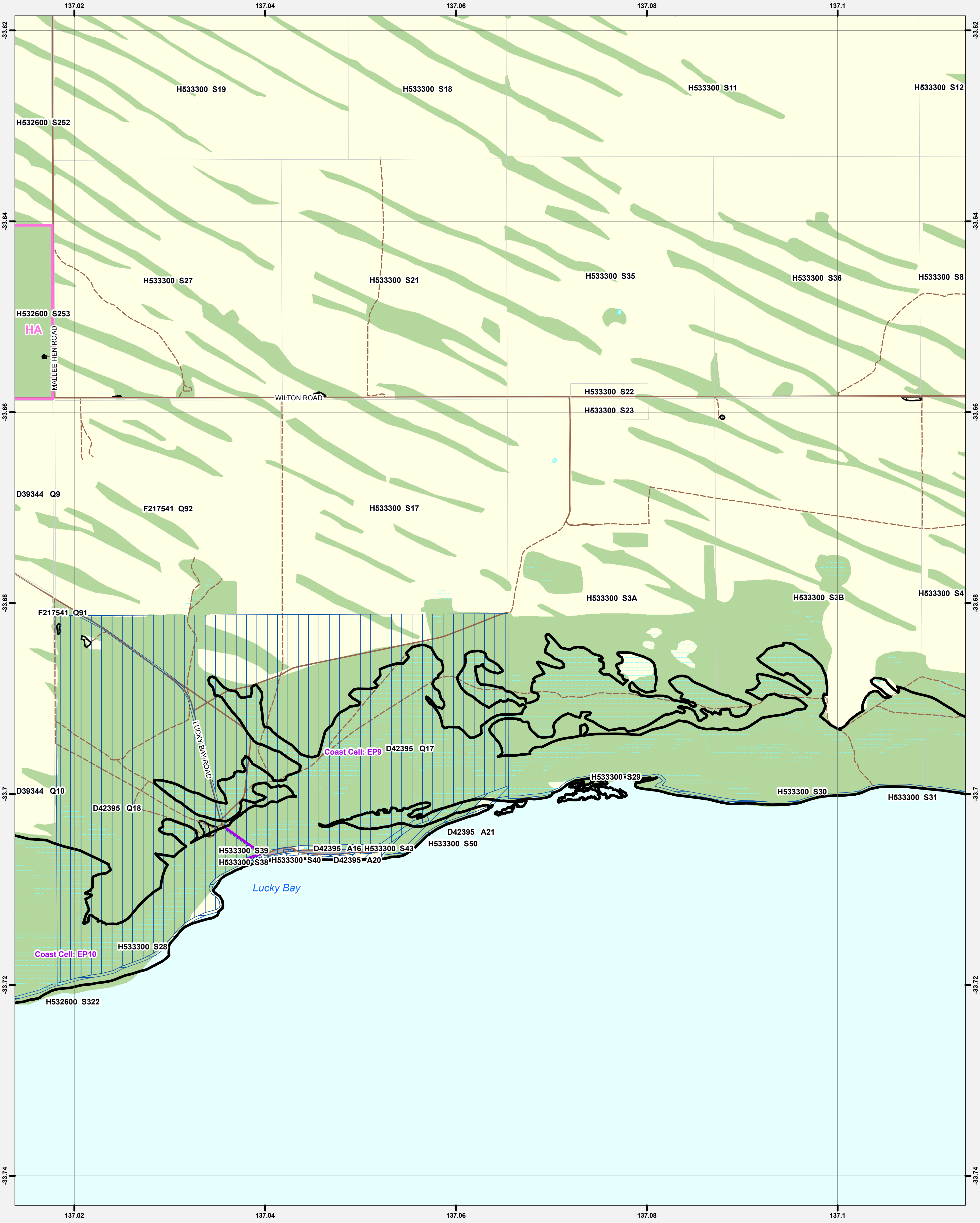
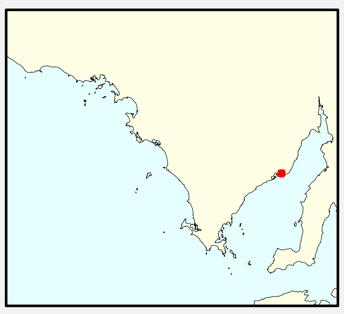
Eyre Peninsula Coastal Action Plan

Map Block 16





Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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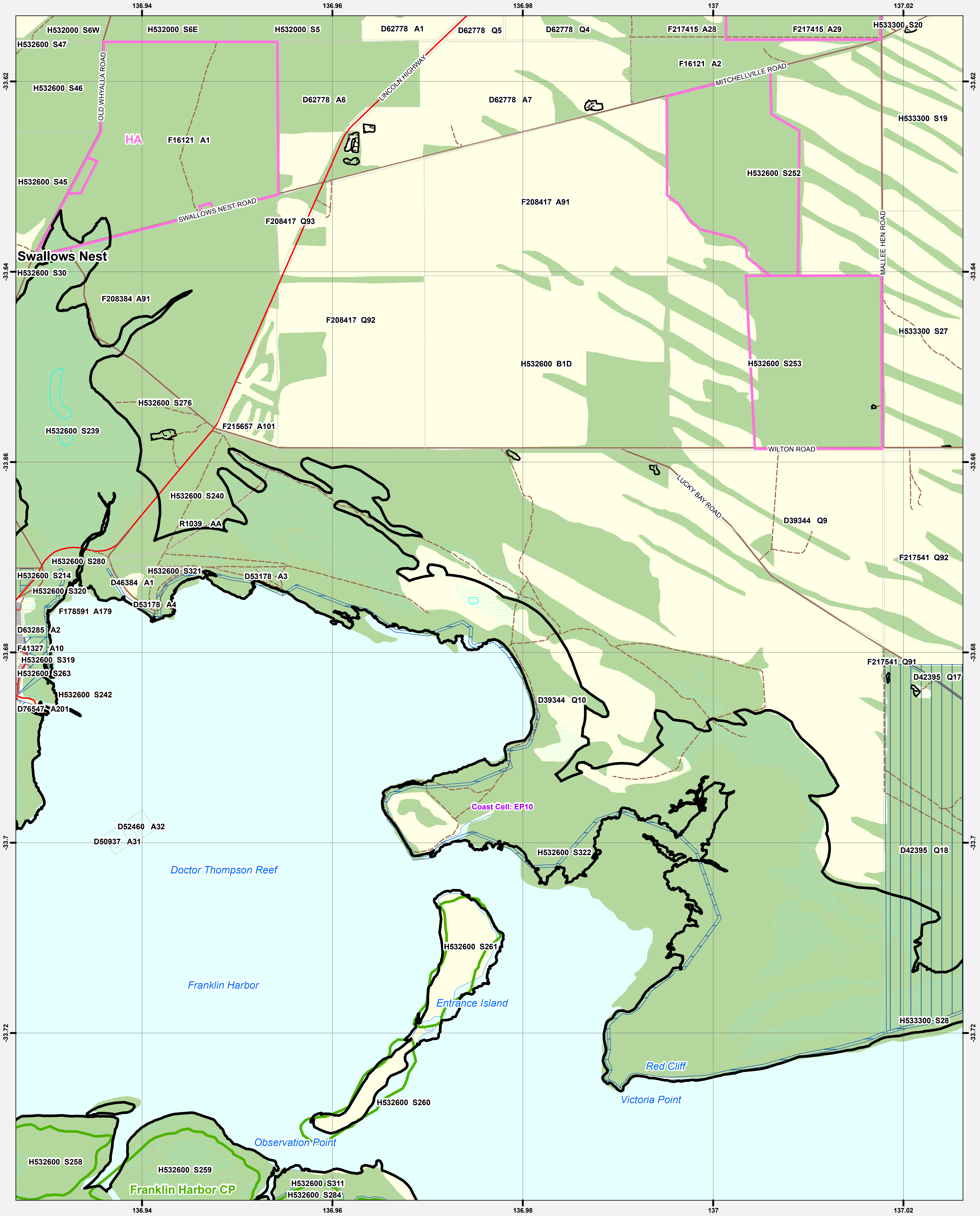
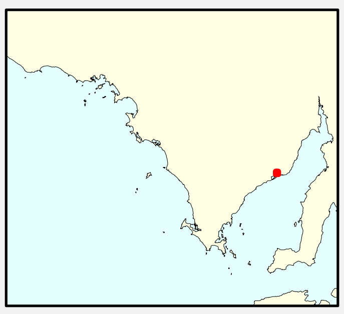
Map Block 17





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Kms

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Navigation Marks
Light Colour
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- ORANGE
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- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
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- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- Land Subject to Inundation (STI)
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- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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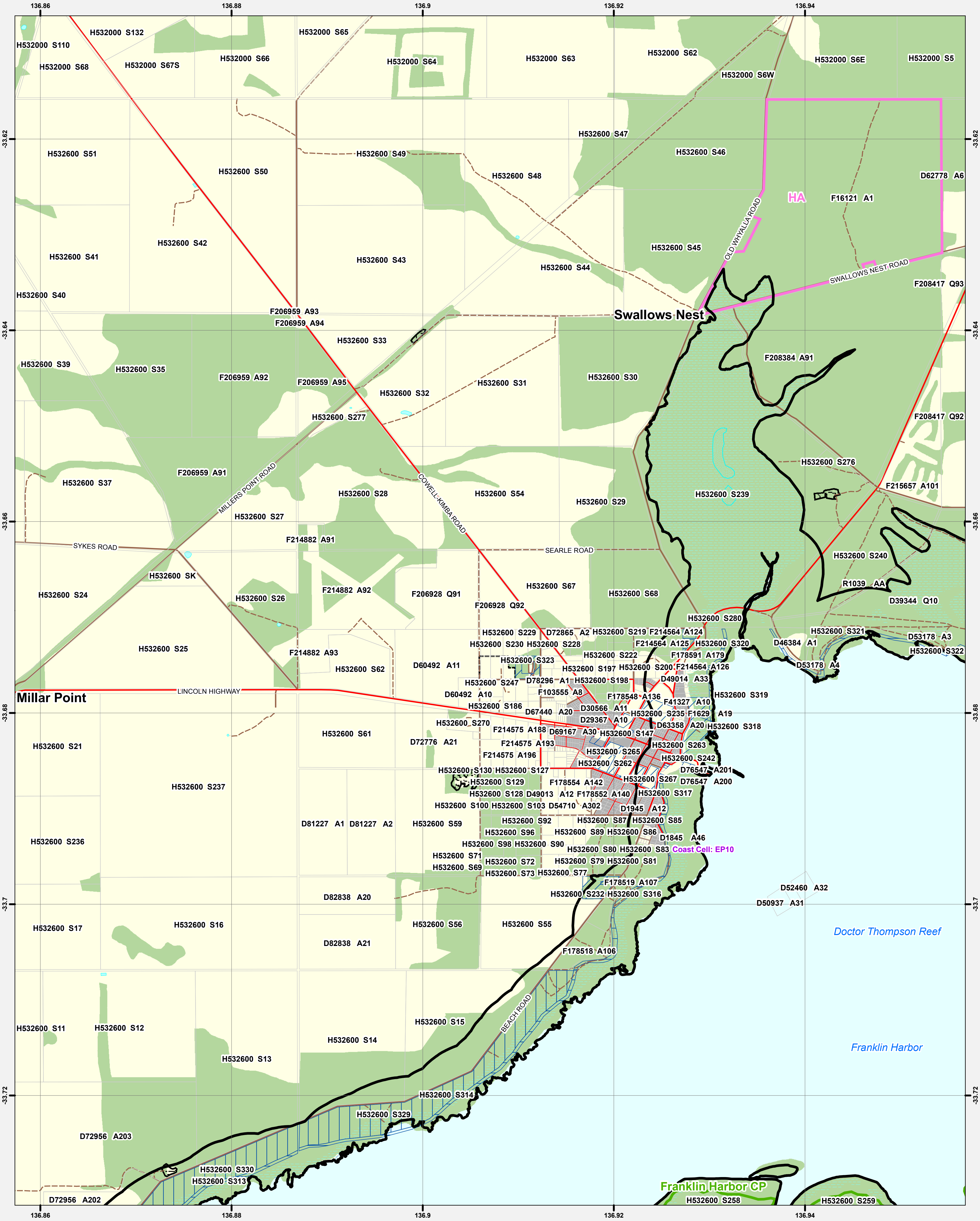
Eyre Peninsula Coastal Action Plan
Map Block 18



N

0 2.5
Kms

Navigation Marks Light Colour	Roads Road Feature Codes	Protected Areas Reserve Type	Waterbodies Type	
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Boundary
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Coastal Cells
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Stockpile, Slag Heap, Storage Dump, Tailing Pond
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Rubbish Dump
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Quarries
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Reefs
YELLOW			Land Subject to Flooding (STF)	Built Up Area
				Native Vegetation

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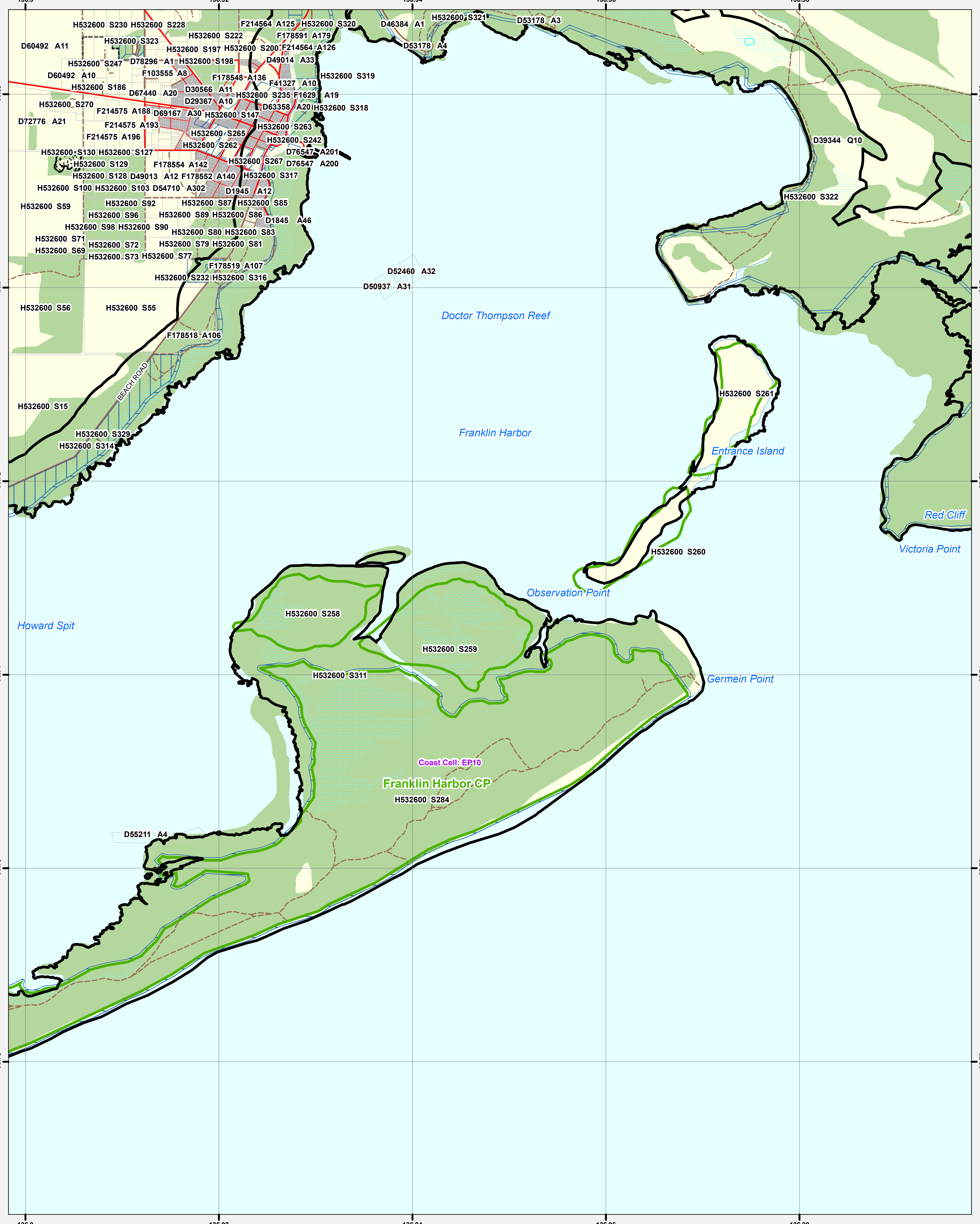
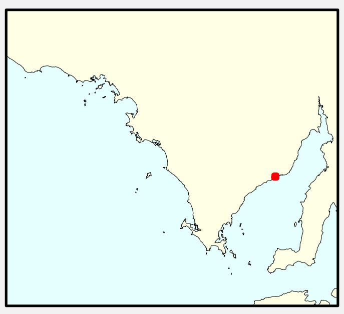
Eyre Peninsula Coastal Action Plan

Map Block 19





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Kms

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Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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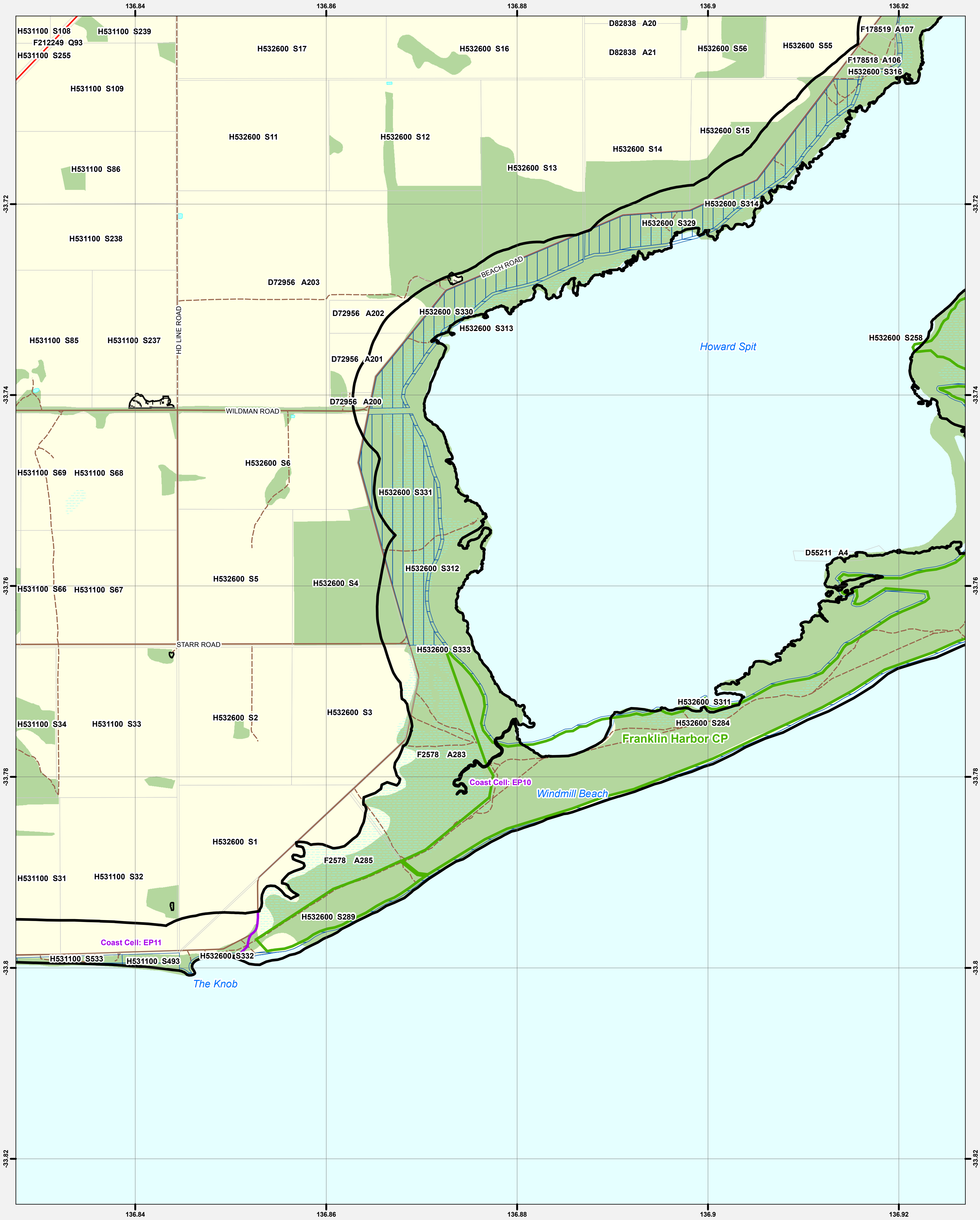
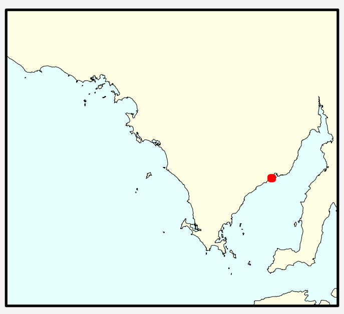
Eyre Peninsula Coastal Action Plan

Map Block 20





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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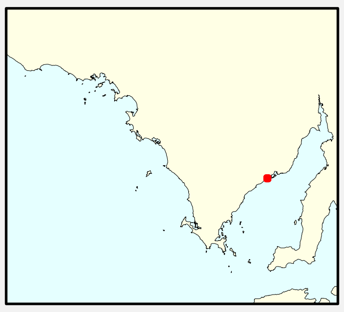
Eyre Peninsula Coastal Action Plan
Map Block 21



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Navigation Marks
Light Colour
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- CLEAR/RED
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- ORANGE
- RED
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Roads
Road Feature Codes
- Highway (divided)
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Protected Areas
Reserve Type
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- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
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- **Coastal Boundary**
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- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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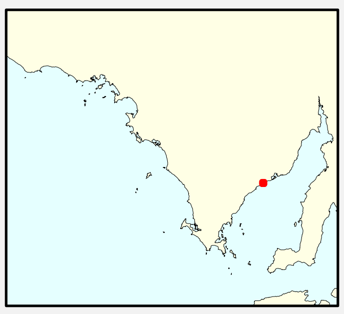
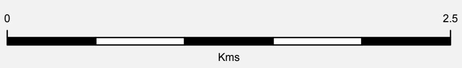
Eyre Peninsula Coastal Action Plan

Map Block 22





Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
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- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
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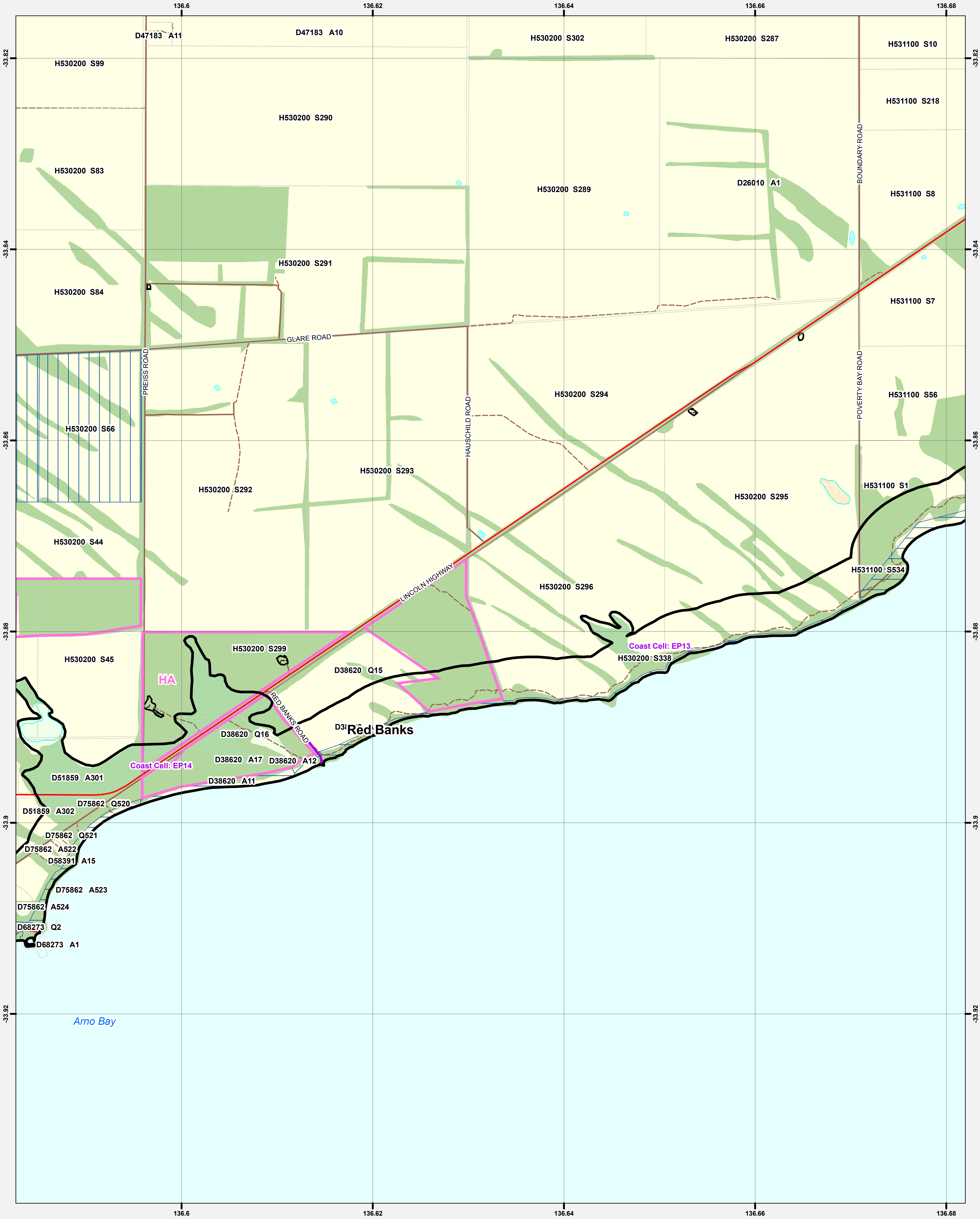
Map Block 23



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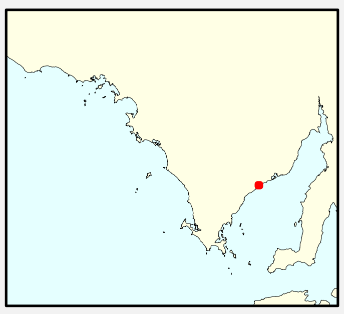

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
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- **Reefs**
- **Built Up Area**
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Eyre Peninsula Coastal Action Plan

Map Block 24

0 2.5
Kms

N

Navigation Marks **Light Colour**
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads **Road Feature Codes**
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas **Reserve Type**
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies **Type**
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
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- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
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- Quarries
- Reefs
- Built Up Area
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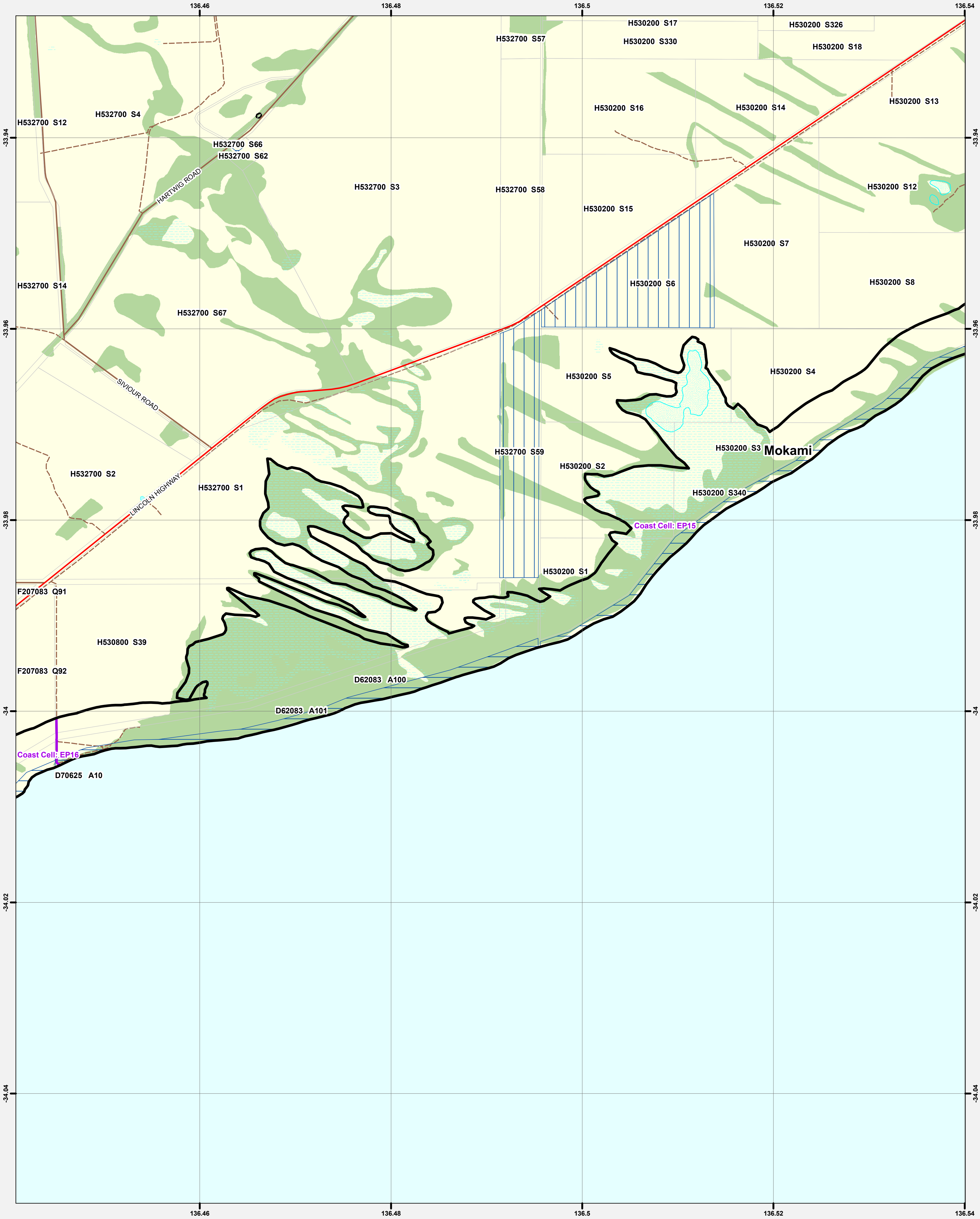
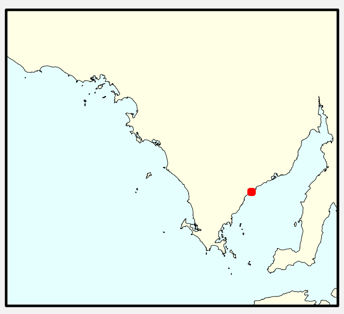
Map Block 25





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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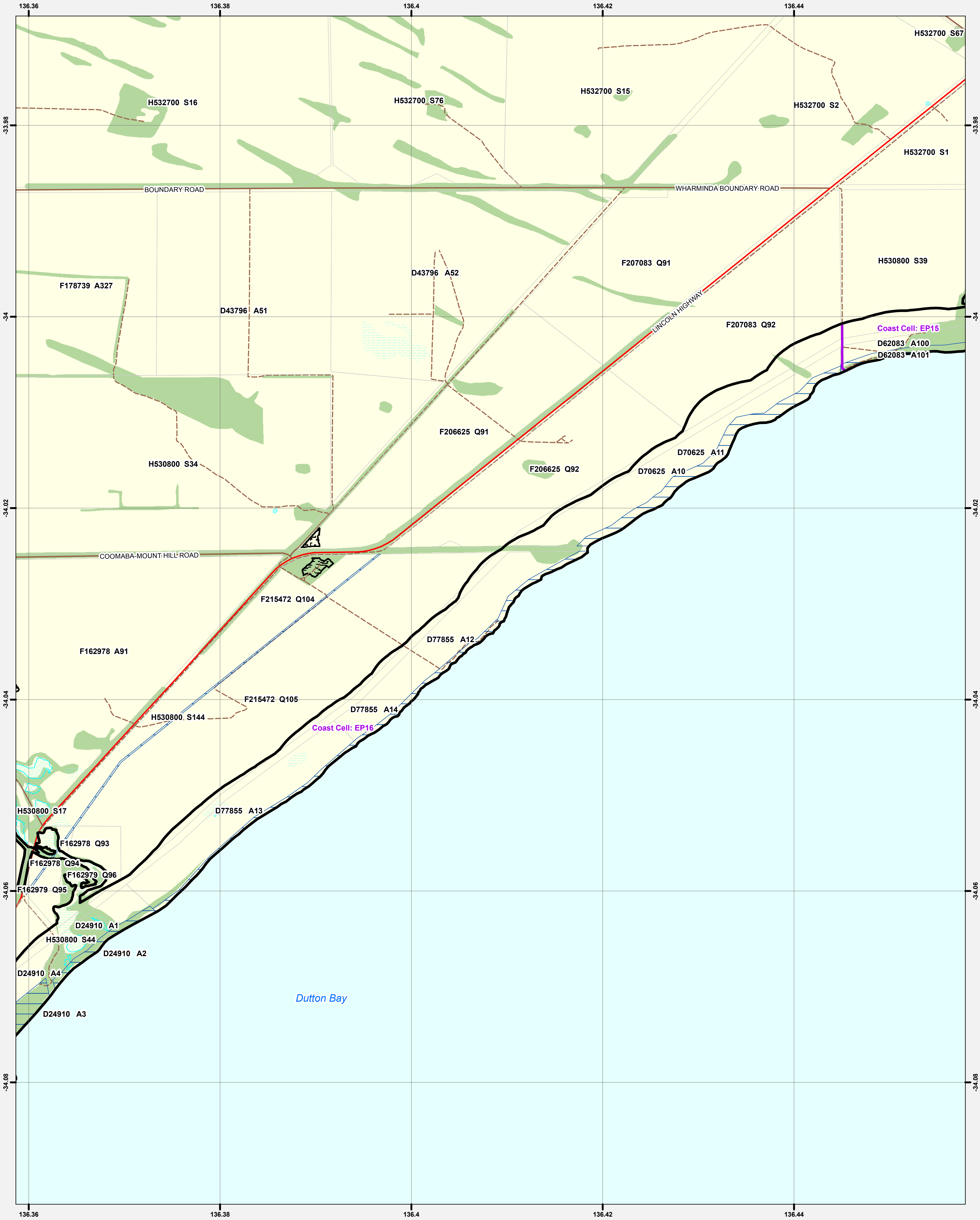
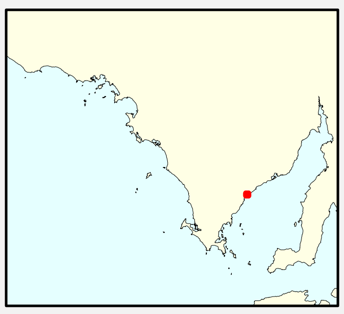
Map Block 26





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Navigation Marks
Light Colour
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- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- Land Subject to Inundation (STI)
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- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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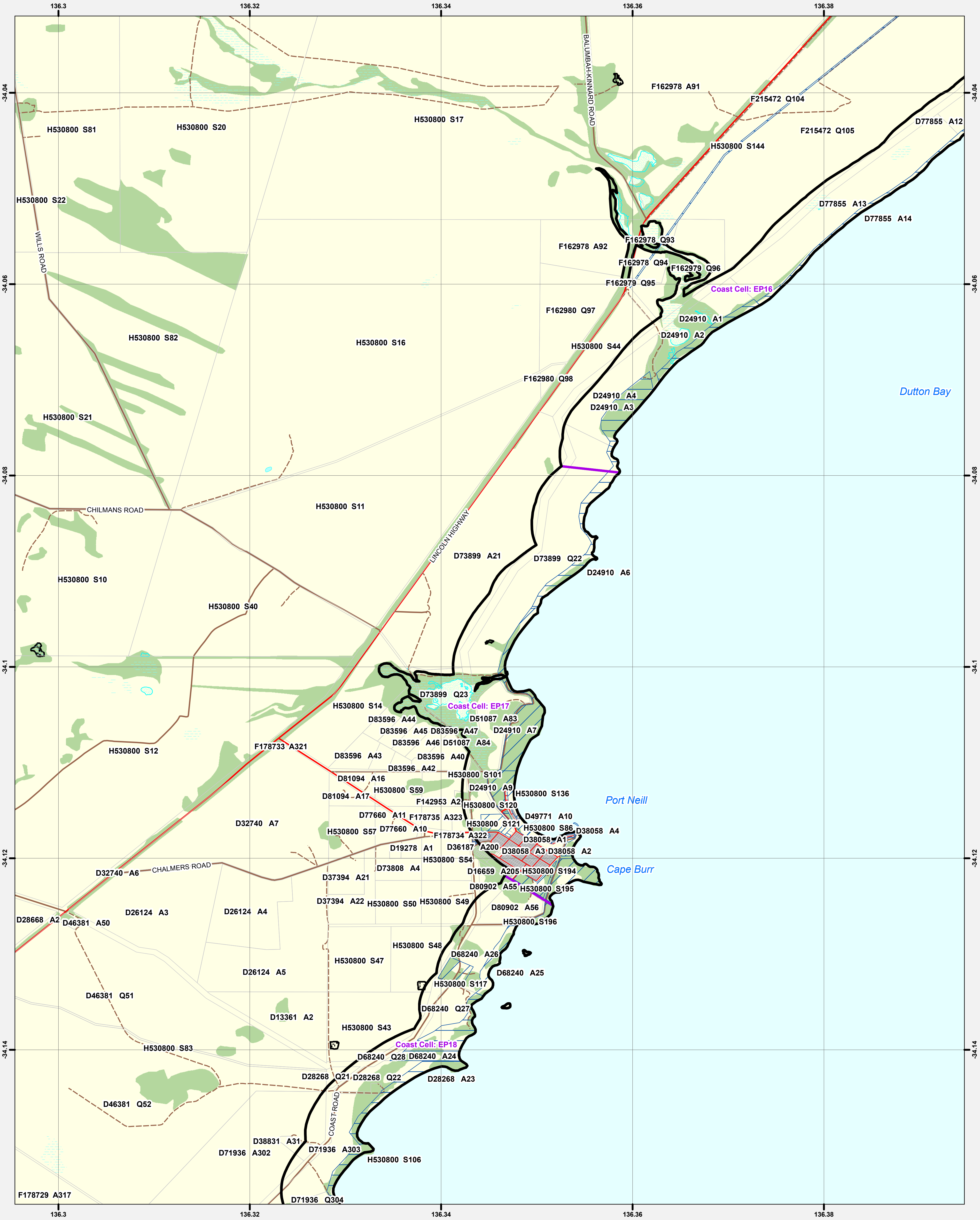
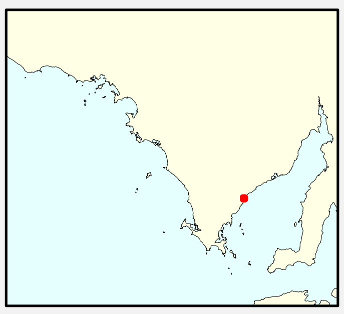
Map Block 27





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Navigation Marks
Light Colour
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- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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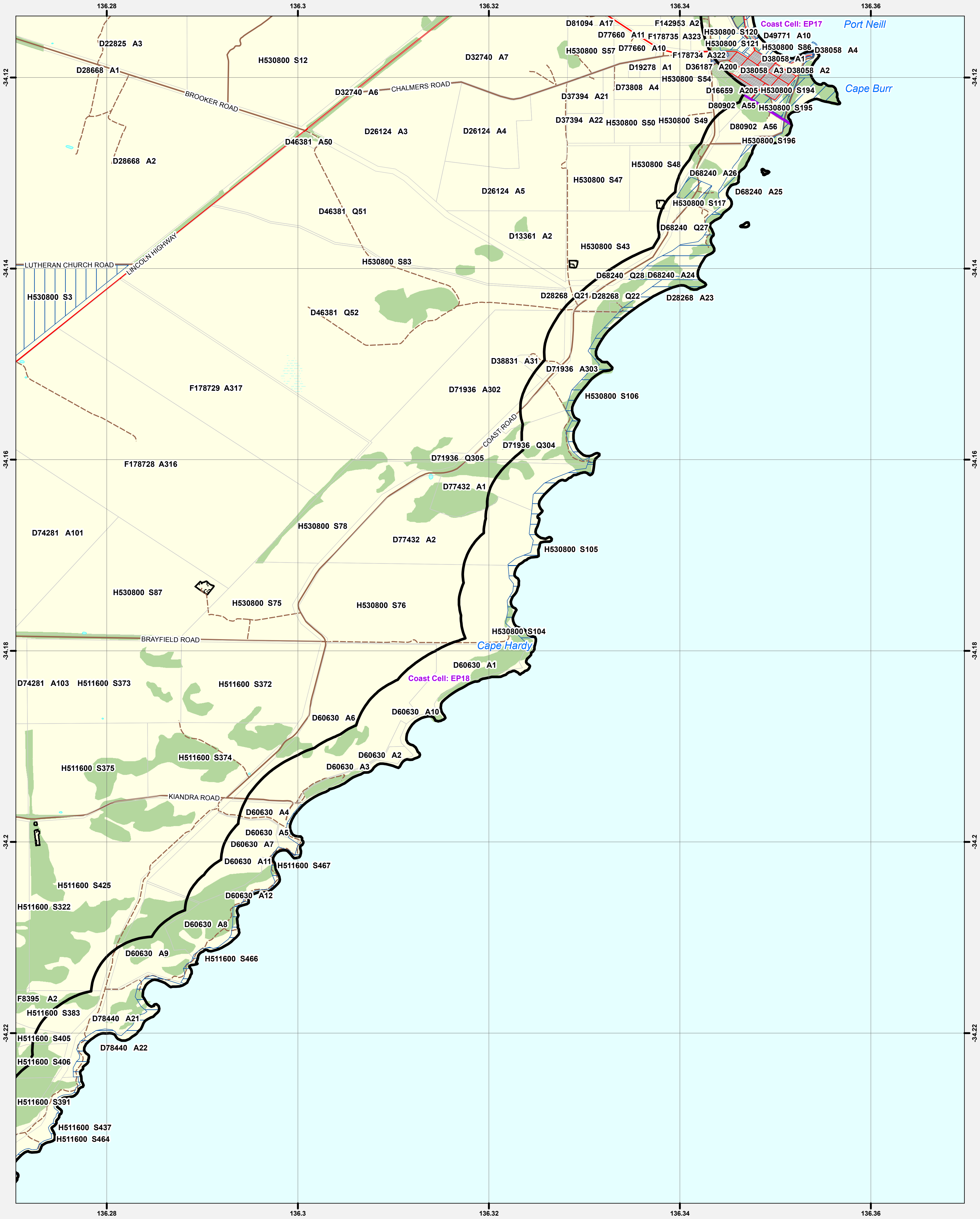
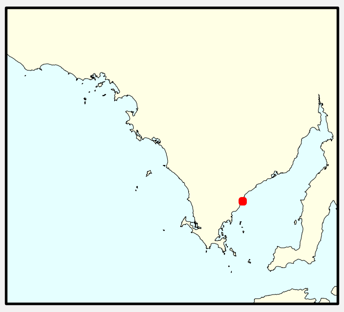
Eyre Peninsula Coastal Action Plan

Map Block 28





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Navigation Marks
Light Colour
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GREEN
ORANGE
RED
WHITE/RED
YELLOW

Roads
Road Feature Codes
Highway (divided)
Sealed
Unsealed
Vehicular Track
Sealed within Builtup Area
Unsealed within Builtup Area
Under Construction

Protected Areas
Reserve Type
National Park
Conservation Park
Conservation Reserve
Wilderness Protection Area
Vegetation Heritage Agreement
Aquatic Reserves
DCDB Parcels

Waterbodies
Type
Lake - Perennial
Dam, Reservoir
Dam, Reservoir
Inland Water Feature
Lake - Intermittent
Lake - Mainly Dry
Land Subject to Inundation (STI)
Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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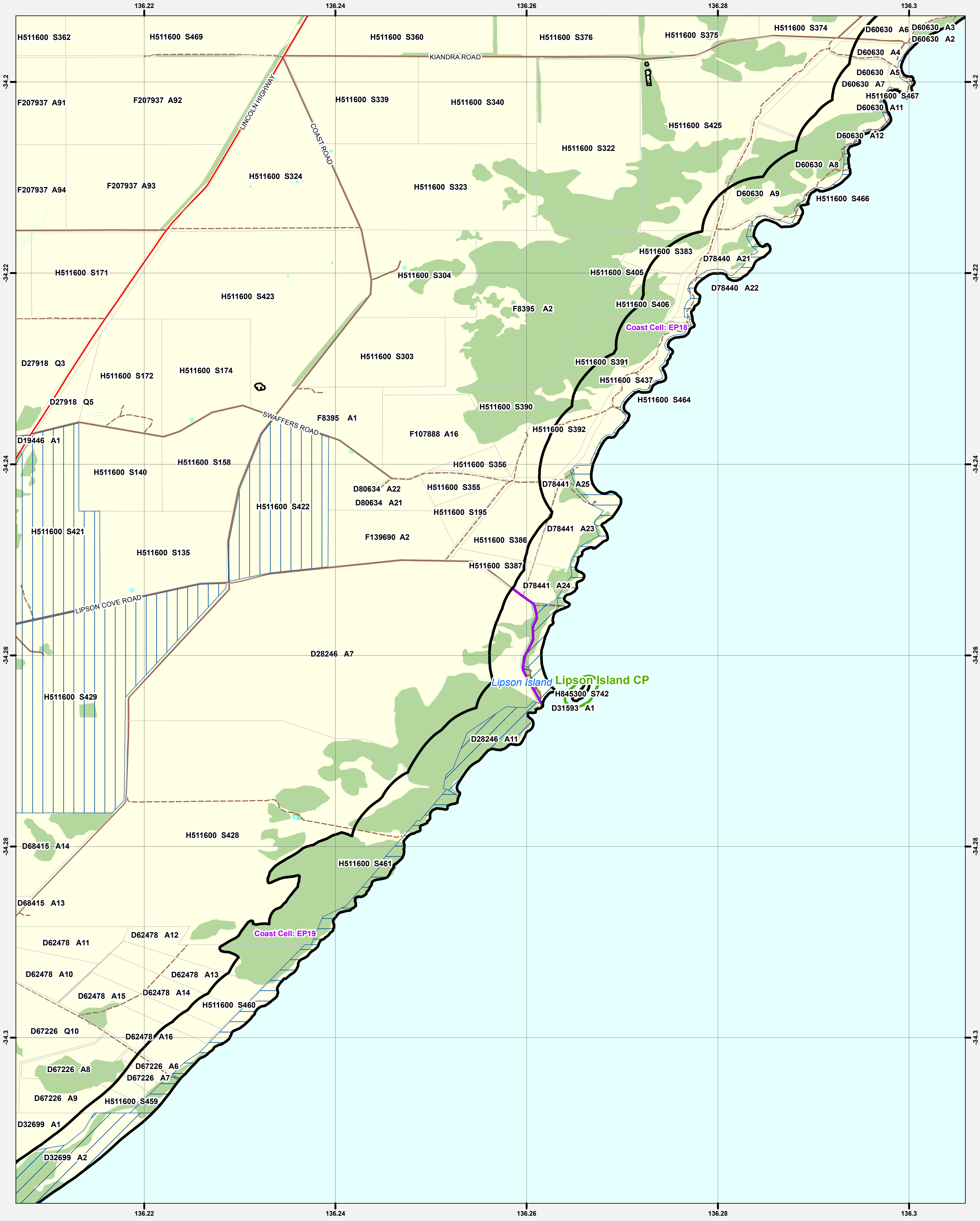
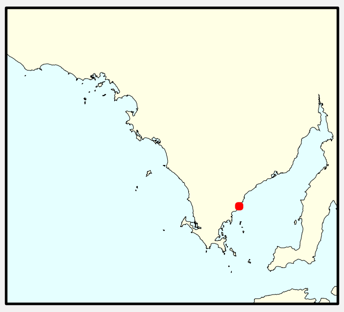
Eyre Peninsula Coastal Action Plan

Map Block 29





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Roads
Road Feature Codes
- Highway (divided)
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- Vehicular Track
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- Under Construction

Protected Areas
Reserve Type
- National Park
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- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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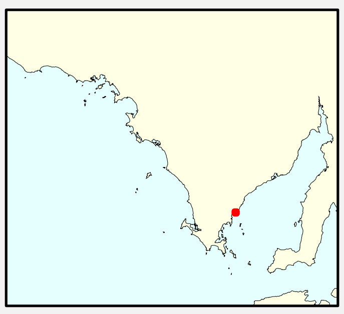
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 30



Navigation Marks
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Roads
Road Feature Codes
- Highway (divided)
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- Vehicular Track
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Protected Areas
Reserve Type
- National Park
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- Conservation Reserve
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- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
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- Coastal Boundary
- Coastal Cells
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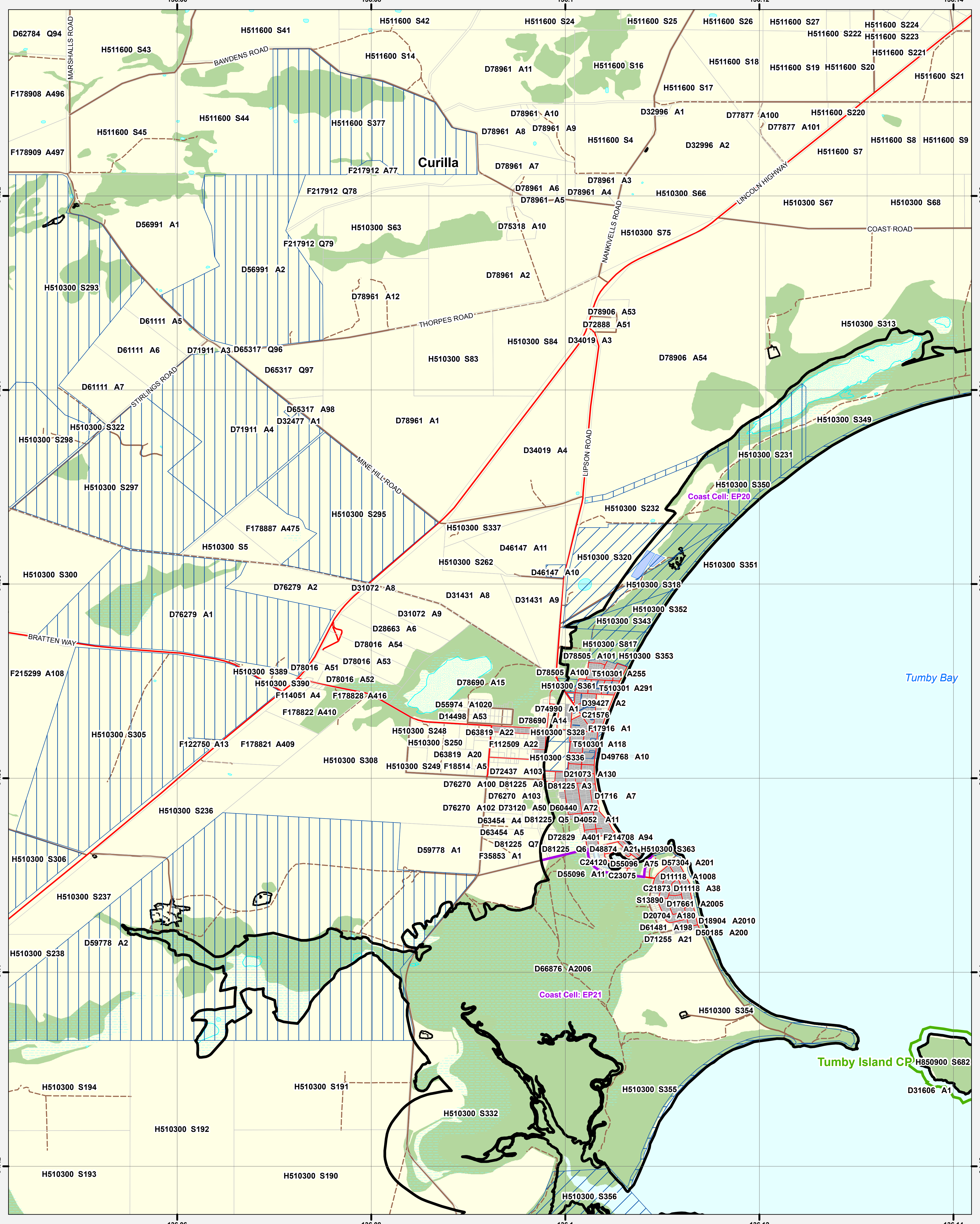
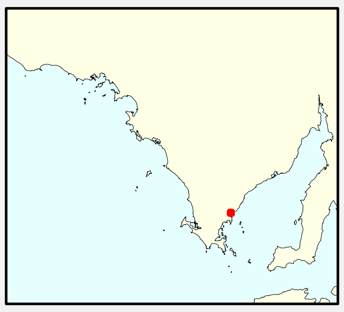
Eyre Peninsula Coastal Action Plan

Map Block 31





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Kms

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Navigation Marks
Light Colour
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- CLEAR/RED
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- ORANGE
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- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
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- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
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- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
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- Coastal Boundary
- Coastal Cells
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- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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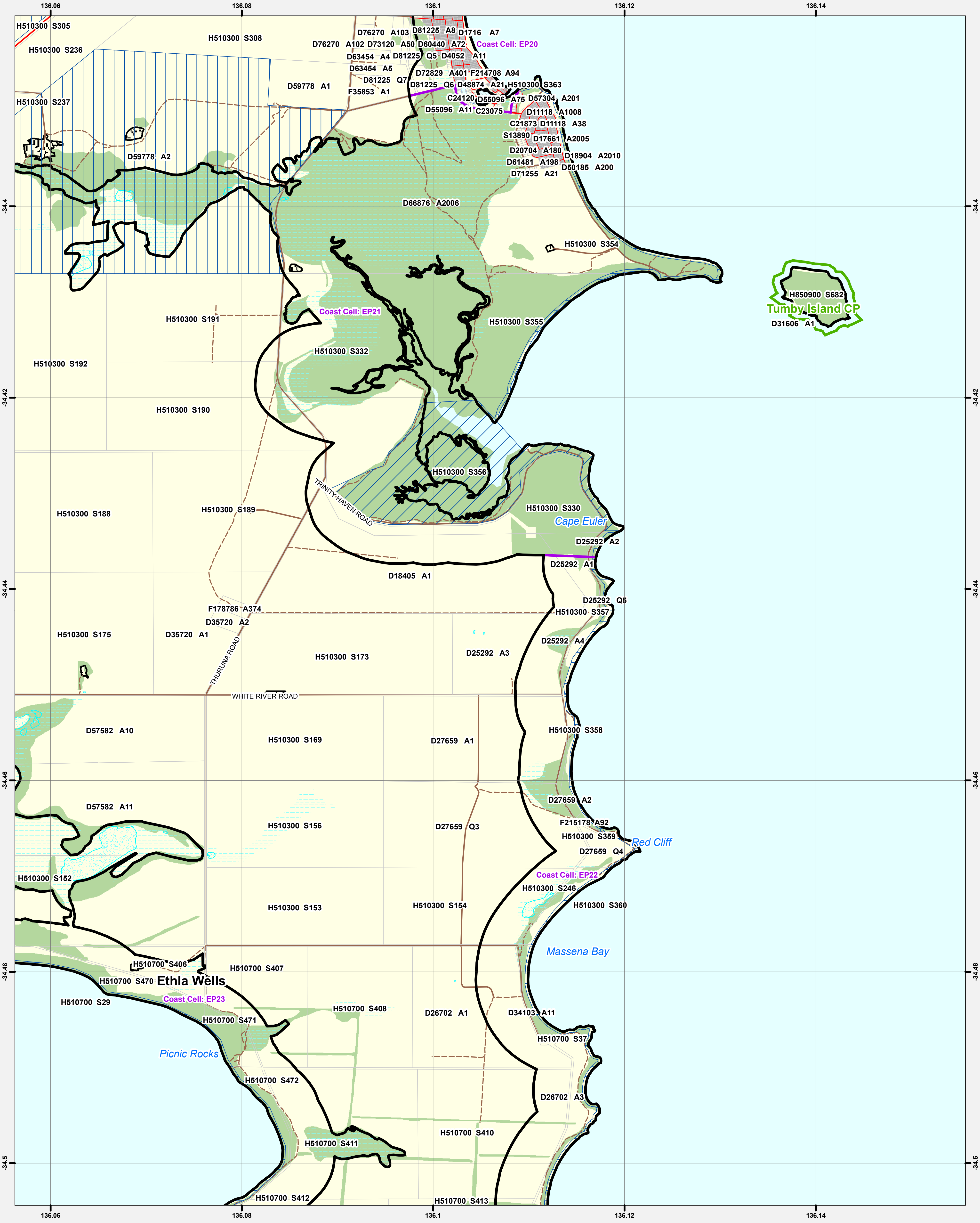
Eyre Peninsula Coastal Action Plan

Map Block 32



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Kms

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Navigation Marks
Light Colour
Unknown Light
CLEAR
CLEAR/RED
GREEN
ORANGE
RED
WHITE/RED
YELLOW

Roads
Road Feature Codes
Highway (divided)
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Unsealed
Vehicular Track
Sealed within Builtup Area
Unsealed within Builtup Area
Under Construction

Protected Areas
Reserve Type
National Park
Conservation Park
Conservation Reserve
Wilderness Protection Area
Vegetation Heritage Agreement
Aquatic Reserves
DCDB Parcels

Waterbodies
Type
Lake - Perennial
Dam, Reservoir
Dam, Reservoir
Inland Water Feature
Lake - Intermittent
Lake - Mainly Dry
Land Subject to Inundation (STI)
Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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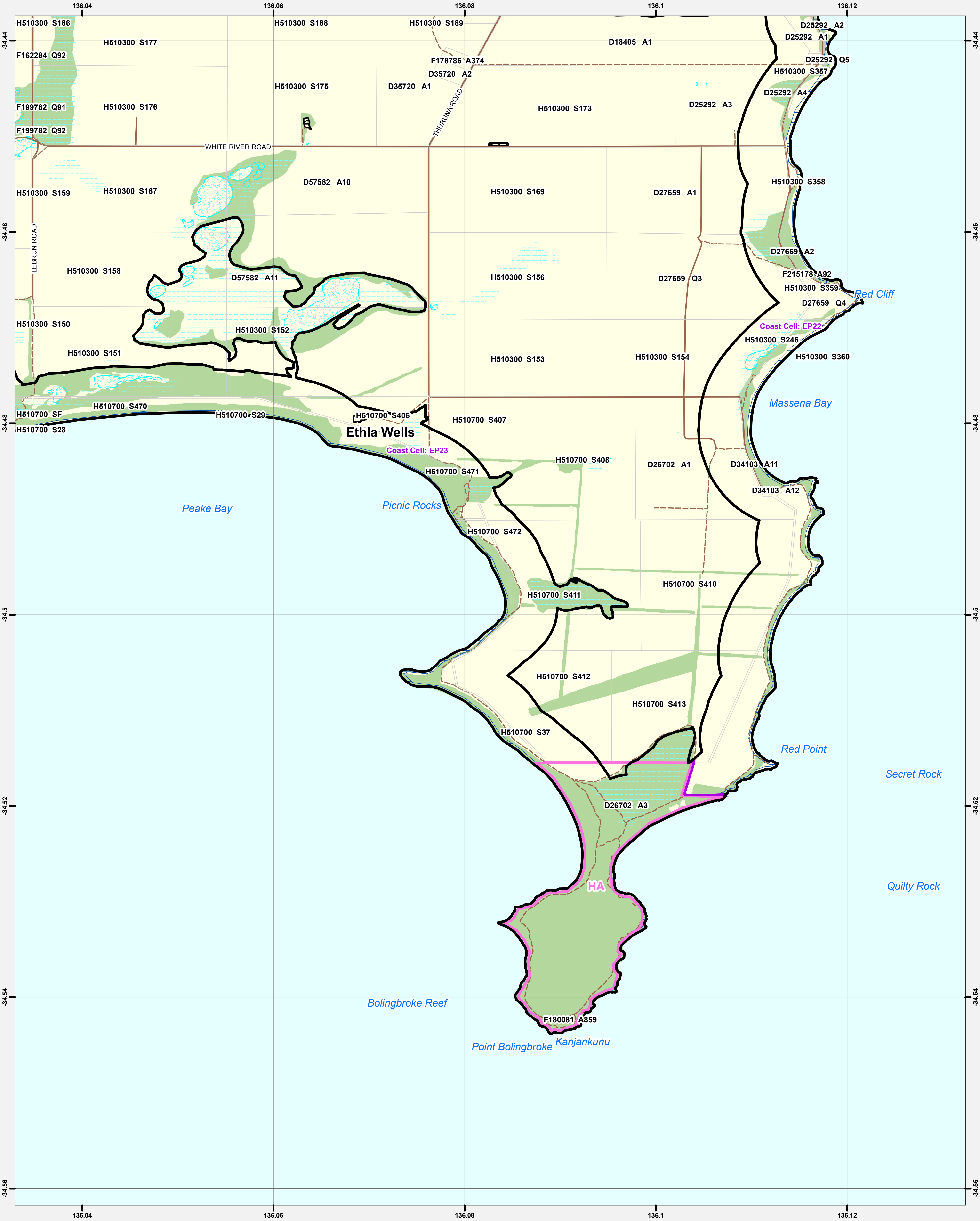
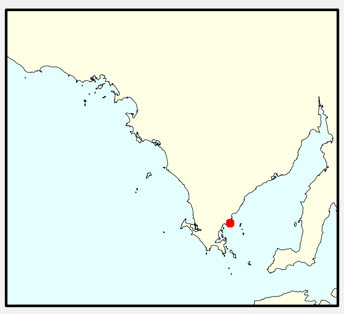
Eyre Peninsula Coastal Action Plan
Map Block 33





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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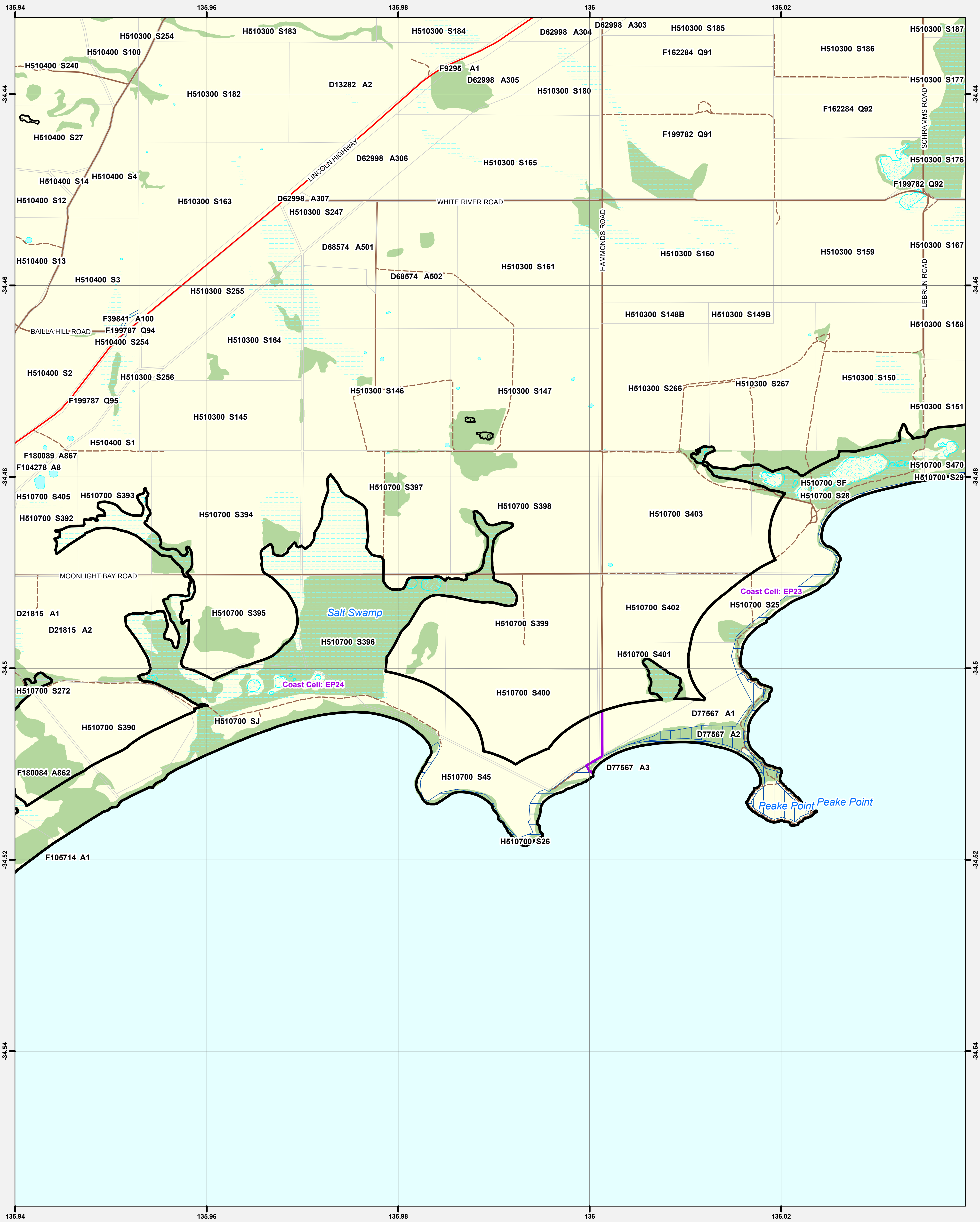
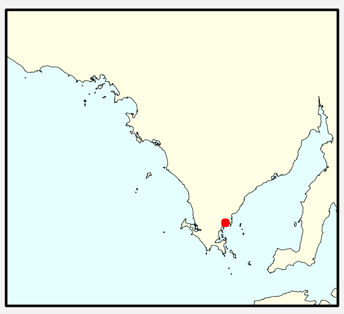
Eyre Peninsula Coastal Action Plan

Map Block 34





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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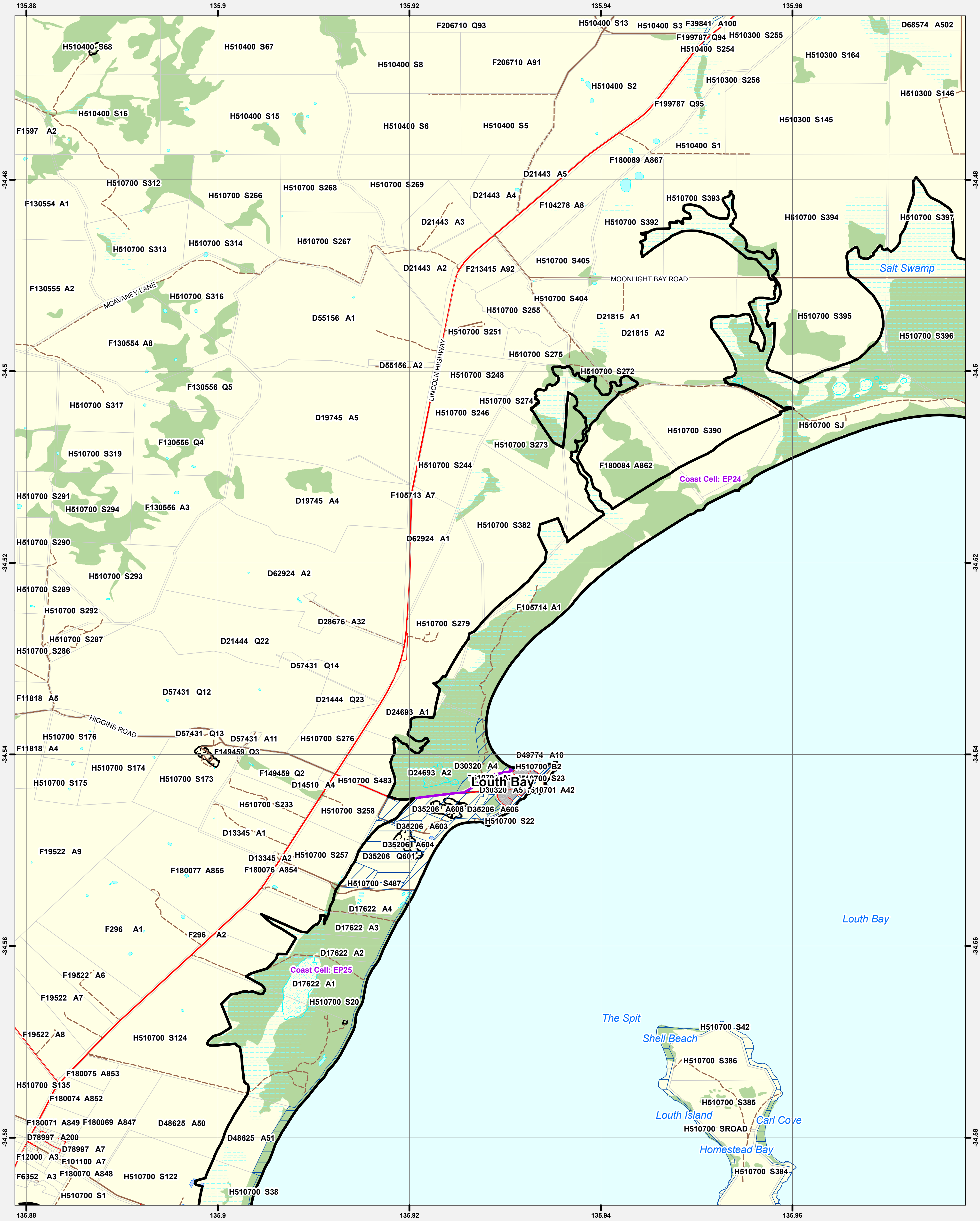
Eyre Peninsula Coastal Action Plan

Map Block 35



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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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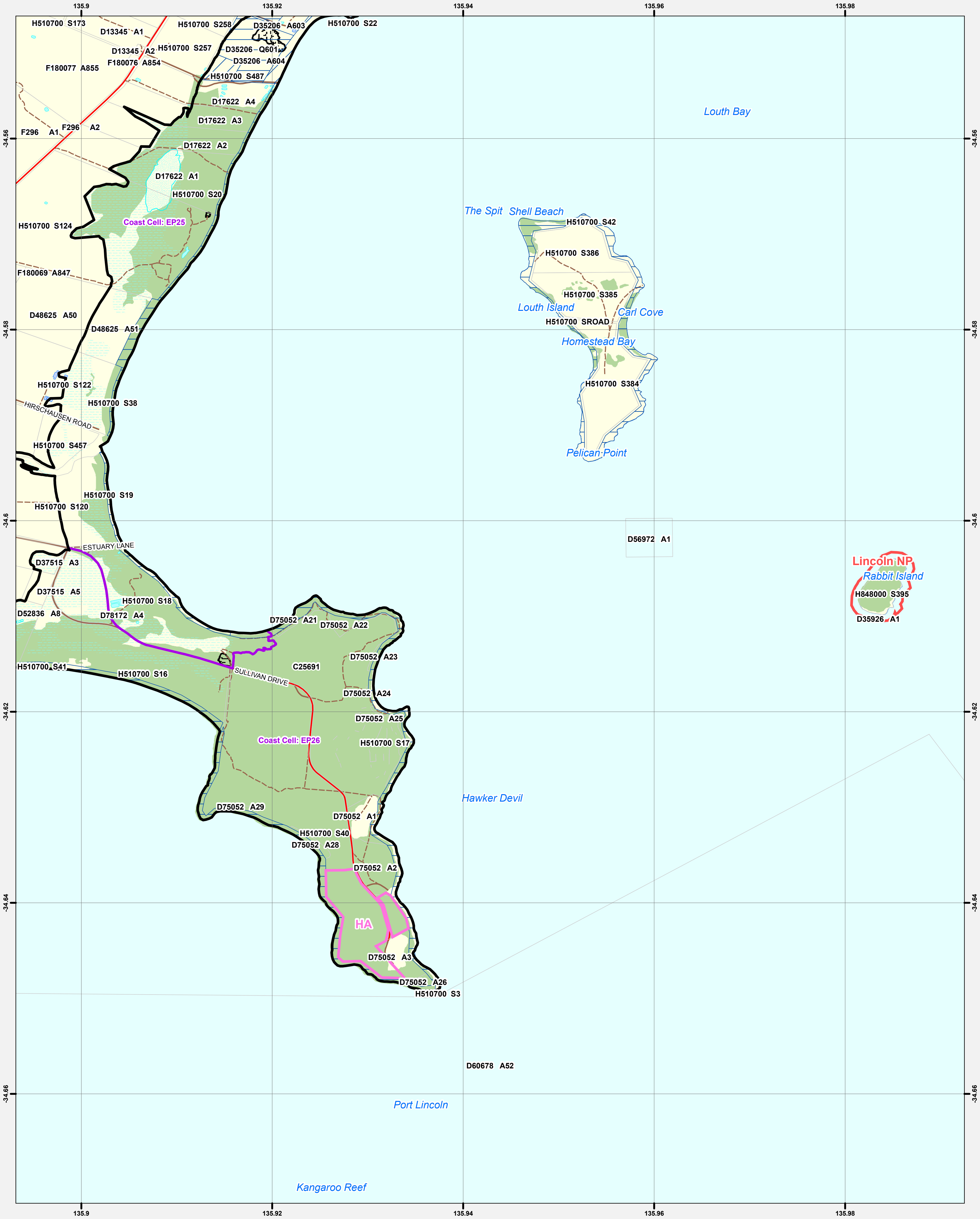
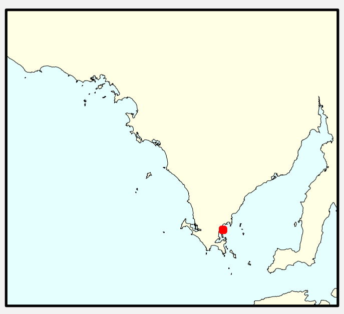
Eyre Peninsula Coastal Action Plan

Map Block 36





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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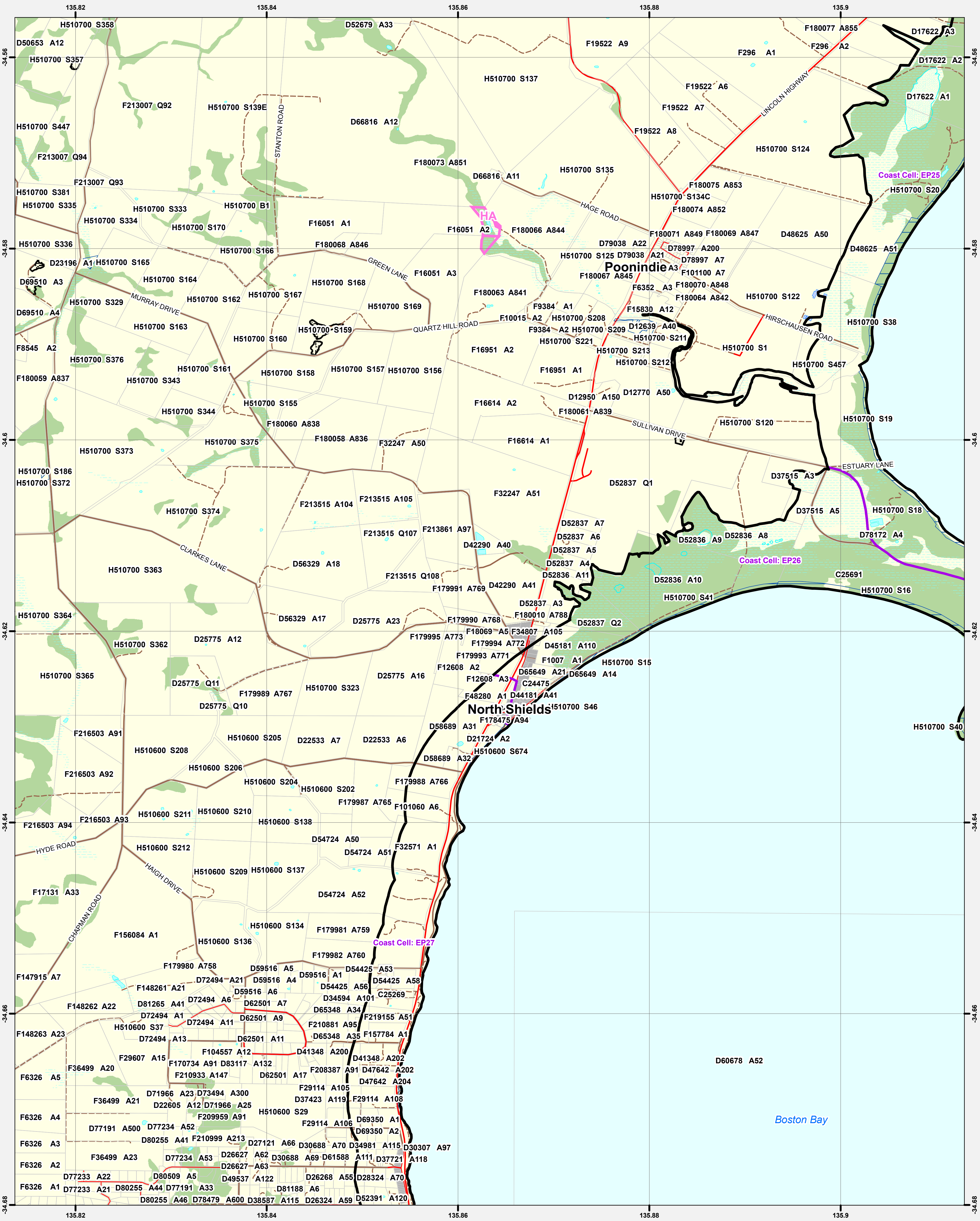
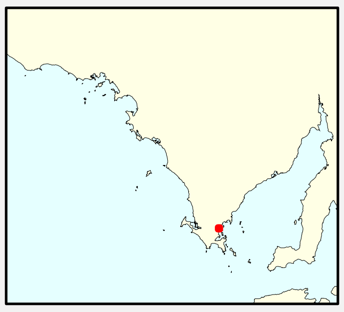
Eyre Peninsula Coastal Action Plan

Map Block 37





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Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Boundary
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Coastal Cells
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Stockpile, Slag Heap, Storage Dump, Tailing Pond
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Rubbish Dump
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Quarries
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Reefs
YELLOW			Land Subject to Flooding (STF)	Built Up Area
				Native Vegetation

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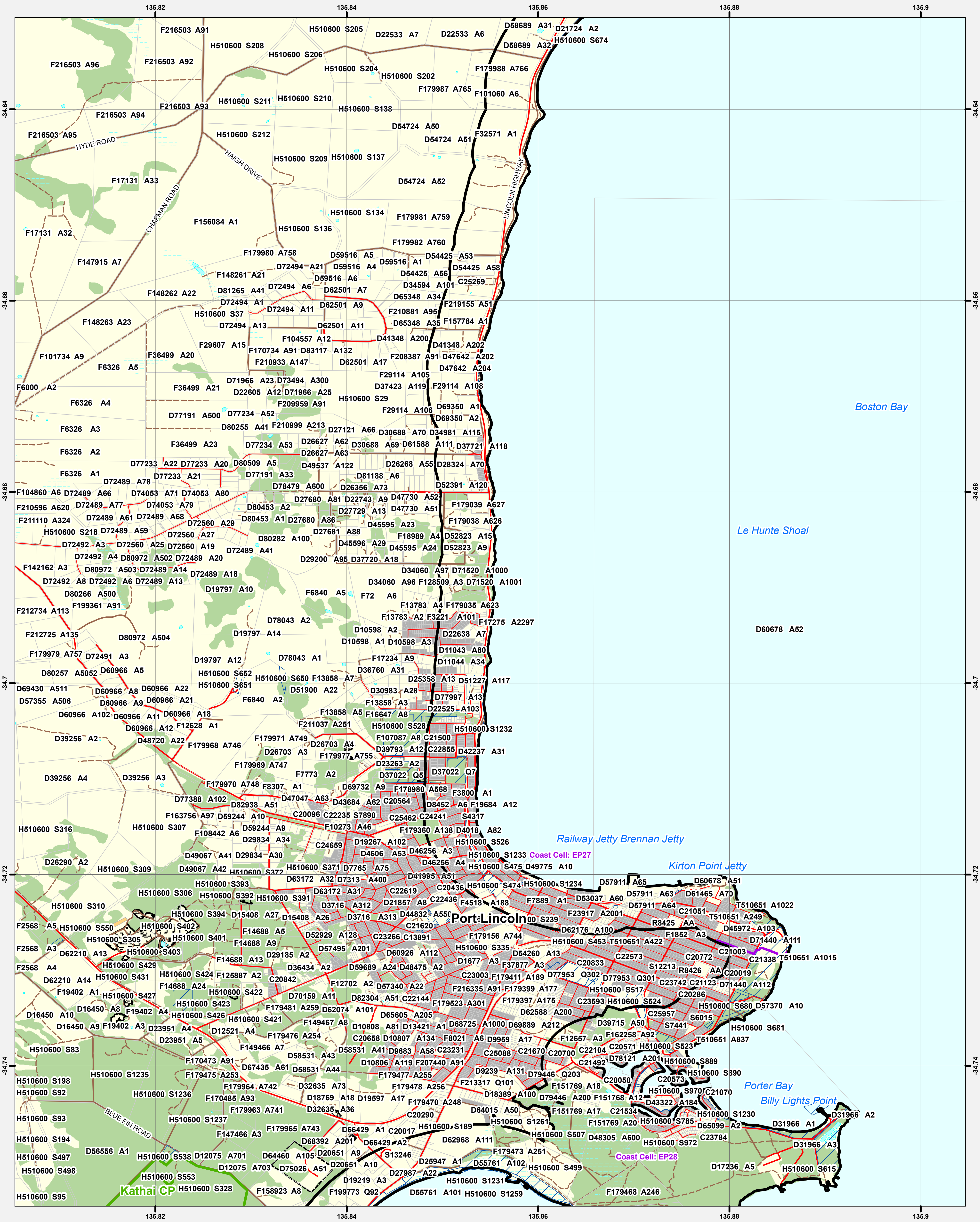
Eyre Peninsula Coastal Action Plan

Map Block 38



0 2.5

Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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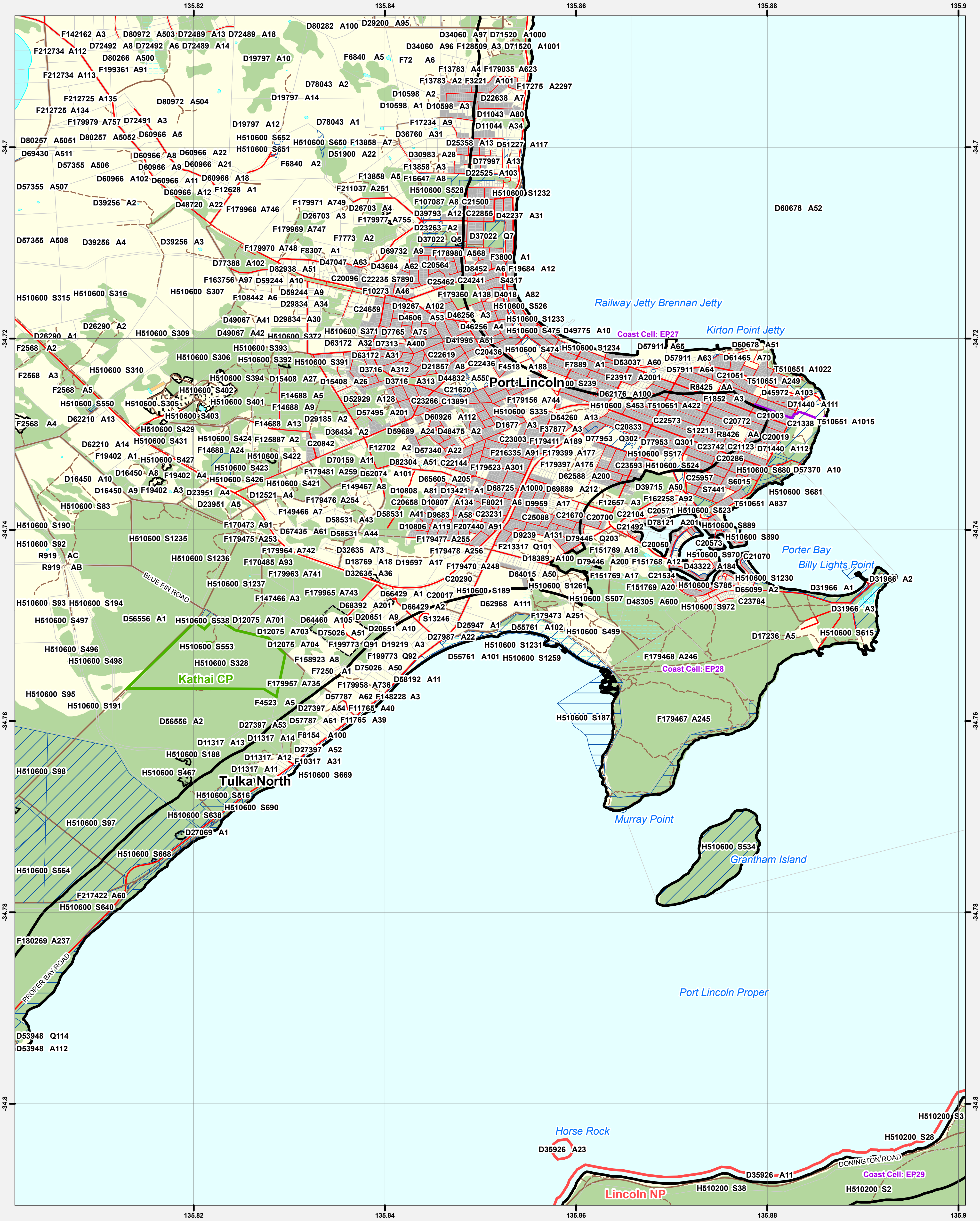
Eyre Peninsula Coastal Action Plan
Map Block 39



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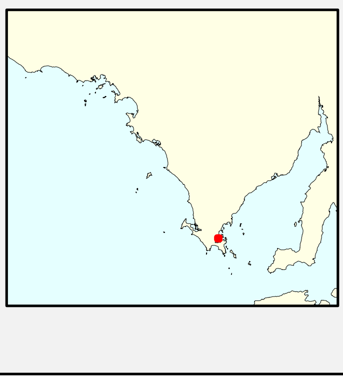

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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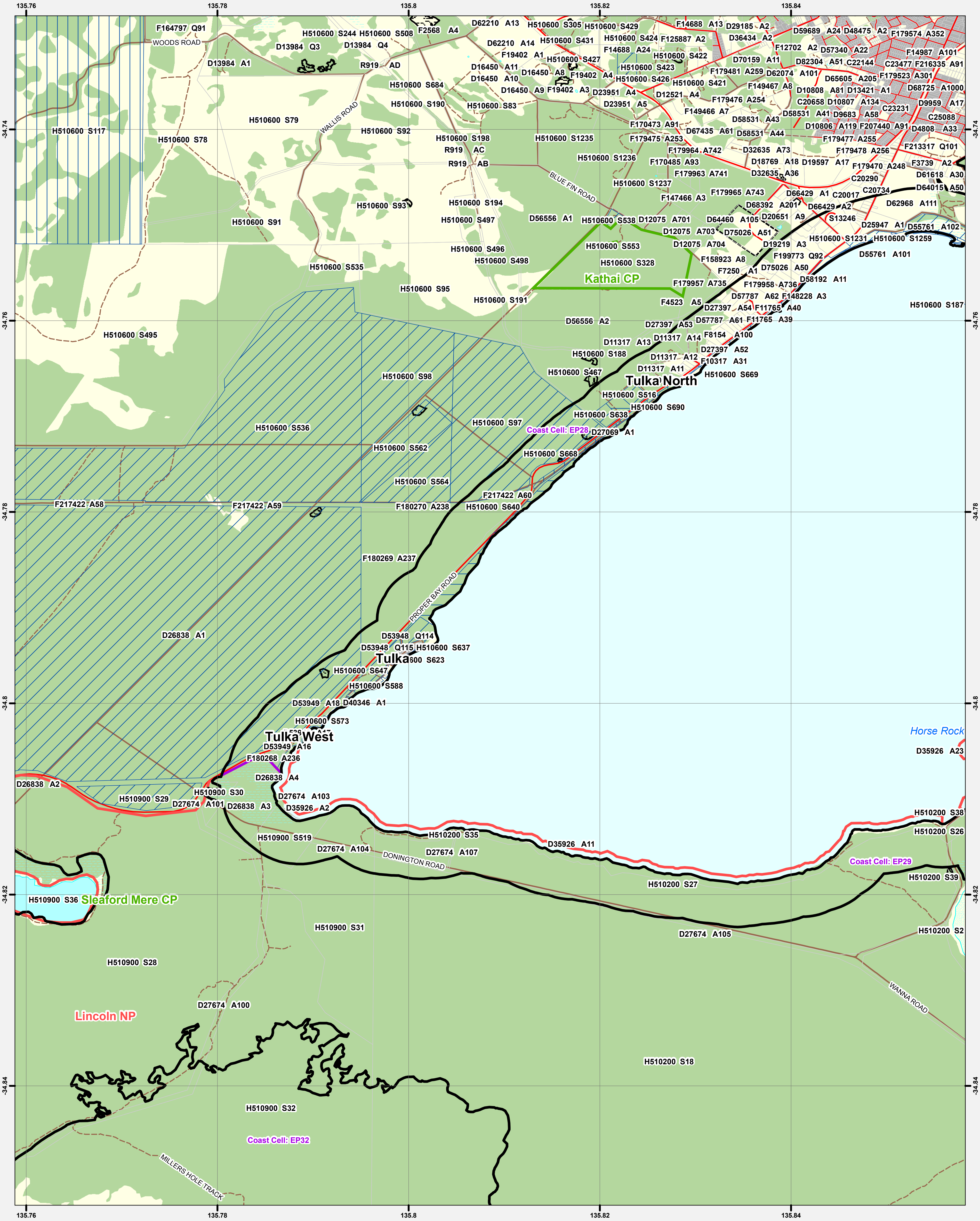
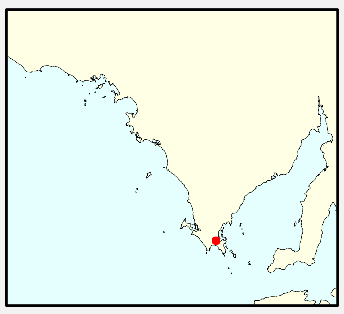
Eyre Peninsula Coastal Action Plan

Map Block 40





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Kms

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Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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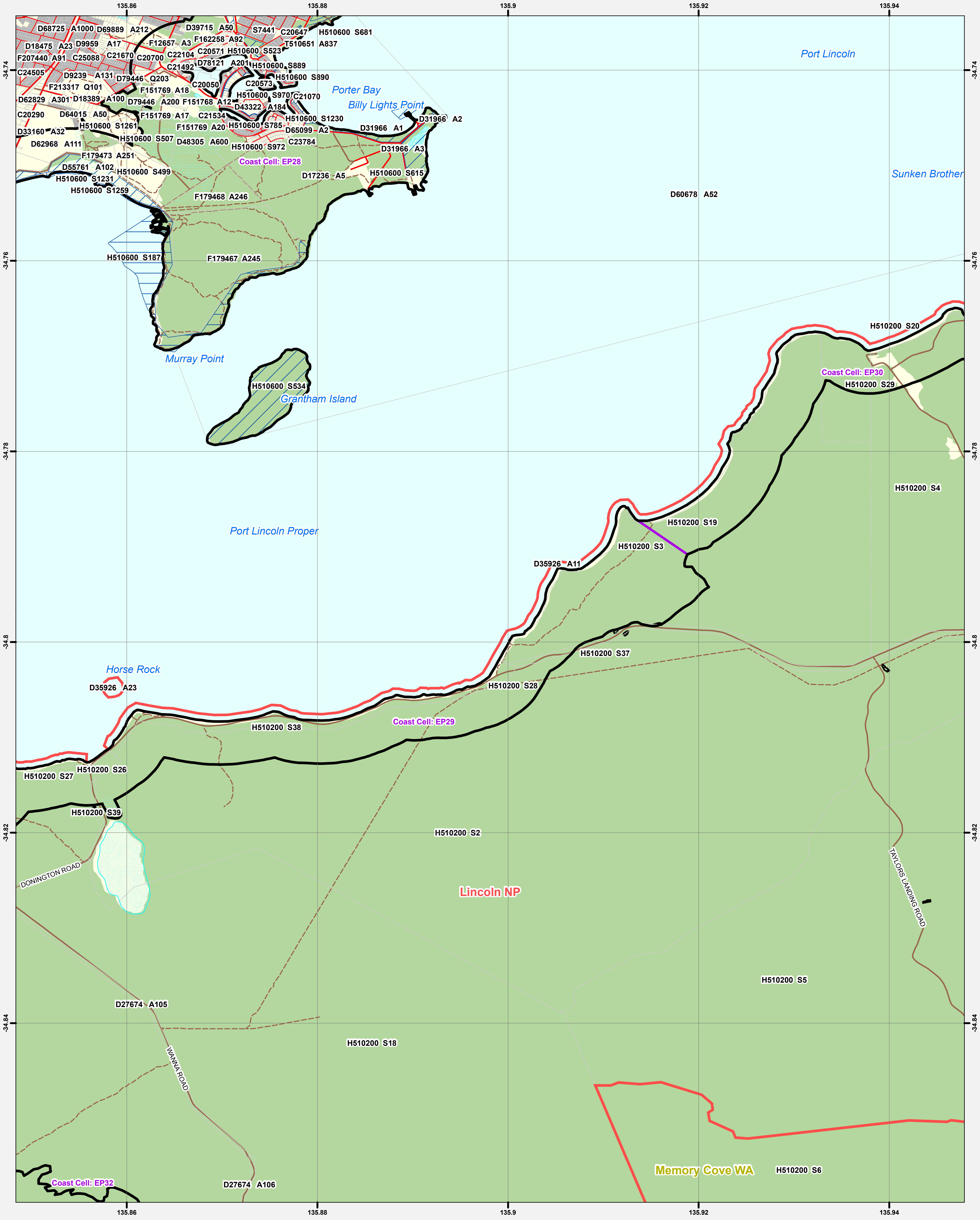
Eyre Peninsula Coastal Action Plan

Map Block 41



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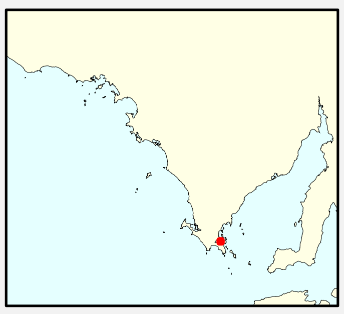

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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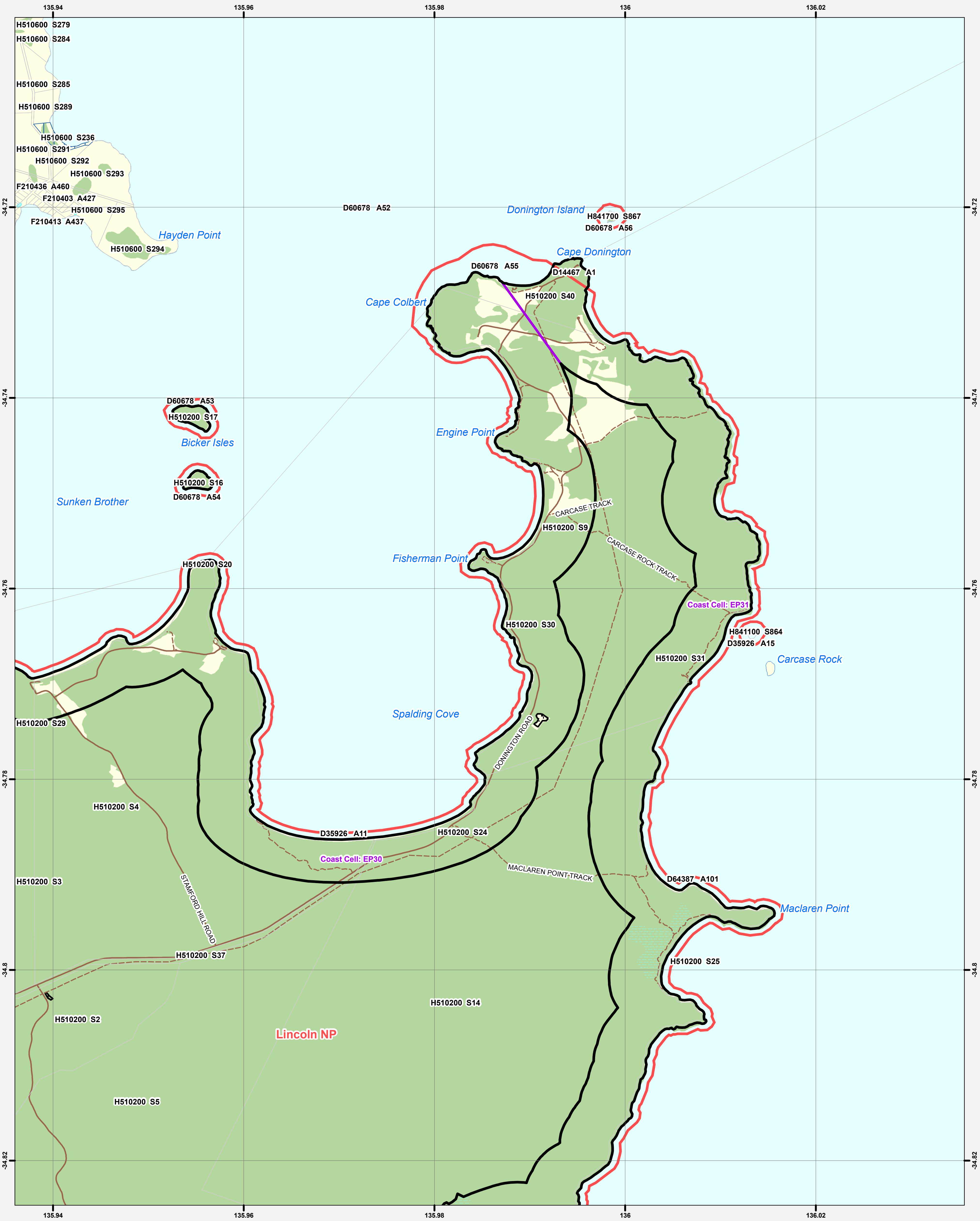
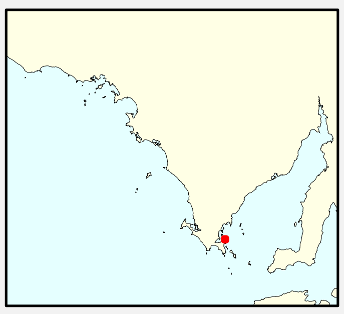
Eyre Peninsula Coastal Action Plan
Map Block 42





0 2.5
Kms

N

Navigation Marks — Light Colour: Unknown Light; CLEAR; CLEAR/RED; GREEN; ORANGE; RED; WHITE/RED; YELLOW

Roads — Road Feature Codes: Highway (divided); Sealed; Unsealed; Vehicular Track; Sealed within Builtup Area; Unsealed within Builtup Area; Under Construction

Protected Areas — Reserve Type: National Park; Conservation Park; Conservation Reserve; Wilderness Protection Area; Vegetation Heritage Agreement; Aquatic Reserves; **DCDB Parcels**

Waterbodies — Type: Lake - Perennial; Dam, Reservoir; Dam, Reservoir; Inland Water Feature; Lake - Intermittent; Lake - Mainly Dry; Land Subject to Inundation (STI); Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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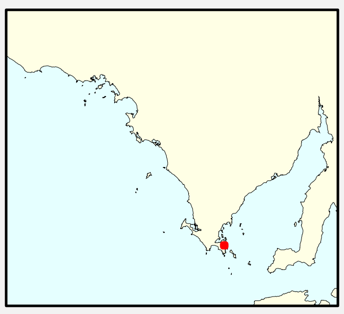
Eyre Peninsula Coastal Action Plan

Map Block 43



0 2.5
Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**
Unknown Light	Highway (divided)	National Park	Lake - Perennial
CLEAR	Sealed	Conservation Park	Dam, Reservoir
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry
WHITE/RED	Under Construction	**DCDB Parcels**	Land Subject to Inundation (STI)
YELLOW			Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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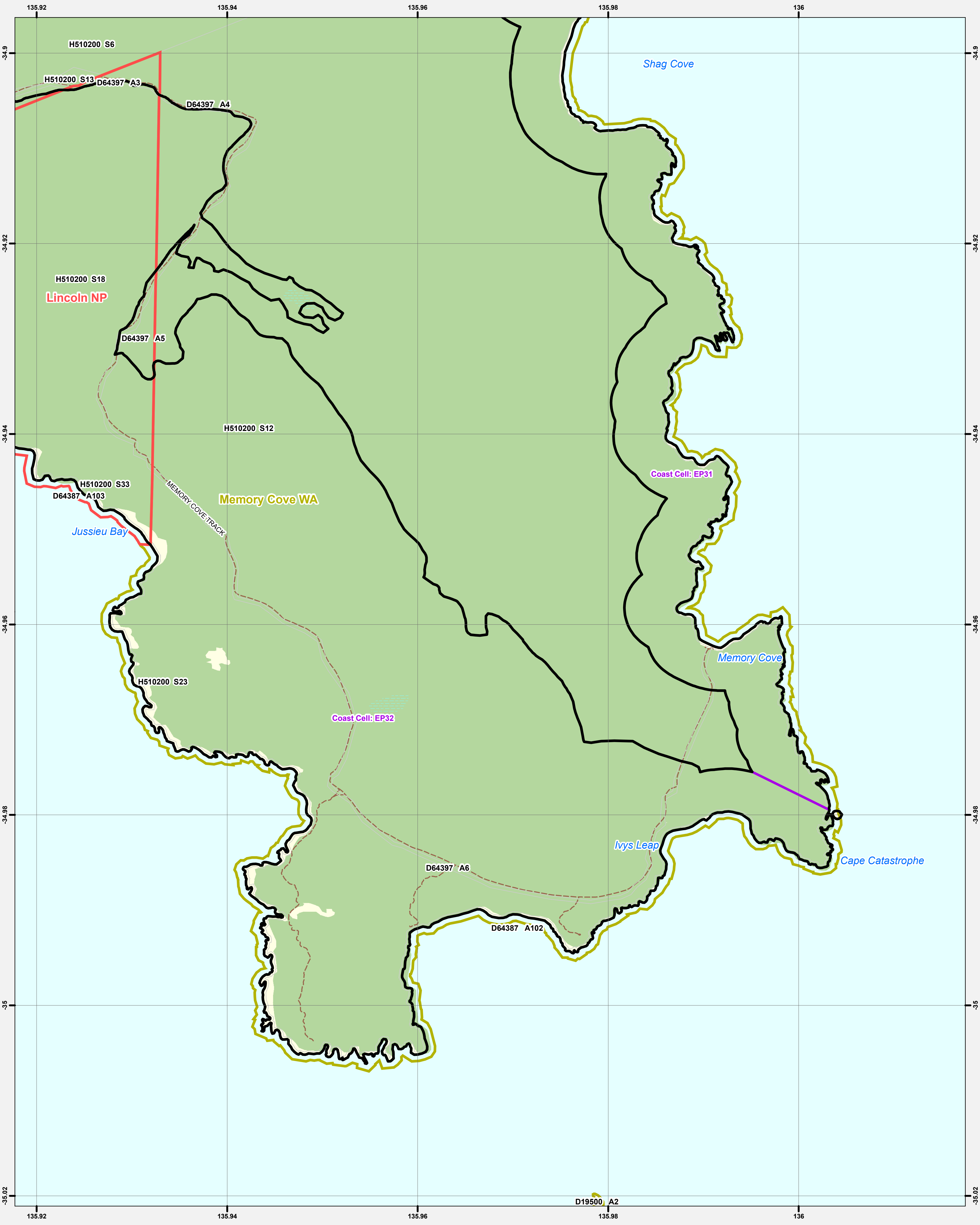
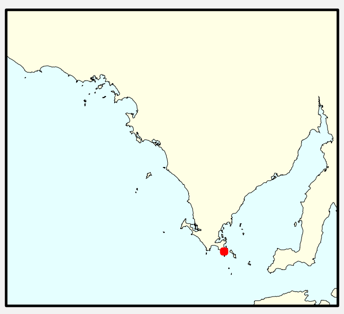
Eyre Peninsula Coastal Action Plan
Map Block 44





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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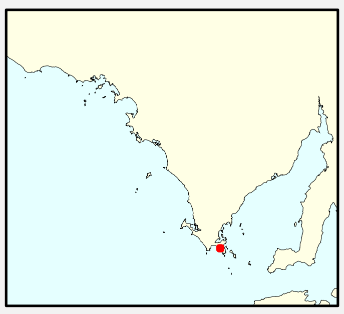
Map Block 45



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Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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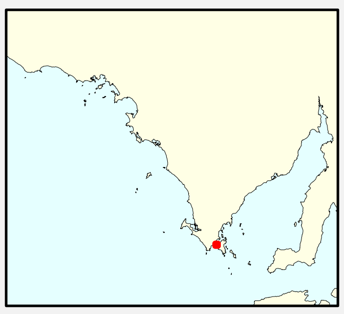
Map Block 46



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Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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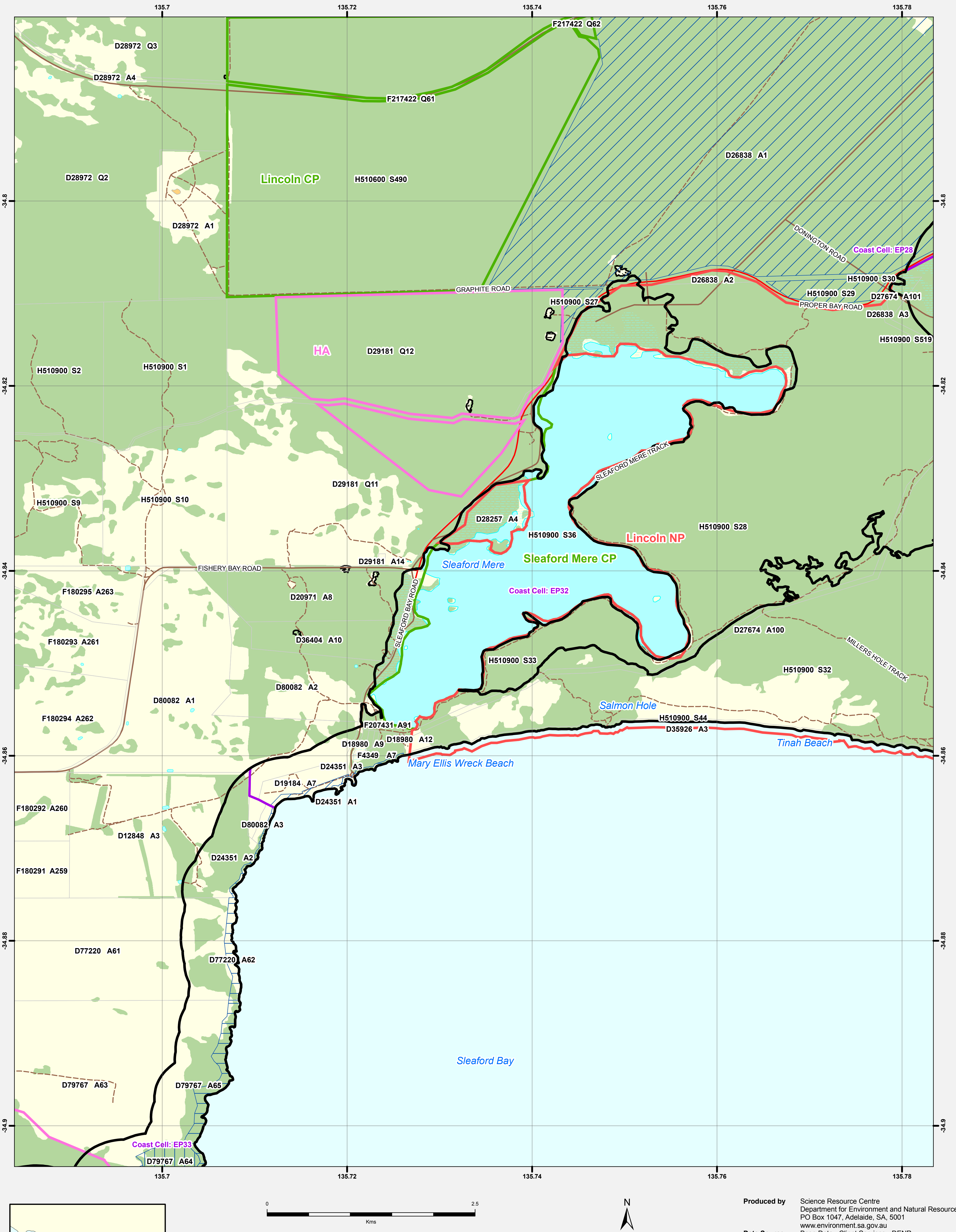
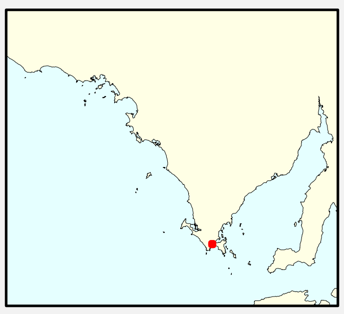
Eyre Peninsula Coastal Action Plan

Map Block 47





Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**	**Coastal Boundary**
Unknown Light	Highway (divided)	National Park	Lake - Perennial	**Coastal Cells**
CLEAR	Sealed	Conservation Park	Dam, Reservoir	**Sewerage Filtration Bed, Effluent Pond**
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	**Stockpile, Slag Heap, Storage Dump, Tailing Pond**
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	**Rubbish Dump**
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	**Quarries**
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	**Reefs**
WHITE/RED	Under Construction	**DCDB Parcels**	Land Subject to Inundation (STI)	**Built Up Area**
YELLOW			Land Subject to Flooding (STF)	**Native Vegetation**

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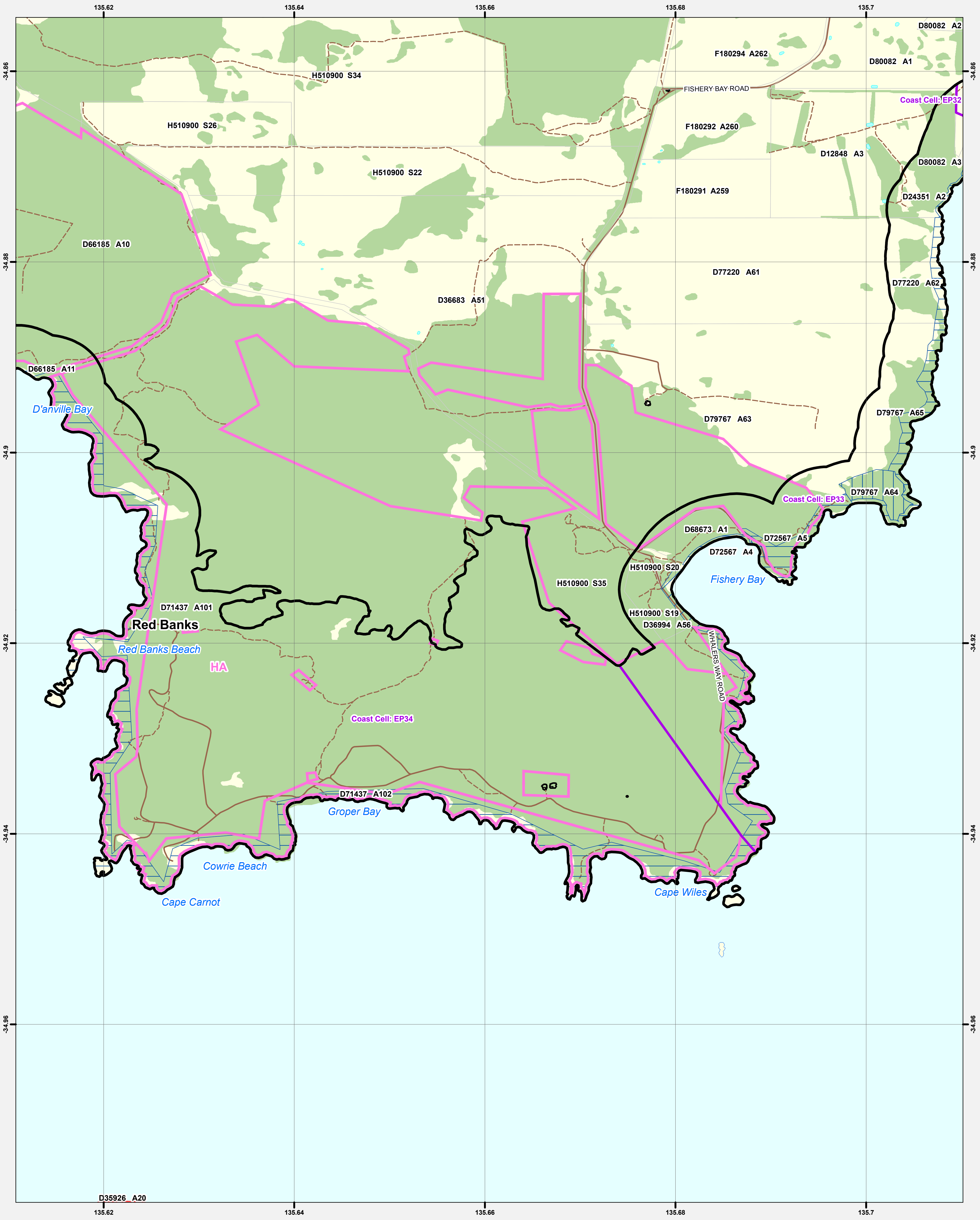
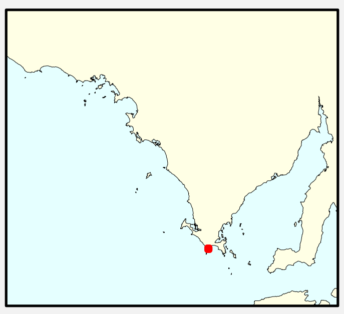
Eyre Peninsula Coastal Action Plan

Map Block 48





Navigation Marks

Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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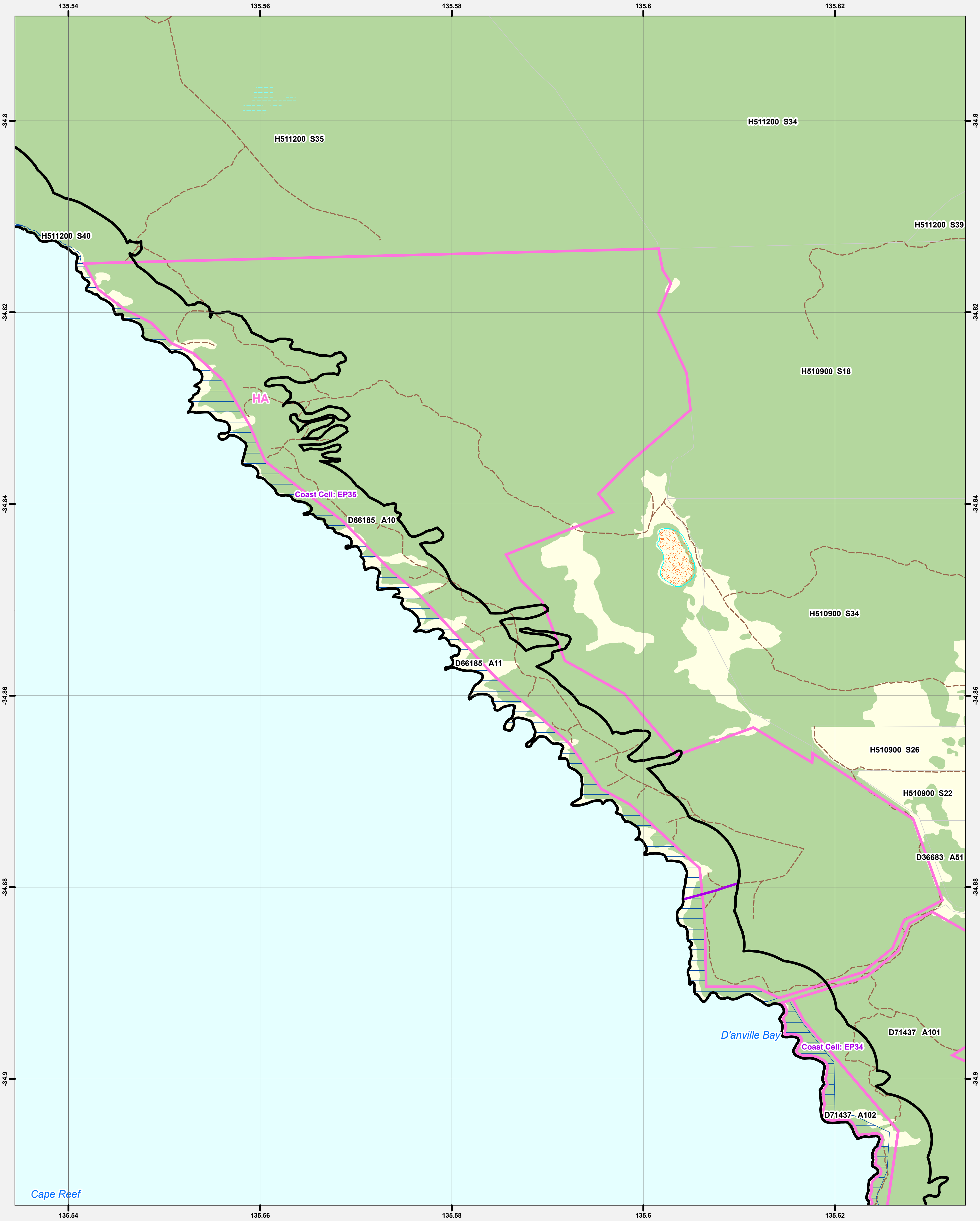
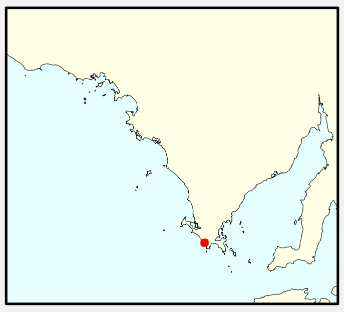
Eyre Peninsula Coastal Action Plan

Map Block 49





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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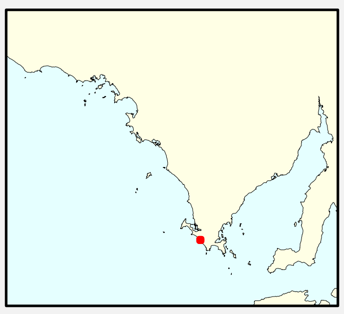
Eyre Peninsula Coastal Action Plan
Map Block 50



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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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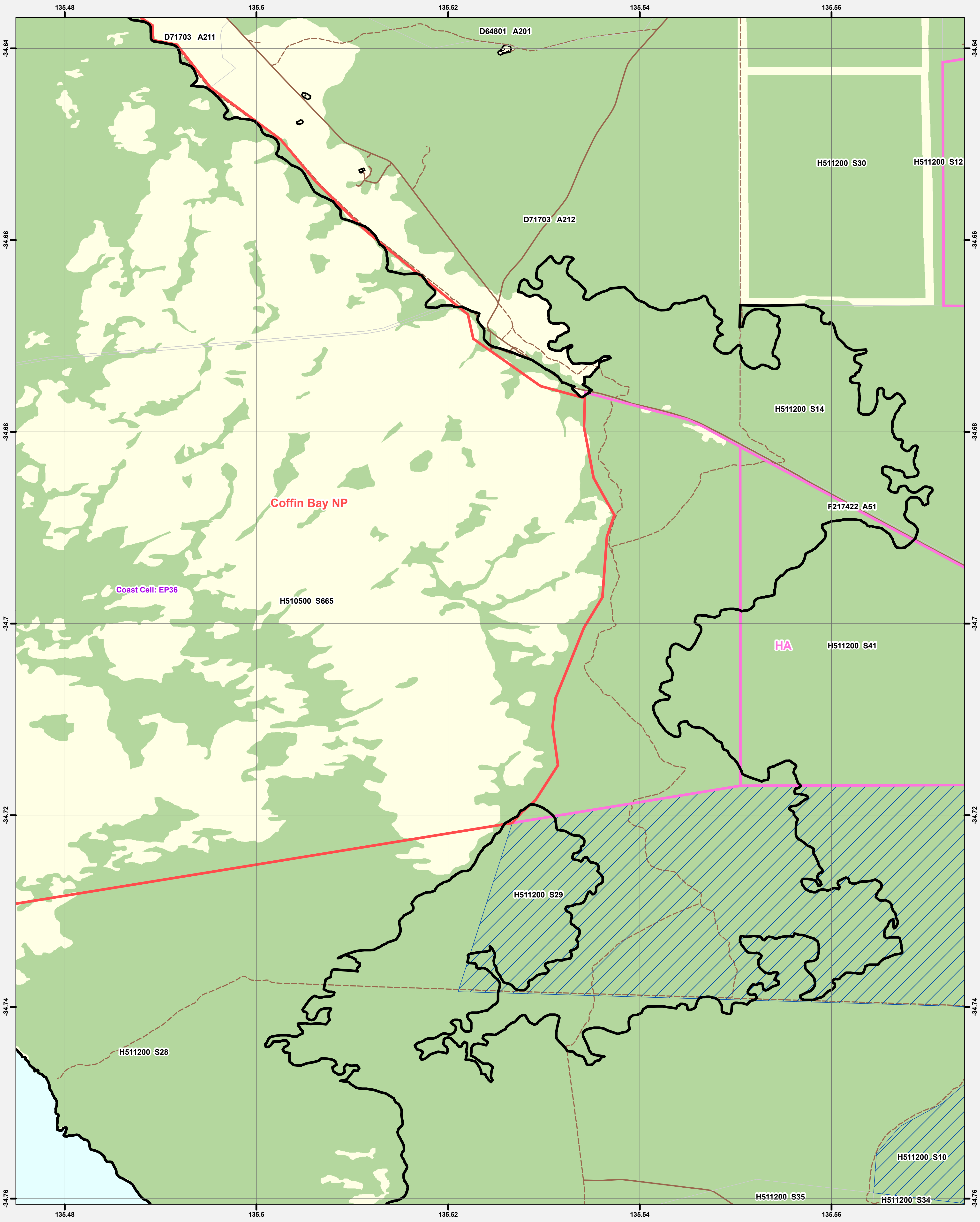
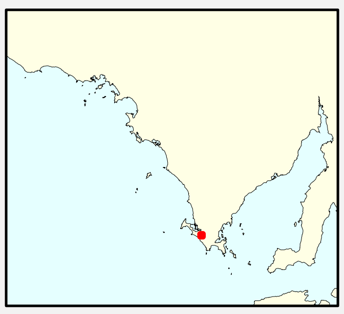
Map Block 51





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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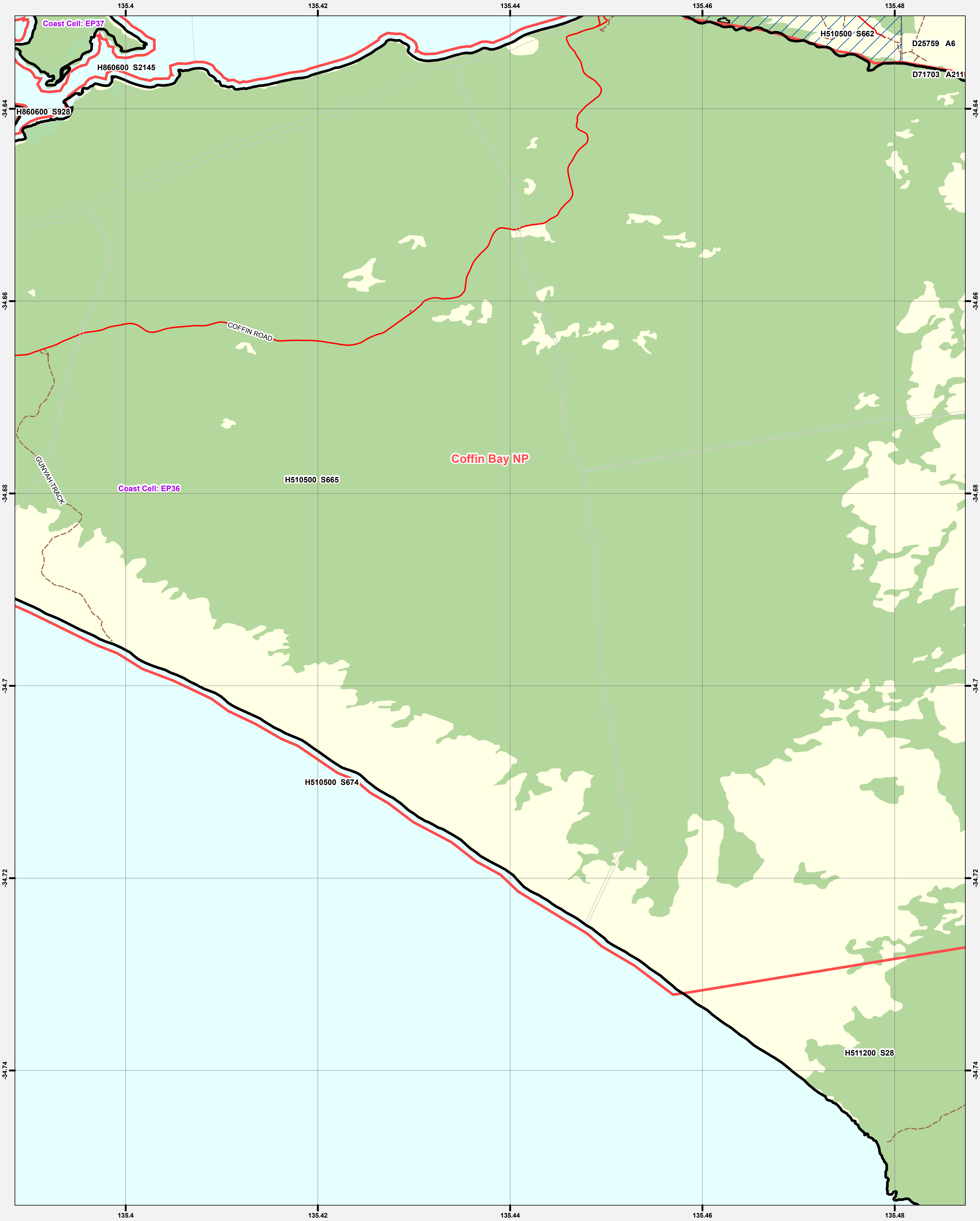
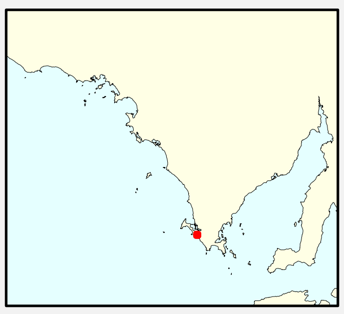
Map Block 52





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Kms

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Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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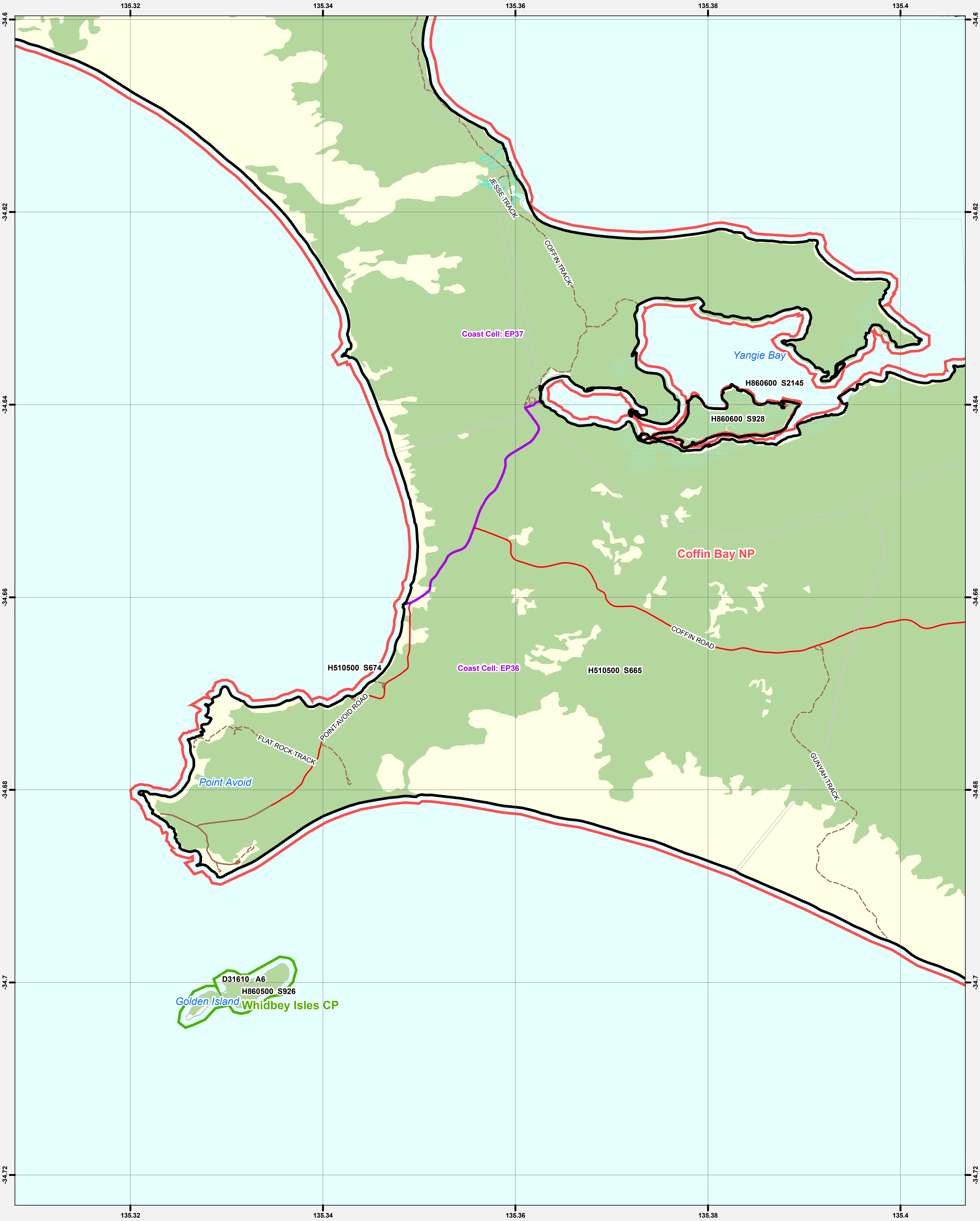
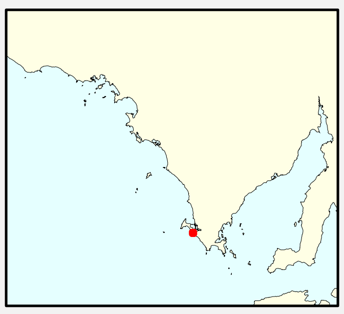
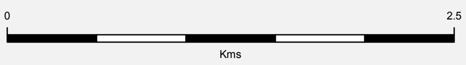
Map Block 53







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Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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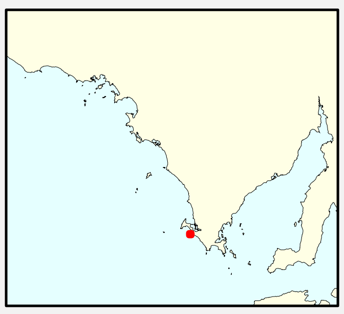
Map Block 54



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N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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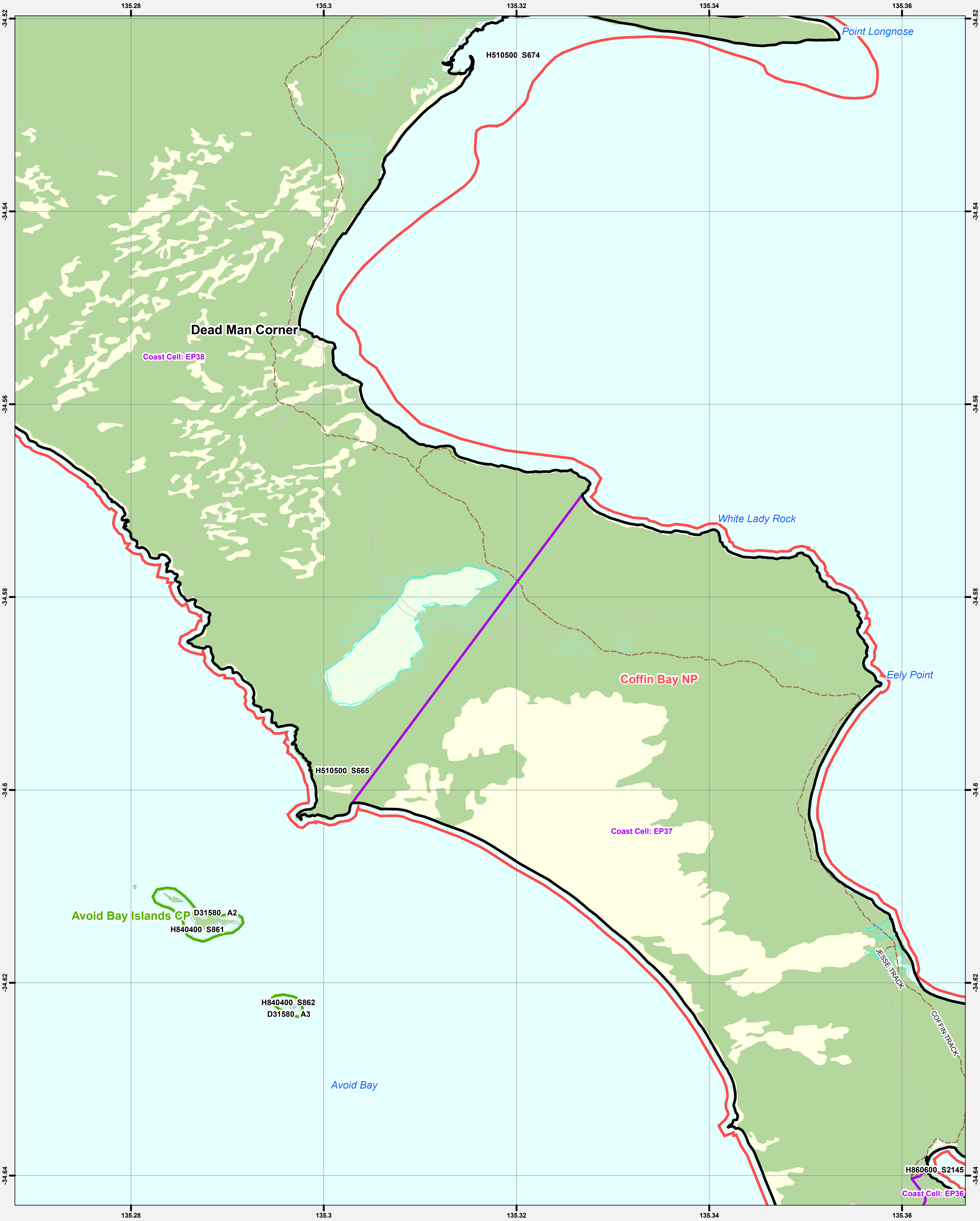
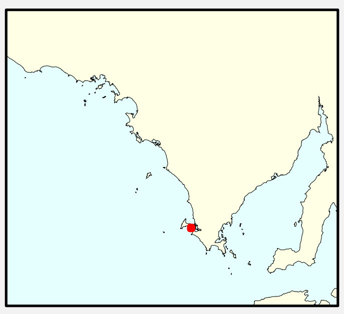
Eyre Peninsula Coastal Action Plan

Map Block 55





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Kms

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Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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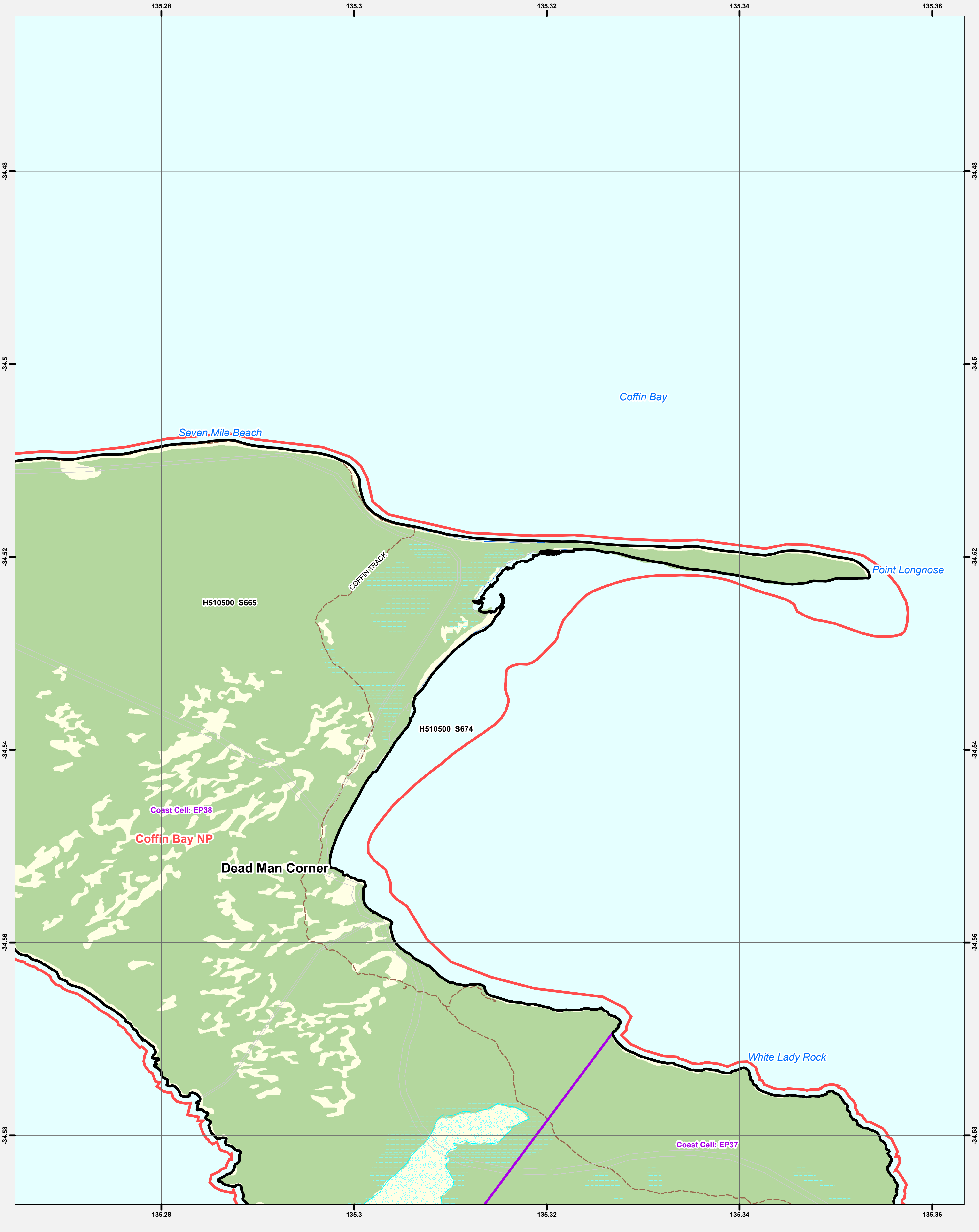
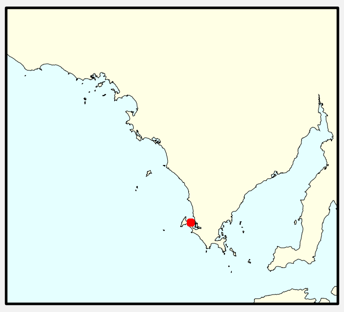
Map Block 56





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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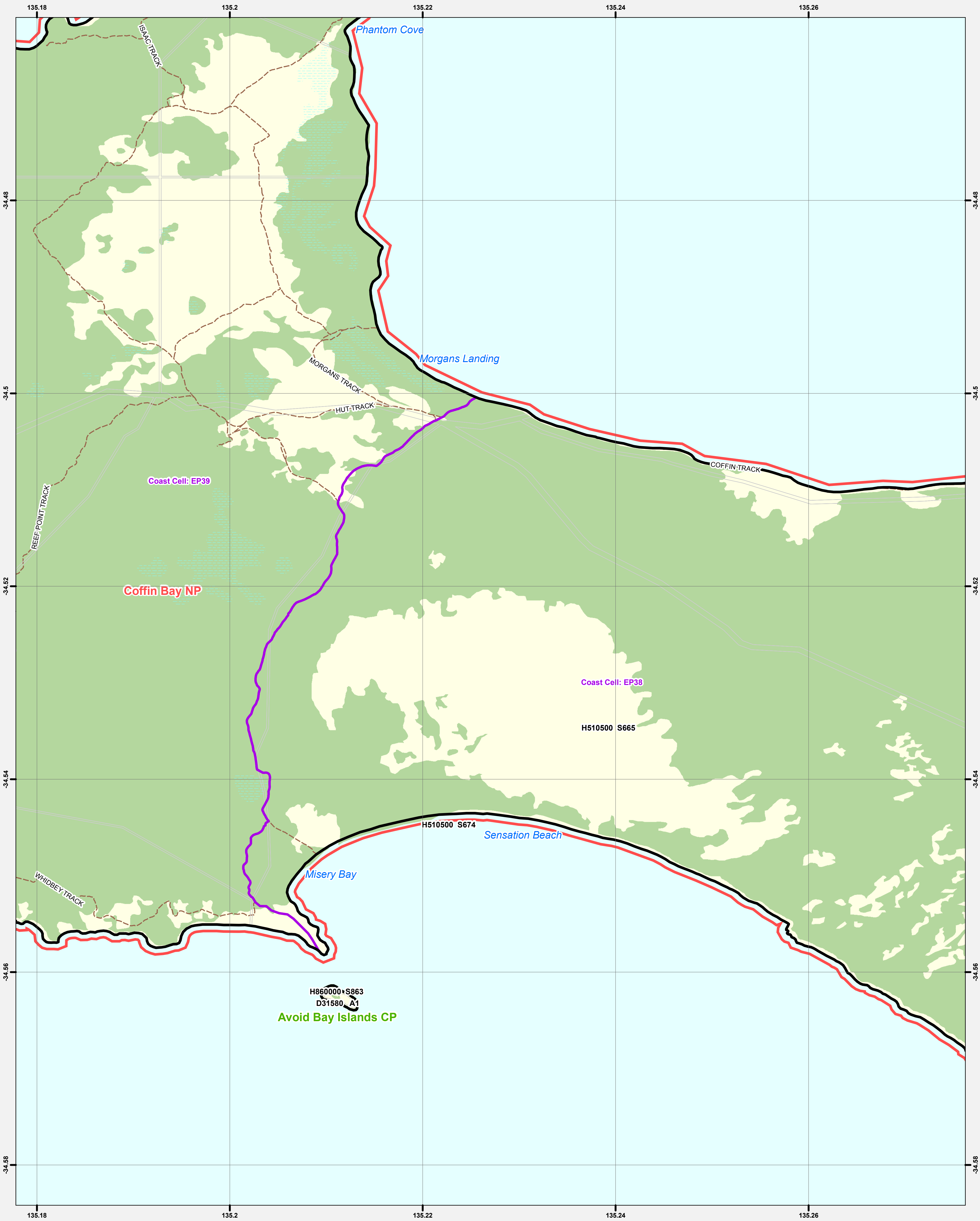
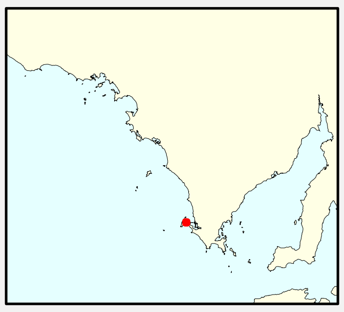
Map Block 57





0 2.5
Kms

N

Navigation Marks

Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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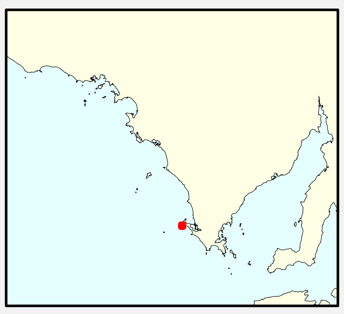
Map Block 58



Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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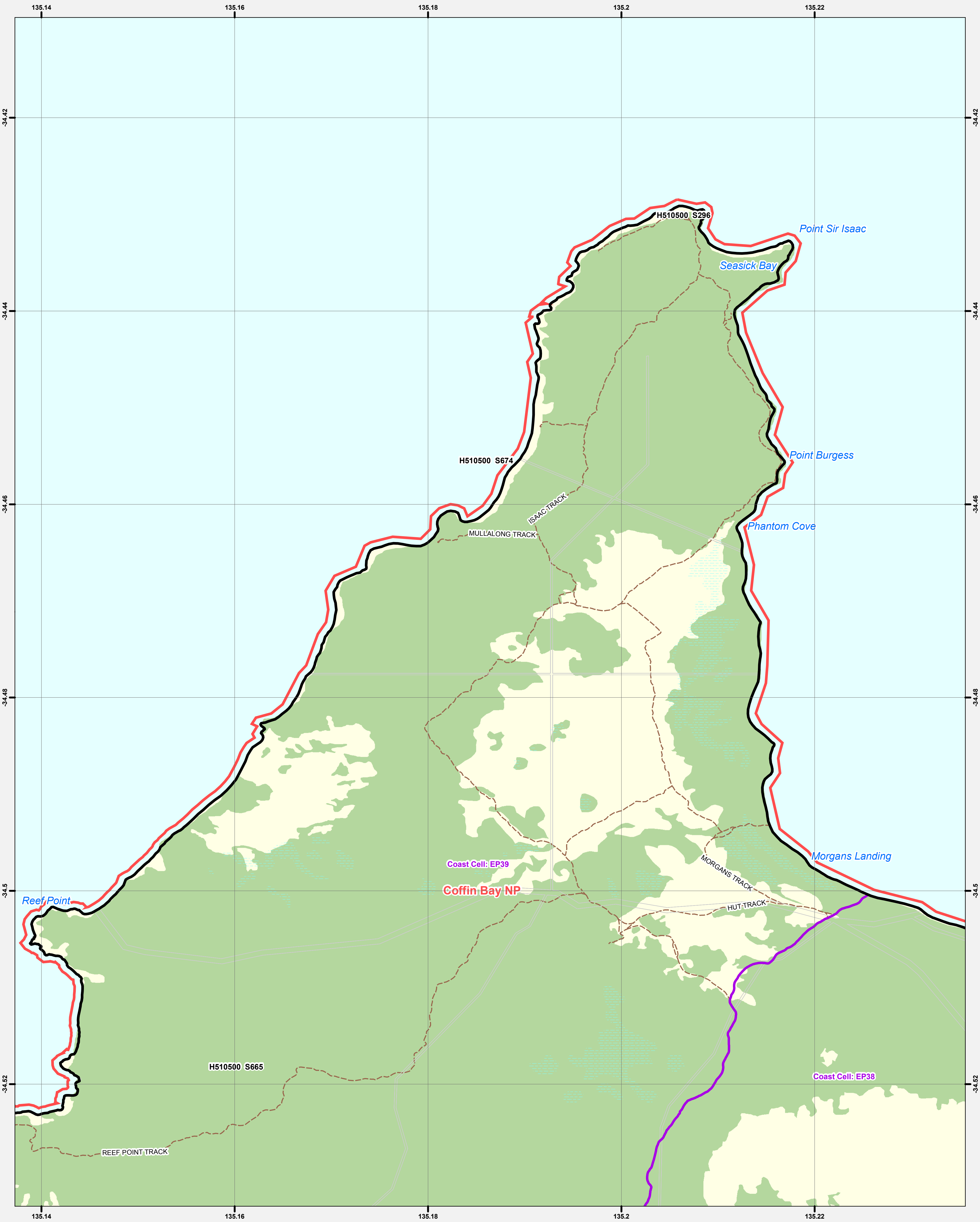
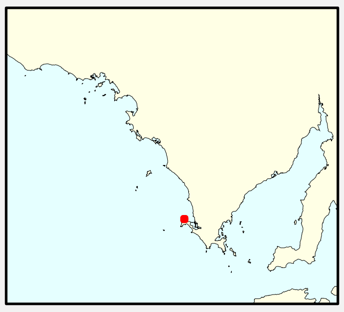
Eyre Peninsula Coastal Action Plan
Map Block 59





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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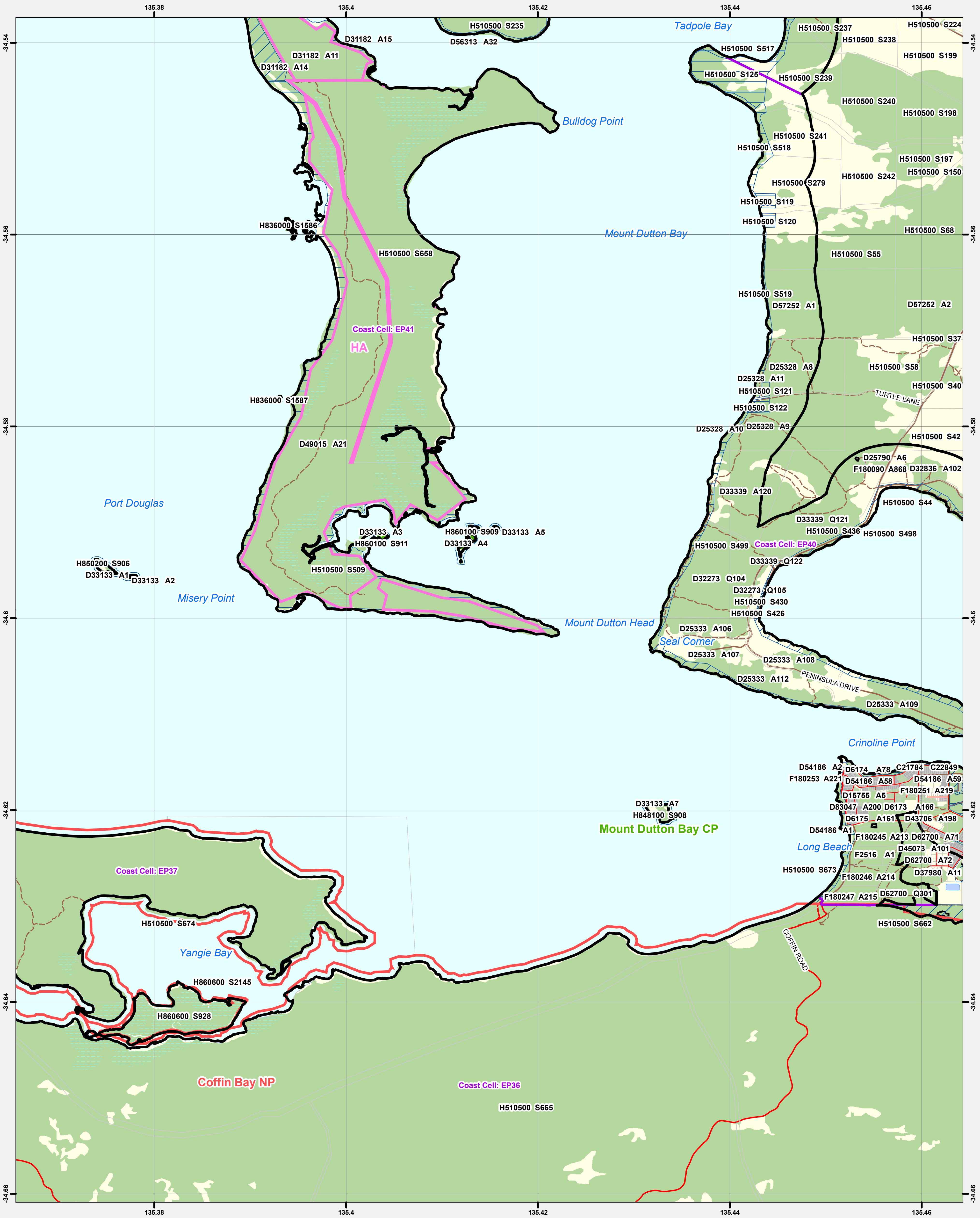
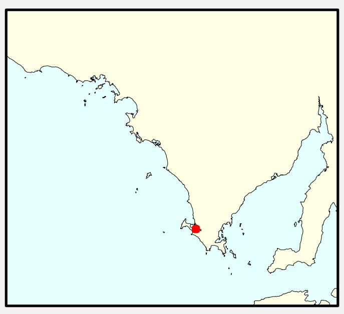
Eyre Peninsula Coastal Action Plan

Map Block 60





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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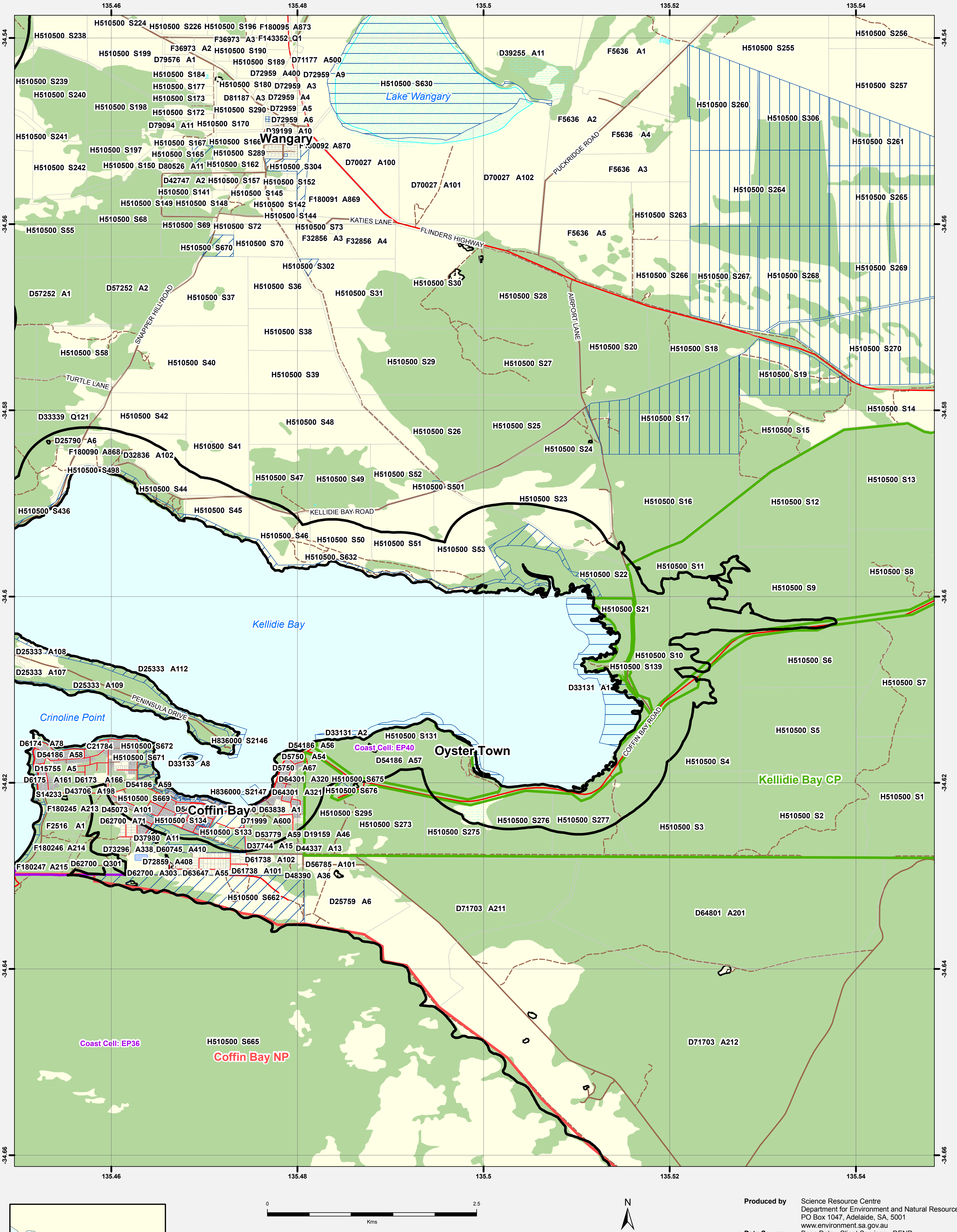
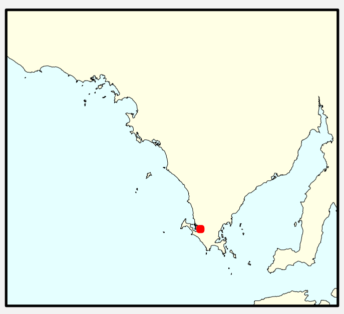
Eyre Peninsula Coastal Action Plan
Map Block 61





Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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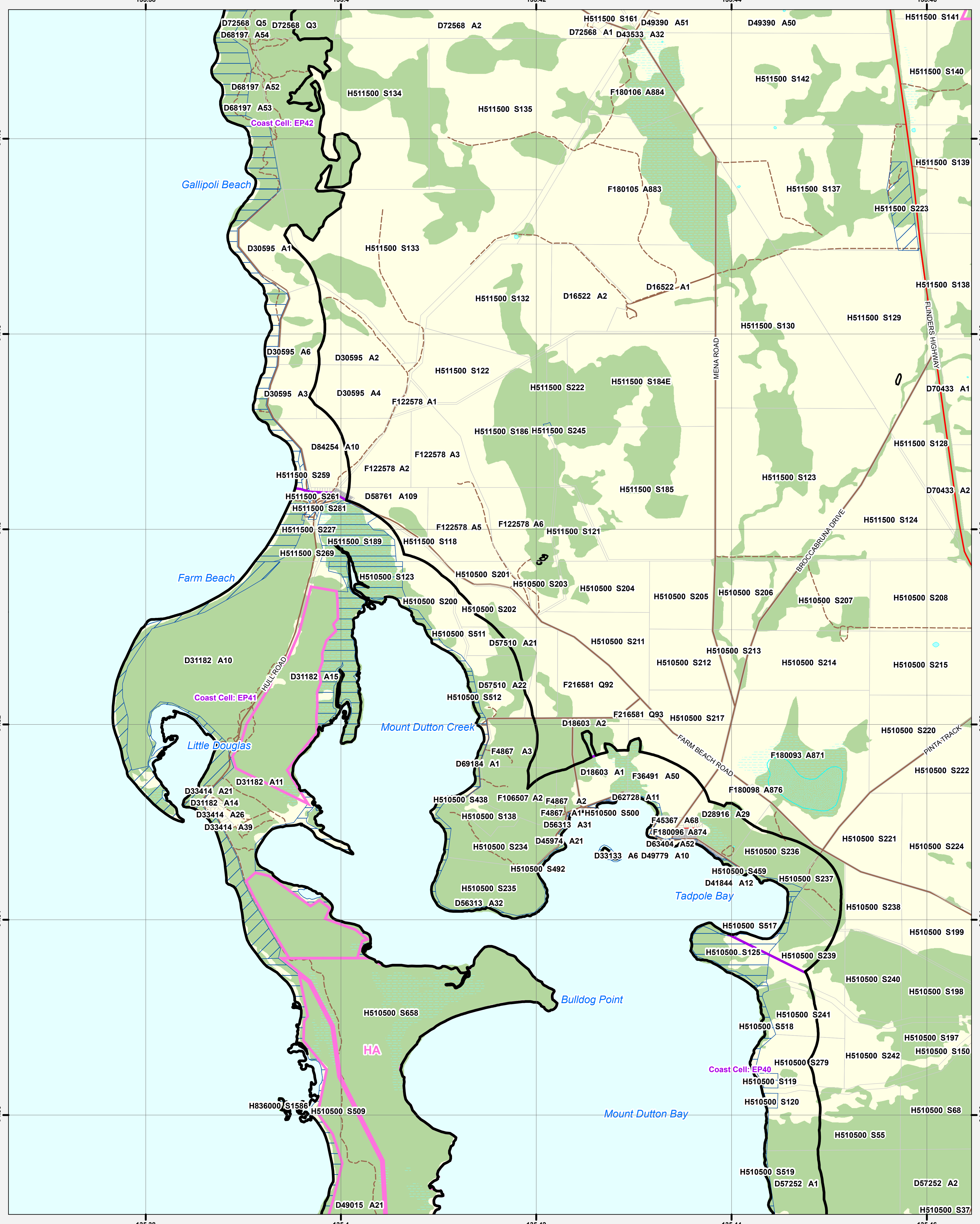
Eyre Peninsula Coastal Action Plan

Map Block 62



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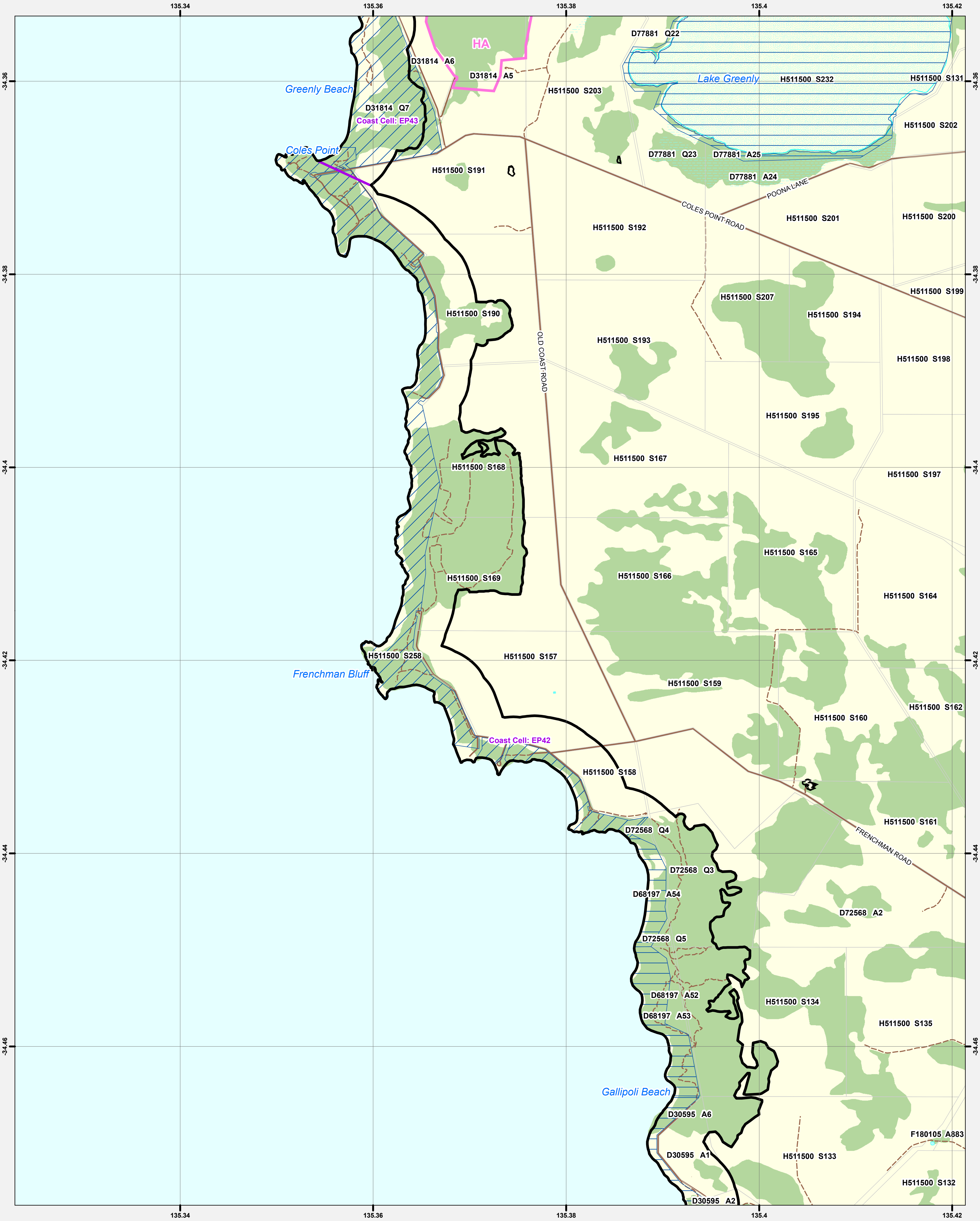
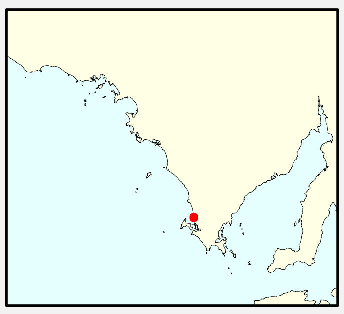
Eyre Peninsula Coastal Action Plan
Map Block 63





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Kms

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Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**	**Coastal Boundary**
Unknown Light	Highway (divided)	National Park	Lake - Perennial	**Coastal Cells**
CLEAR	Sealed	Conservation Park	Dam, Reservoir	**Sewerage Filtration Bed, Effluent Pond**
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	**Stockpile, Slag Heap, Storage Dump, Tailing Pond**
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	**Rubbish Dump**
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	**Quarries**
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	**Reefs**
WHITE/RED	Under Construction	**DCDB Parcels**	Land Subject to Inundation (STI)	**Built Up Area**
YELLOW			Land Subject to Flooding (STF)	**Native Vegetation**

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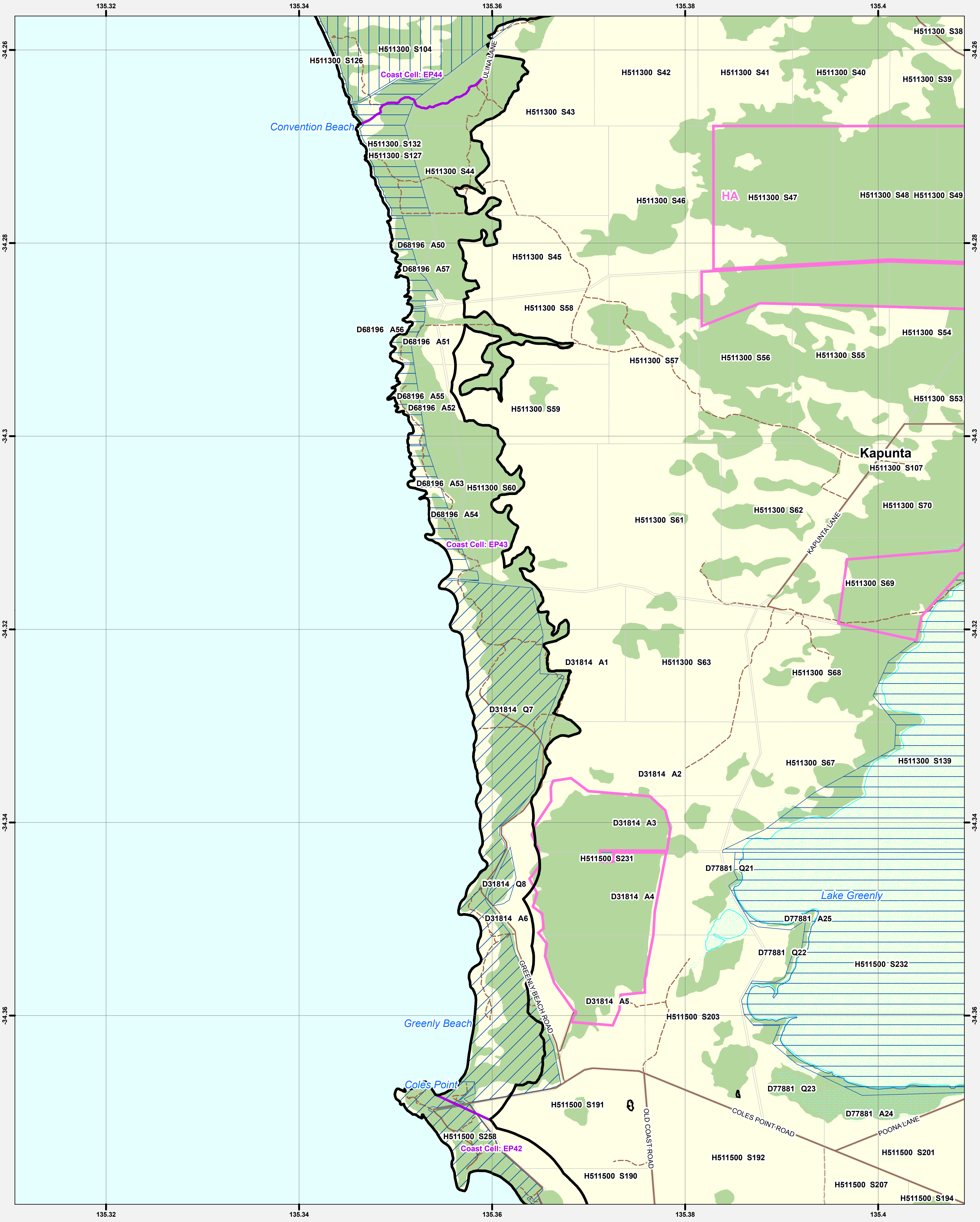
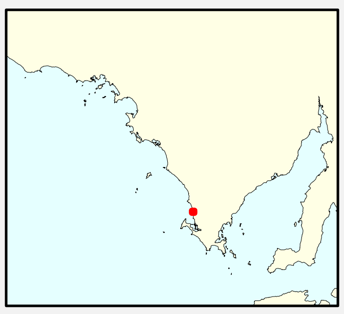
Eyre Peninsula Coastal Action Plan

Map Block 64





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Kms

N

Navigation Marks

Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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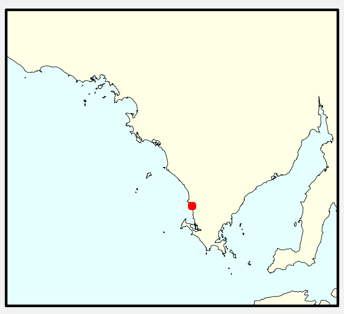
Eyre Peninsula Coastal Action Plan
Map Block 65



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N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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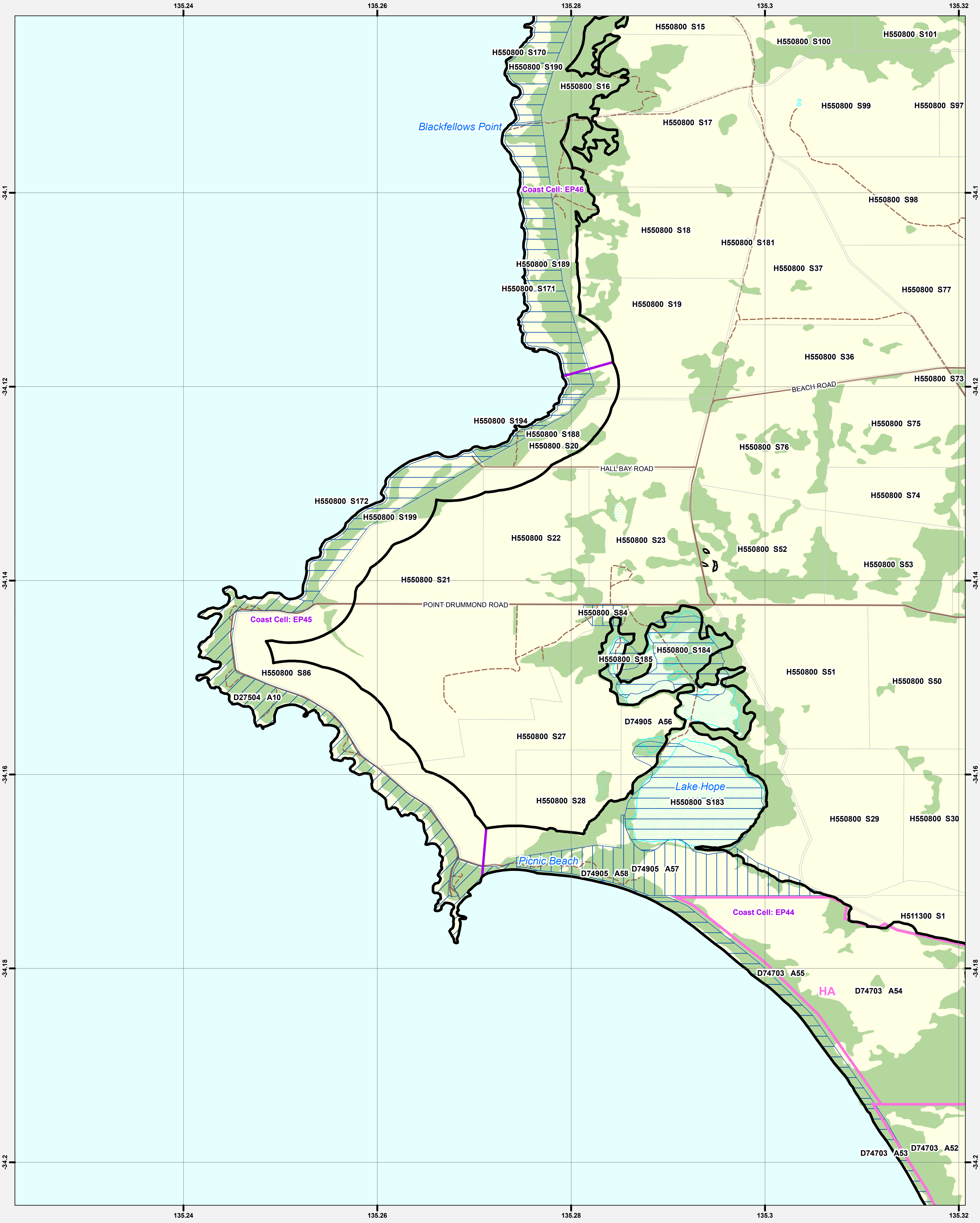
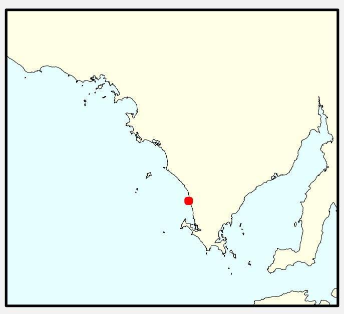
Eyre Peninsula Coastal Action Plan

Map Block 66





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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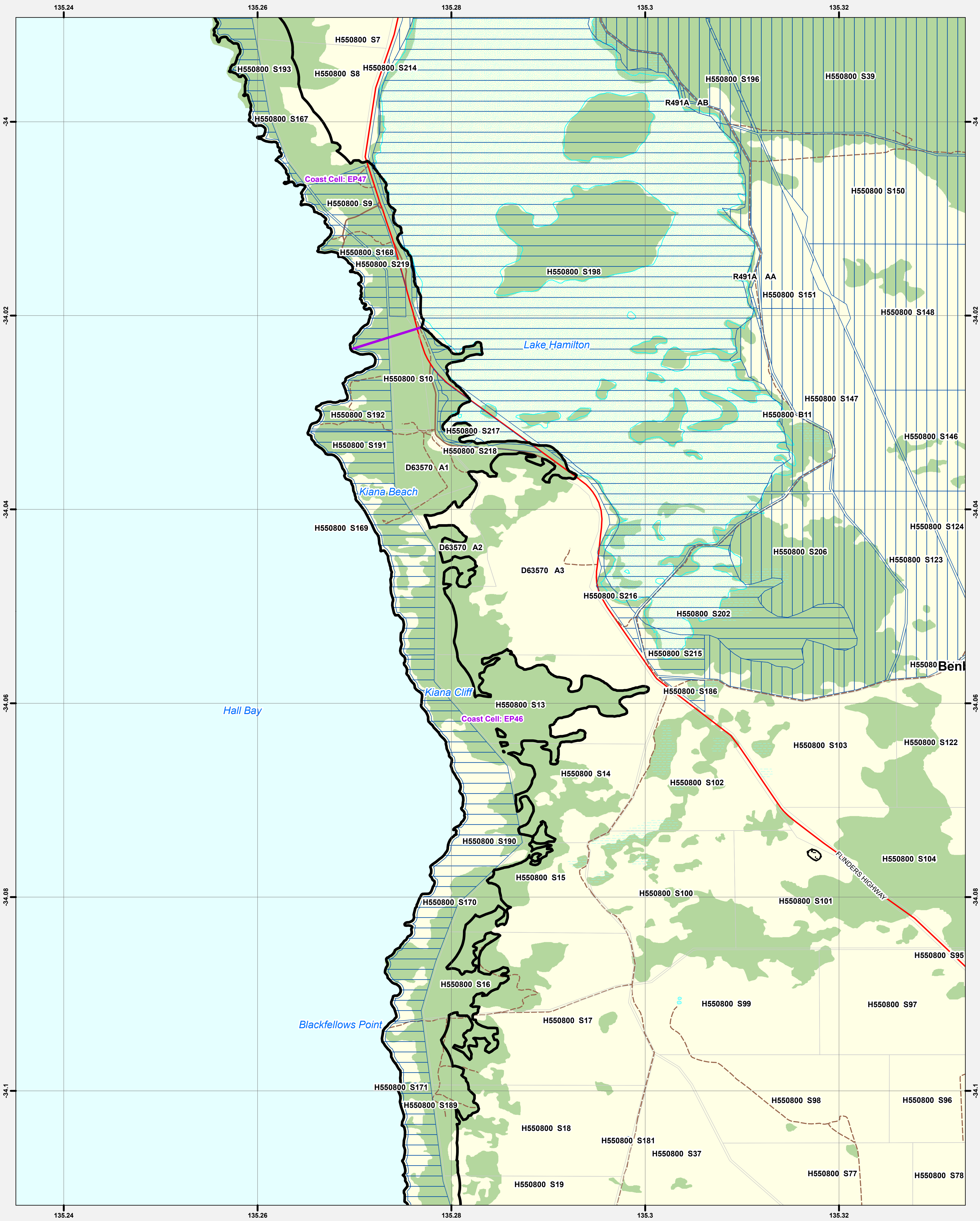
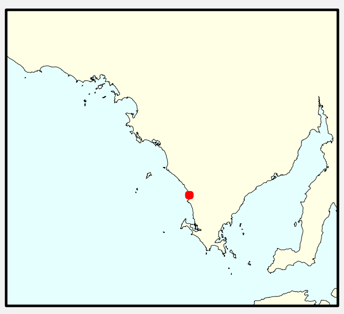
Map Block 67





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Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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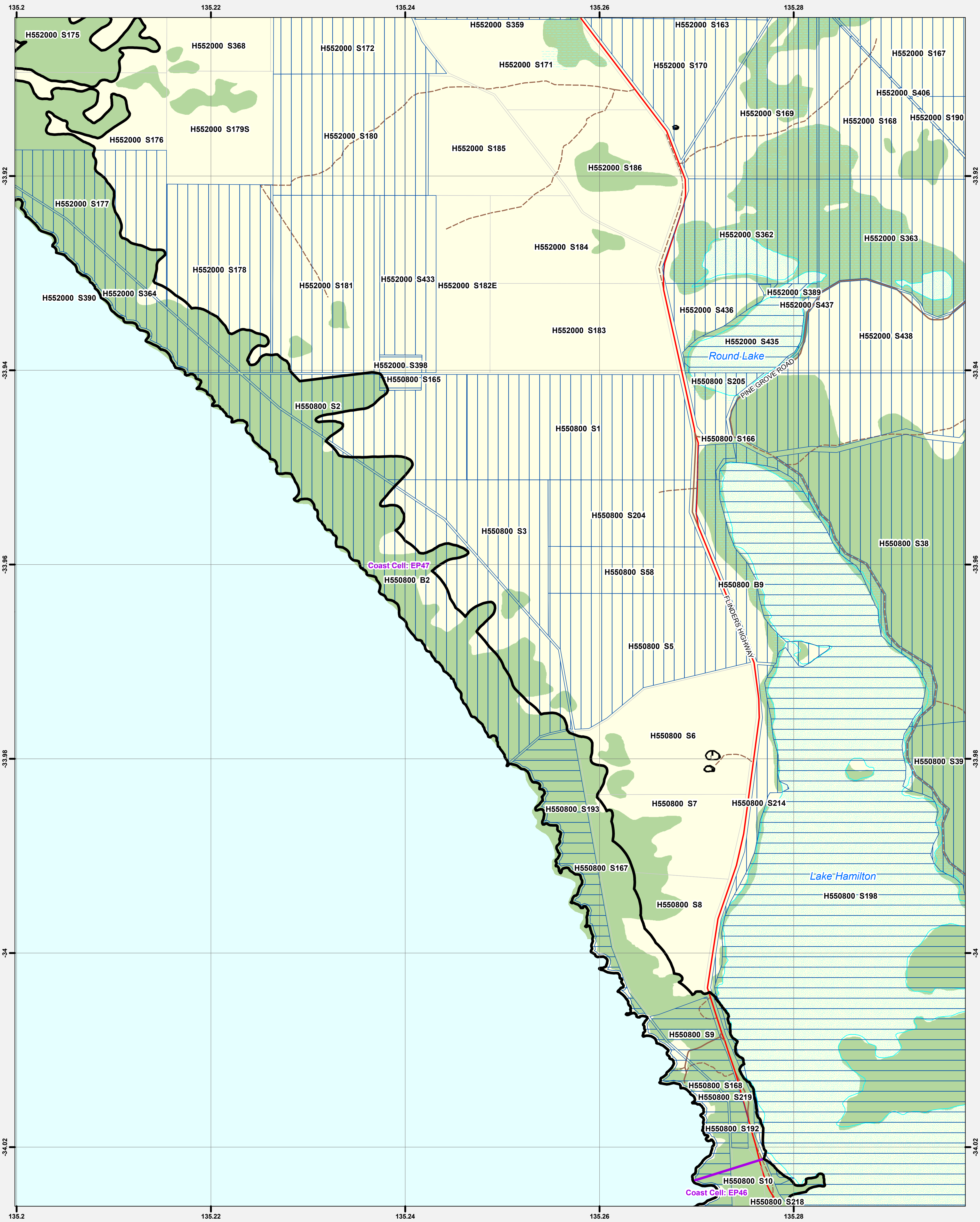
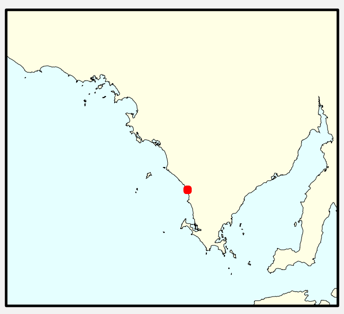
Map Block 68





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Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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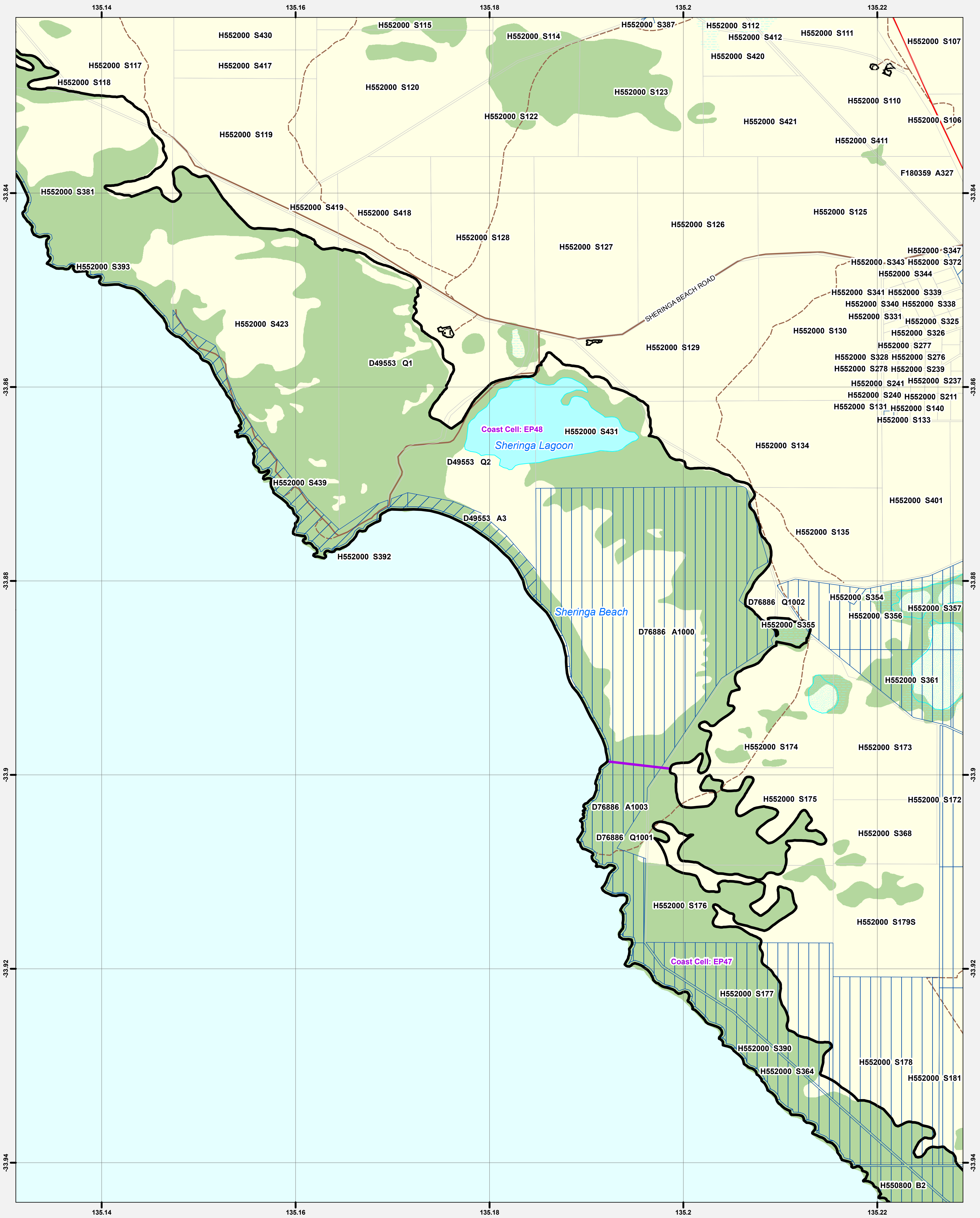
Map Block 69



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Kms
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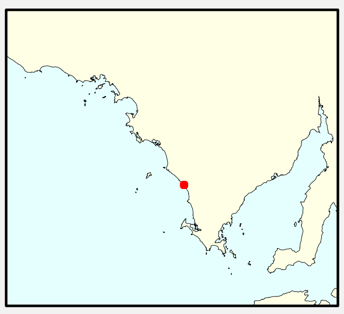

Navigation Marks Light Colour	Roads Road Feature Codes	Protected Areas Reserve Type	Waterbodies Type	
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Boundary
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Coastal Cells
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Stockpile, Slag Heap, Storage Dump, Tailing Pond
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Rubbish Dump
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Quarries
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Reefs
YELLOW			Land Subject to Flooding (STF)	Built Up Area
				Native Vegetation

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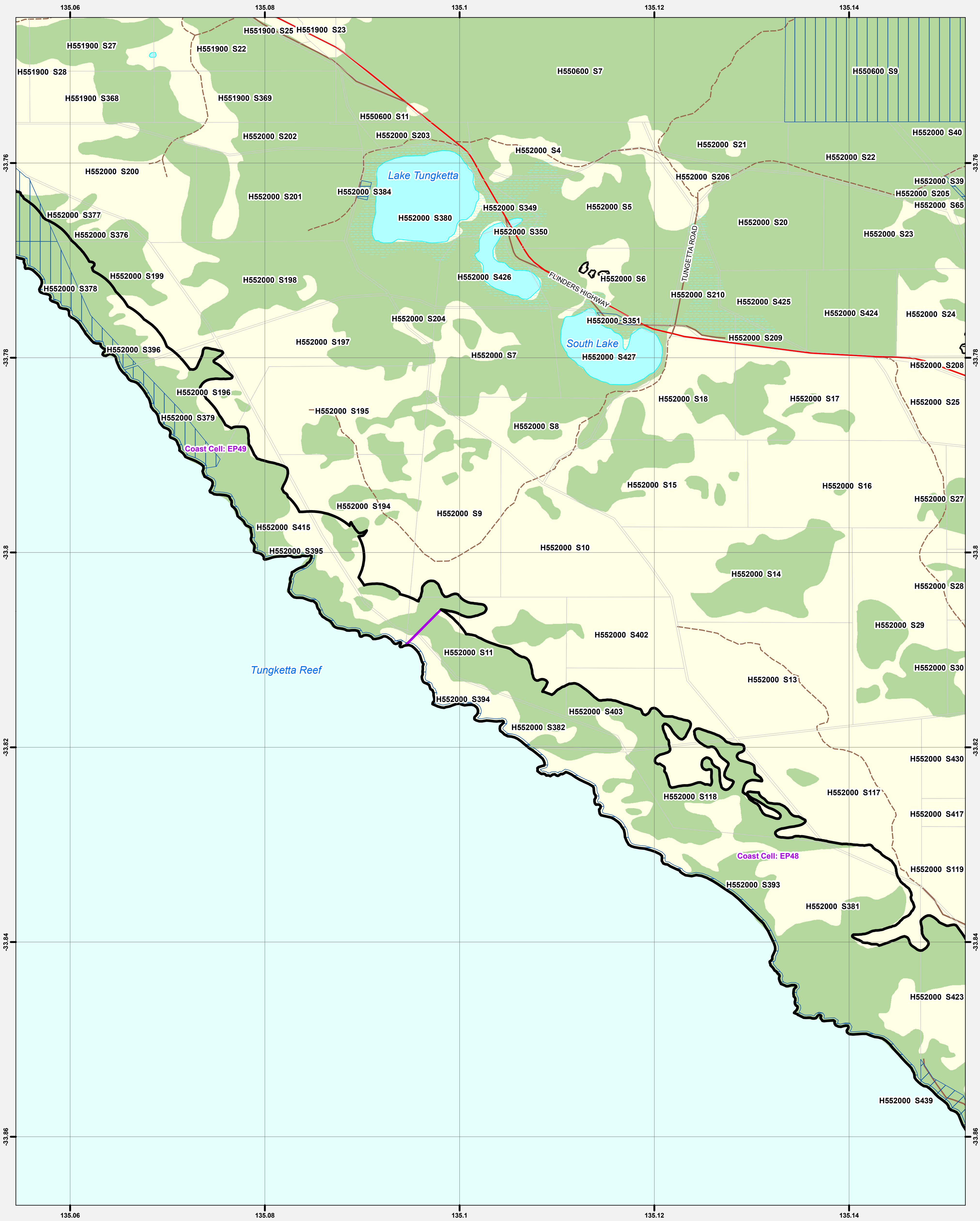
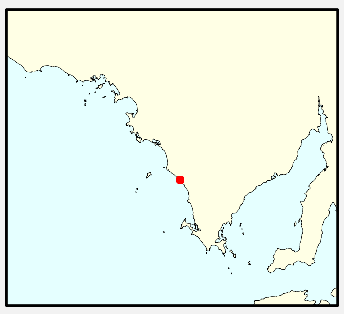
Eyre Peninsula Coastal Action Plan

Map Block 70





Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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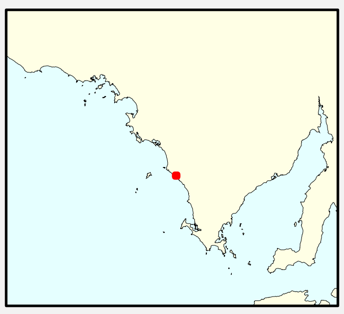
Eyre Peninsula Coastal Action Plan

Map Block 71



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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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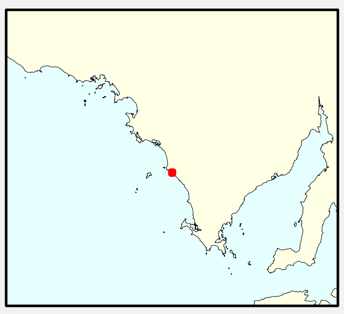
Eyre Peninsula Coastal Action Plan
Map Block 72



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Kms

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Navigation Marks
Light Colour
- Unknown Light
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- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
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- Rubbish Dump
- Quarries
- Reefs
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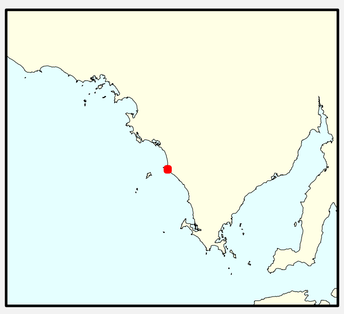
Eyre Peninsula Coastal Action Plan

Map Block 73



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Kms

N

Navigation Marks
Light Colour
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- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
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- YELLOW

Roads
Road Feature Codes
- Highway (divided)
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- Sealed within Builtup Area
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Protected Areas
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- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
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- Dam, Reservoir
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- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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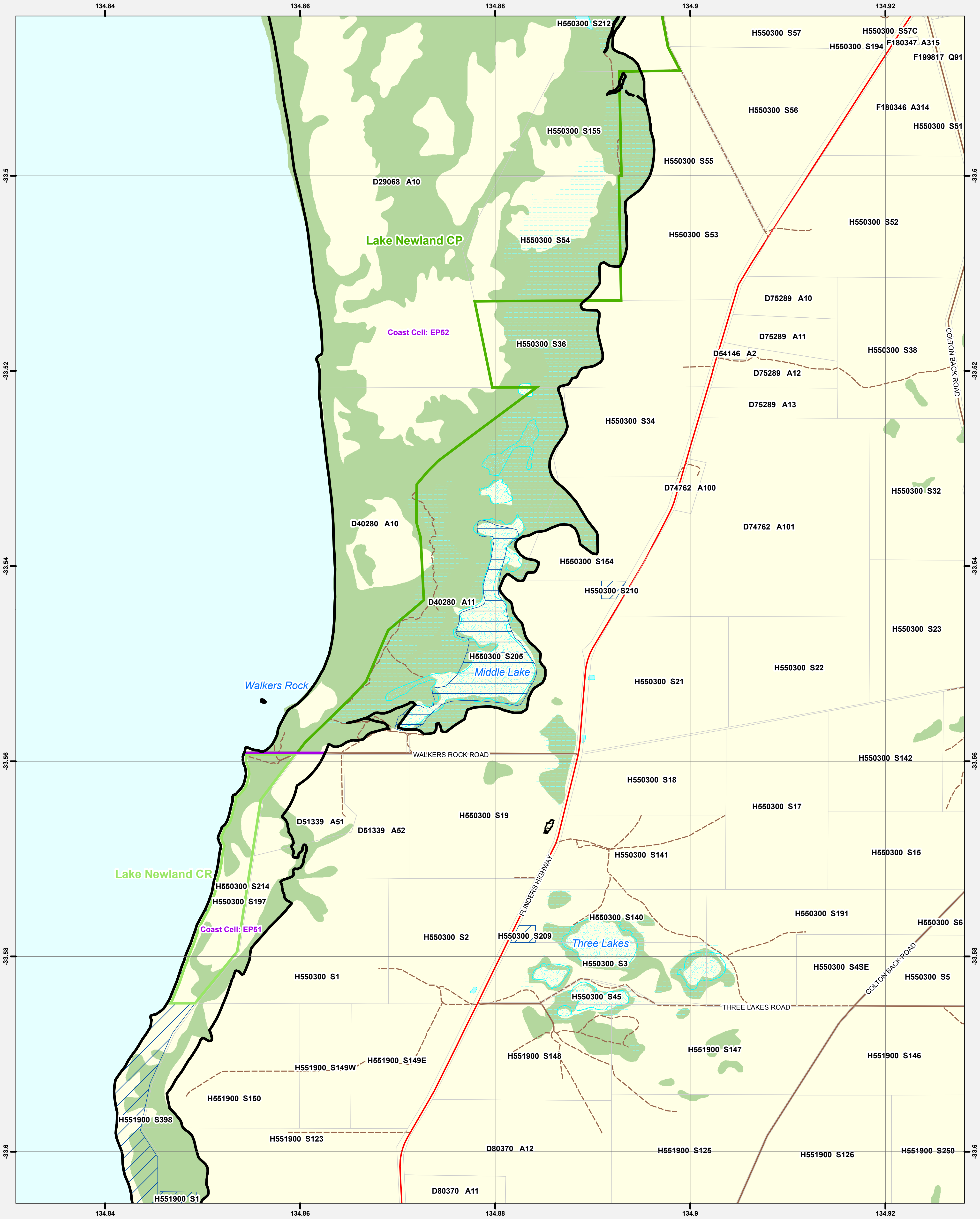
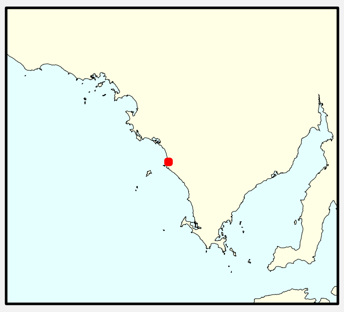
Datum	Geocentric Datum of Australia, 1994

Eyre Peninsula Coastal Action Plan

Map Block 74





0 2.5
Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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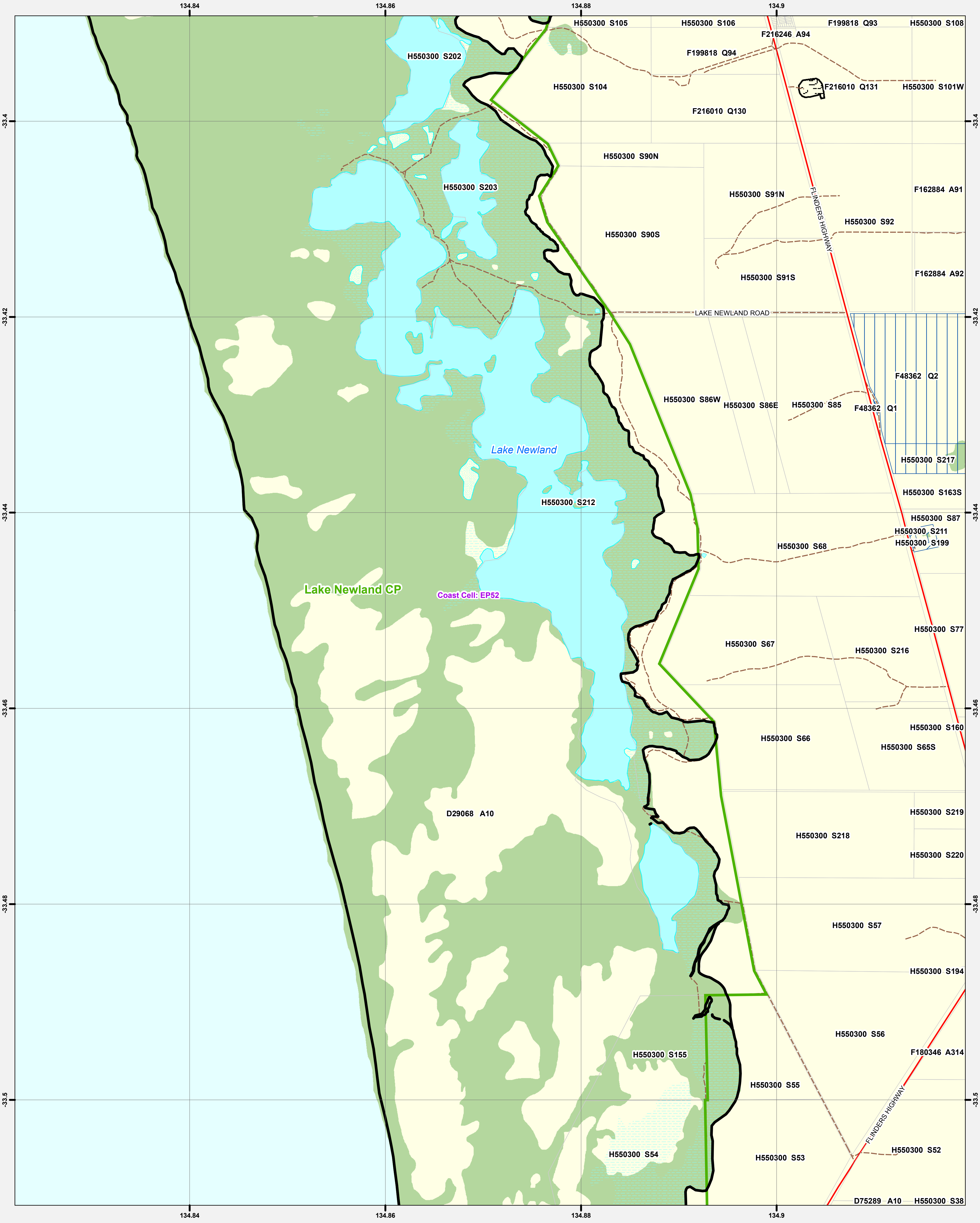
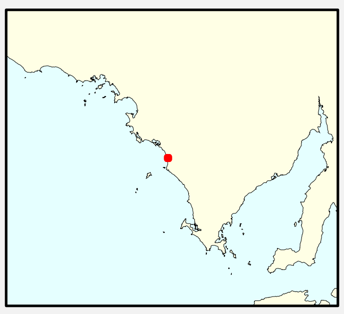
Eyre Peninsula Coastal Action Plan

Map Block 75





0 2.5

Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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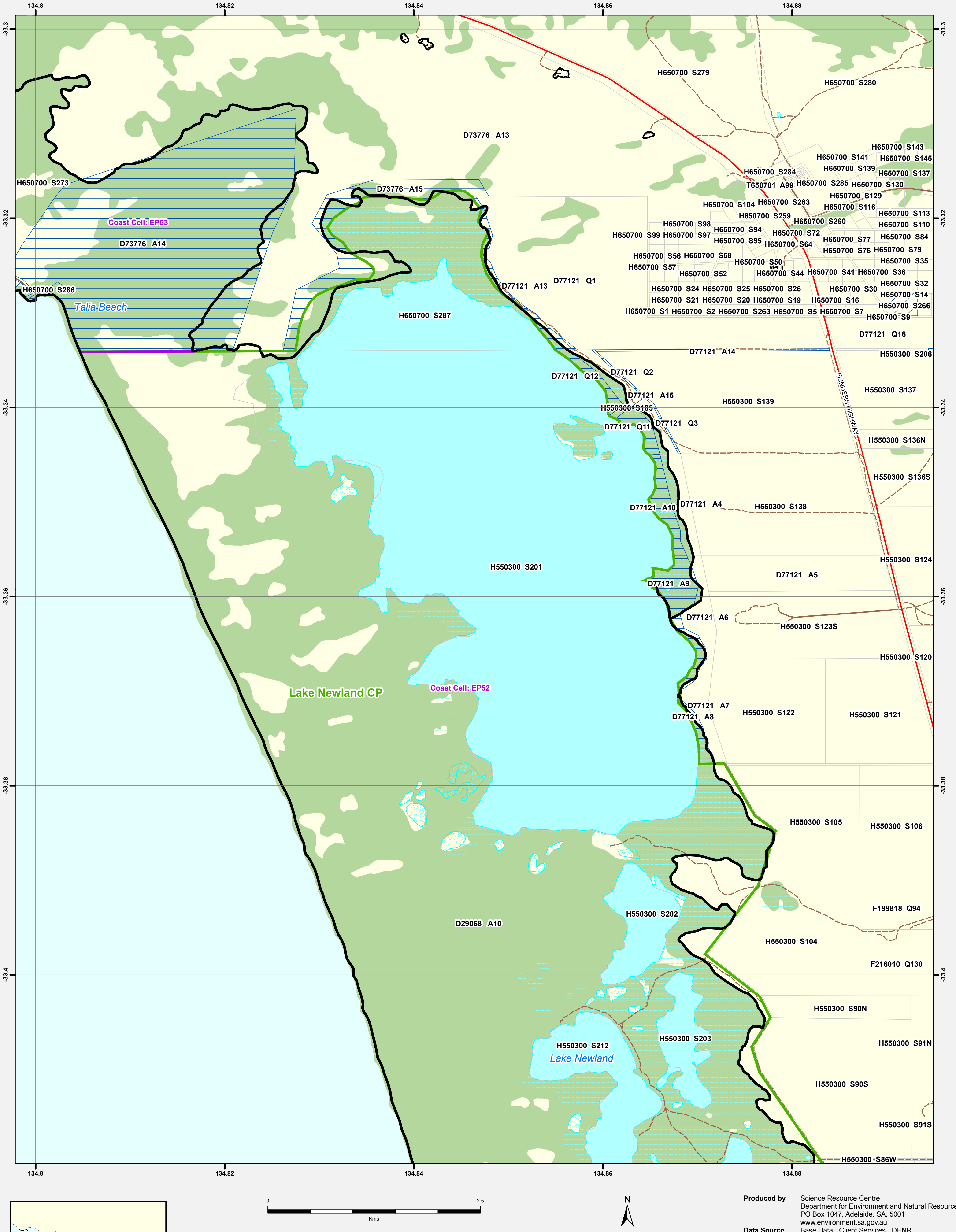
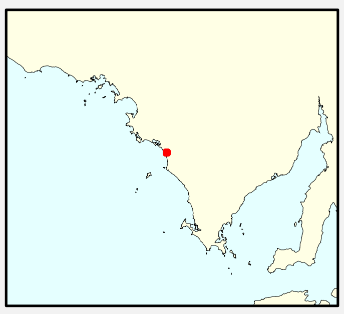
Eyre Peninsula Coastal Action Plan
Map Block 76





Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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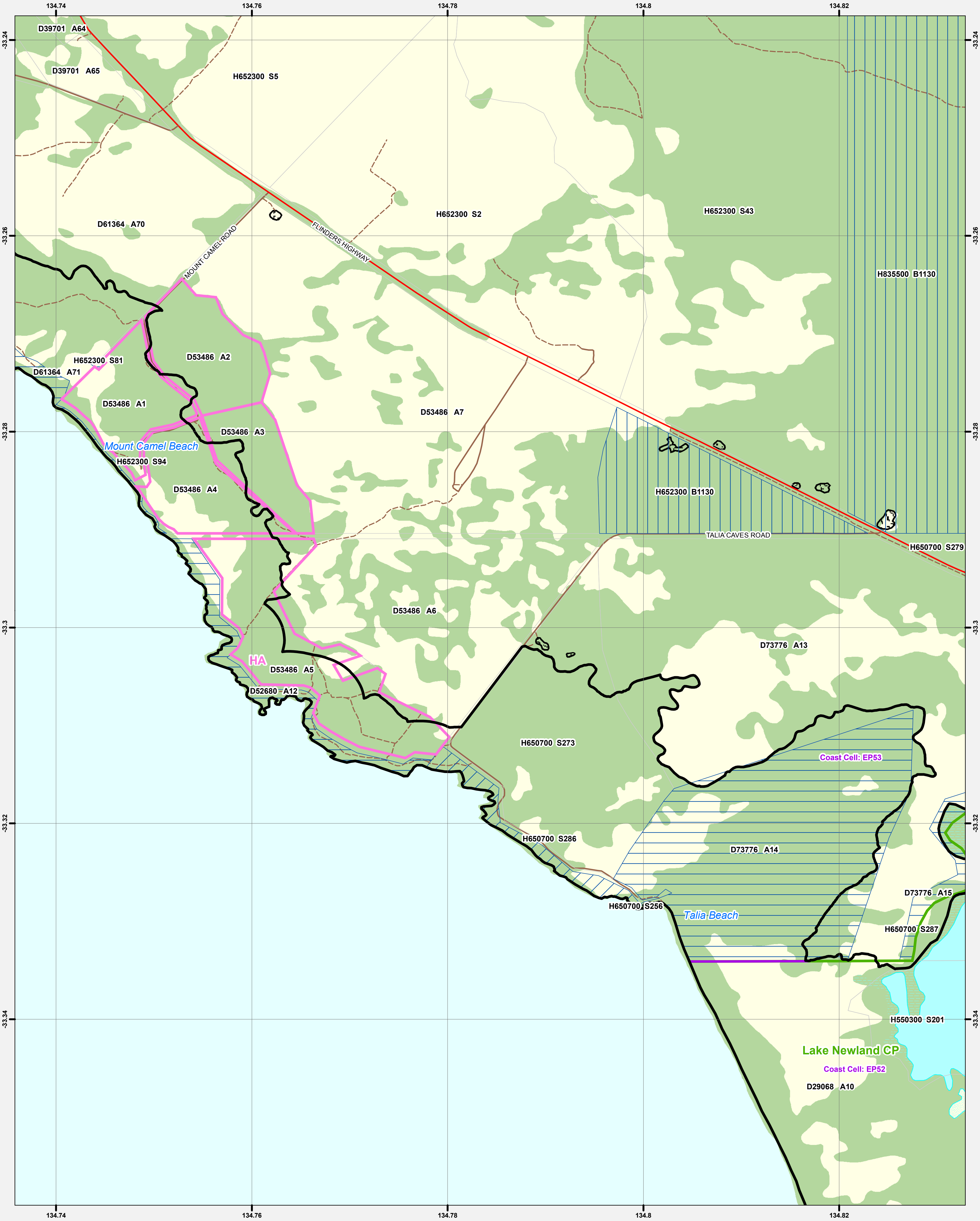
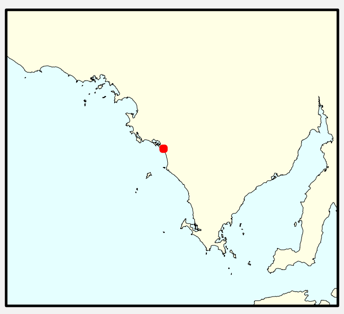
Eyre Peninsula Coastal Action Plan

Map Block 77





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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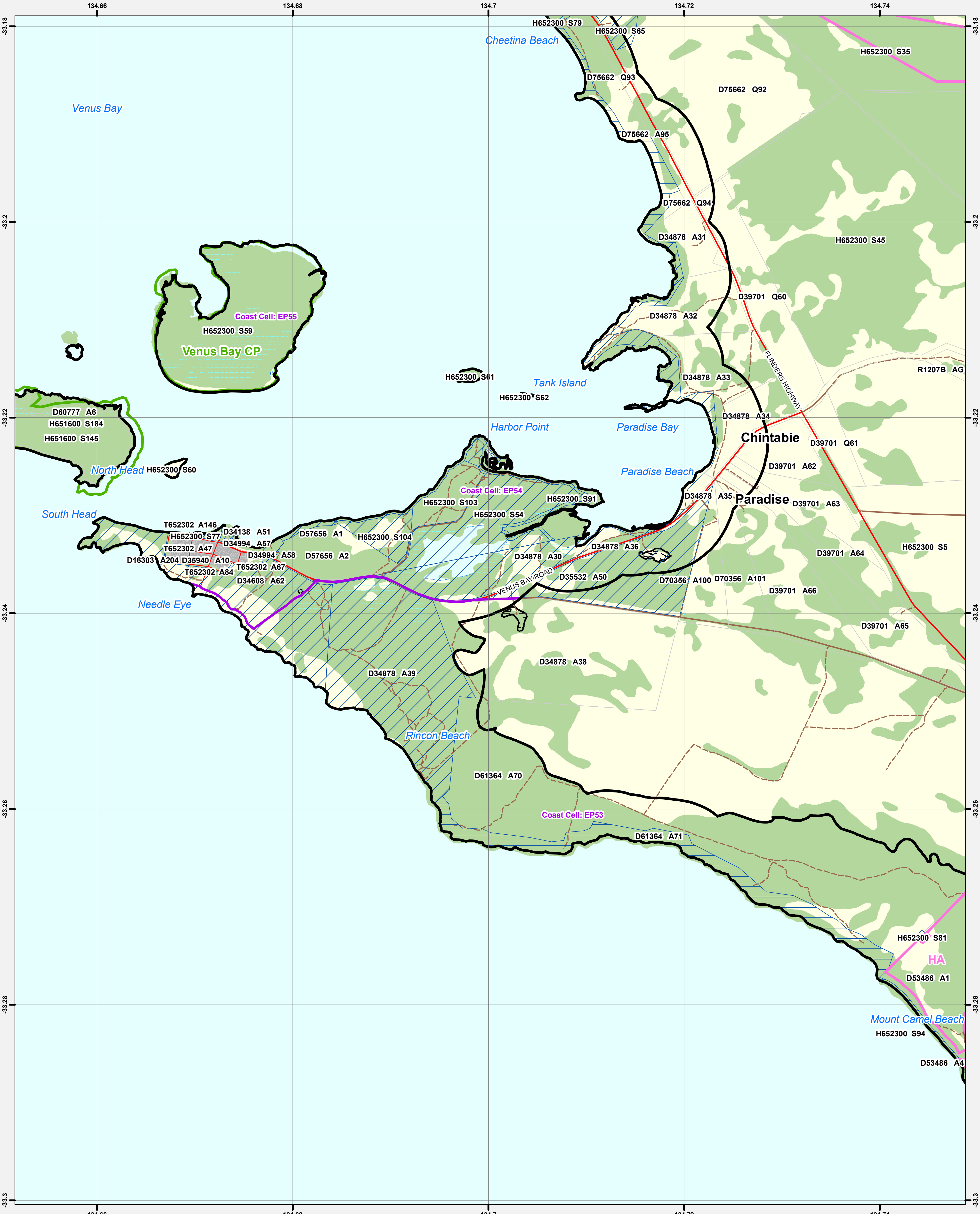
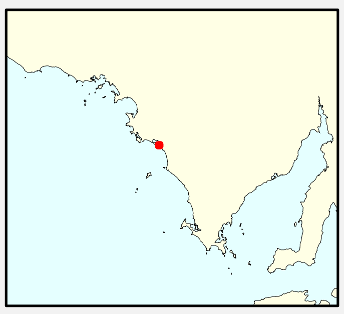
Map Block 78





Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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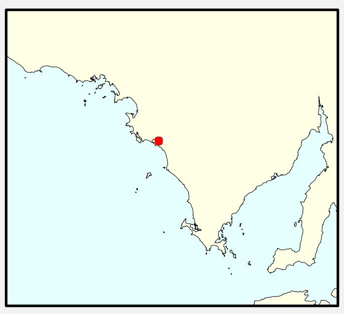
Map Block 79



Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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Projection: Geographic

Datum: Geocentric Datum of Australia, 1994

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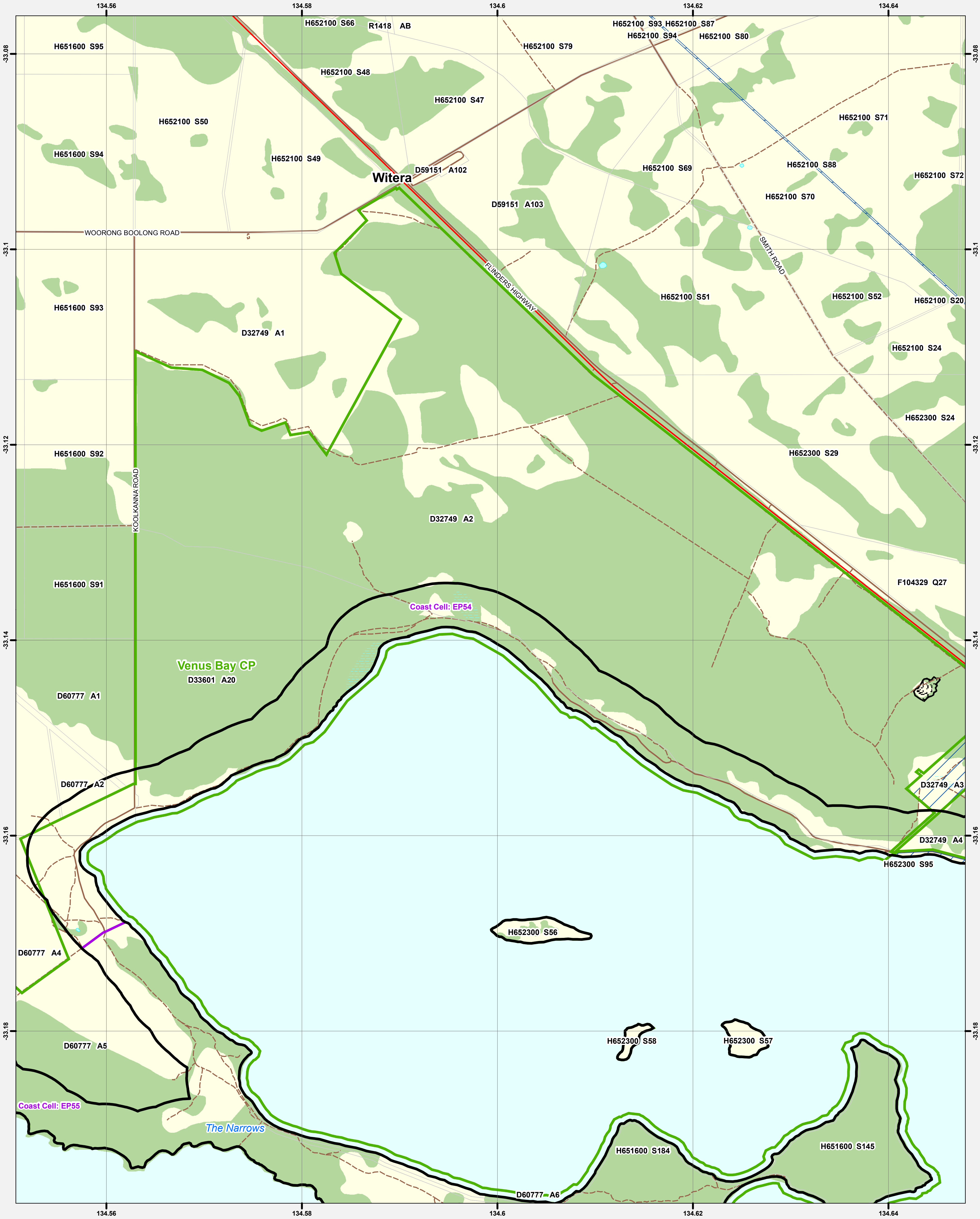
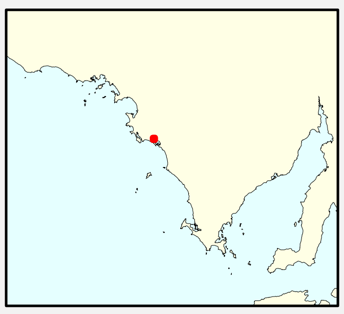
Map Block 80





0 2.5

Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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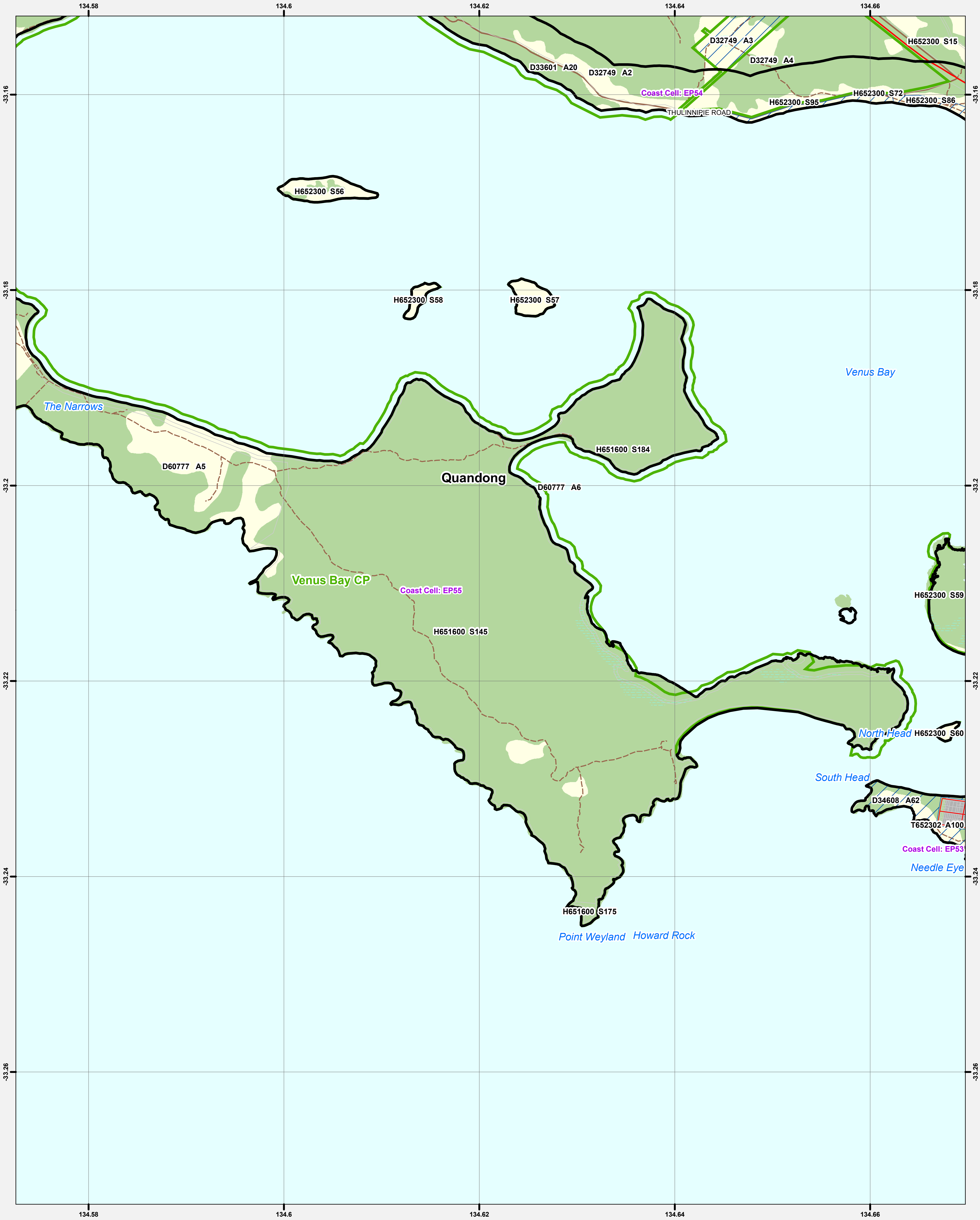
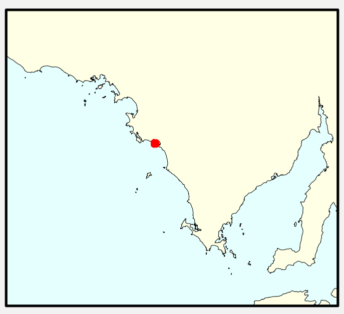
Eyre Peninsula Coastal Action Plan

Map Block 81





0 2.5
Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	**Road Feature Codes**	**Reserve Type**	**Type**	**Coastal Boundary**
Unknown Light	Highway (divided)	National Park	Lake - Perennial	**Coastal Cells**
CLEAR	Sealed	Conservation Park	Dam, Reservoir	**Sewerage Filtration Bed, Effluent Pond**
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	**Stockpile, Slag Heap, Storage Dump, Tailing Pond**
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	**Rubbish Dump**
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	**Quarries**
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	**Reefs**
WHITE/RED	Under Construction	**DCDB Parcels**	Land Subject to Inundation (STI)	**Built Up Area**
YELLOW			Land Subject to Flooding (STF)	**Native Vegetation**

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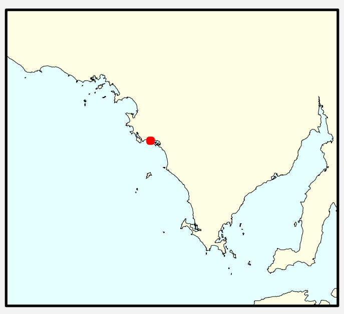
Map Block 82



0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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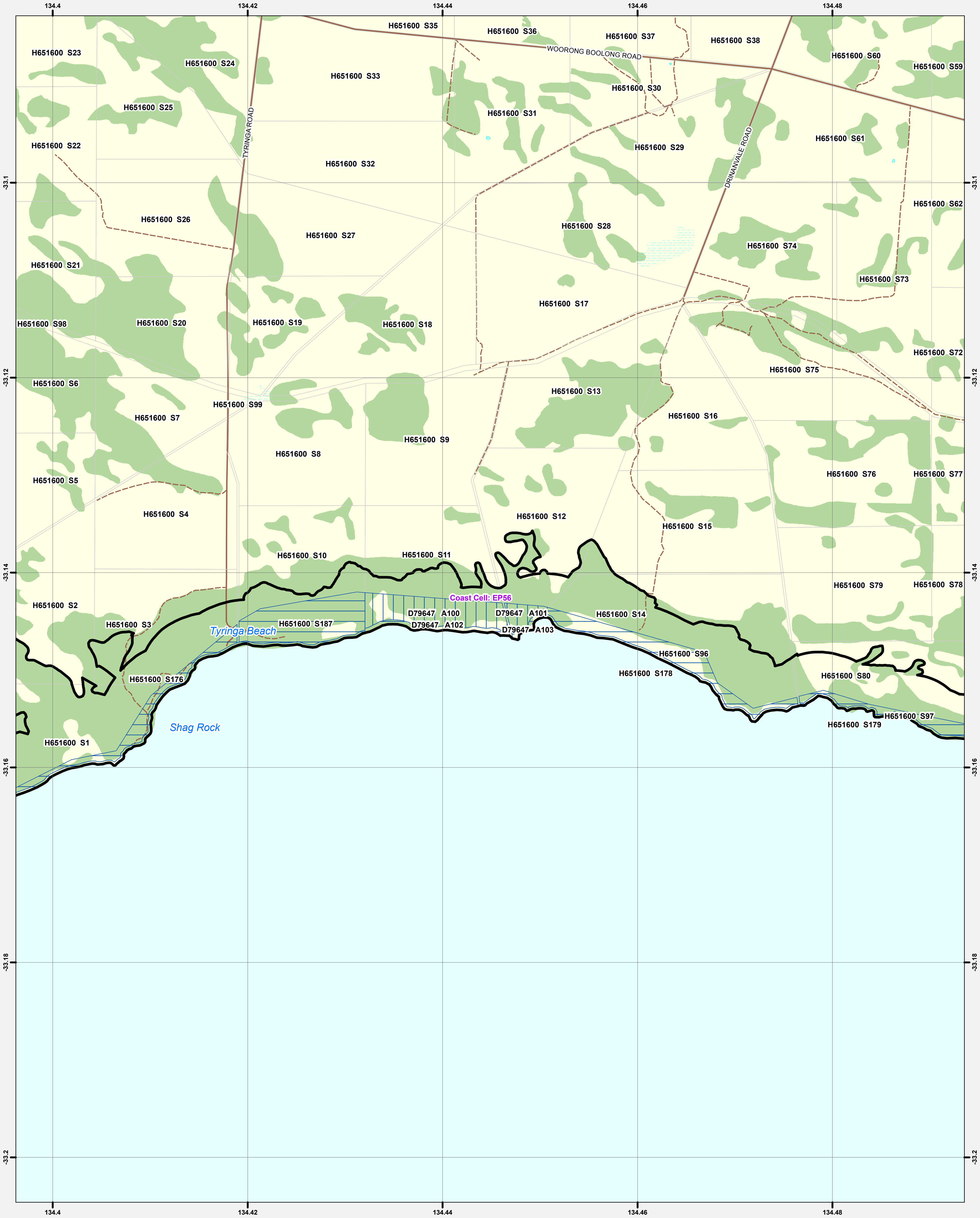
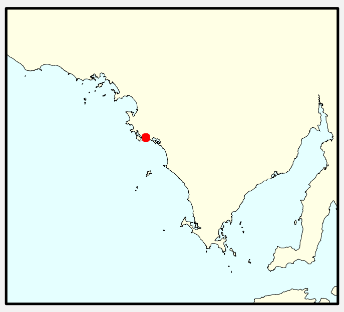
Map Block 83





0 2.5
Kms

N

Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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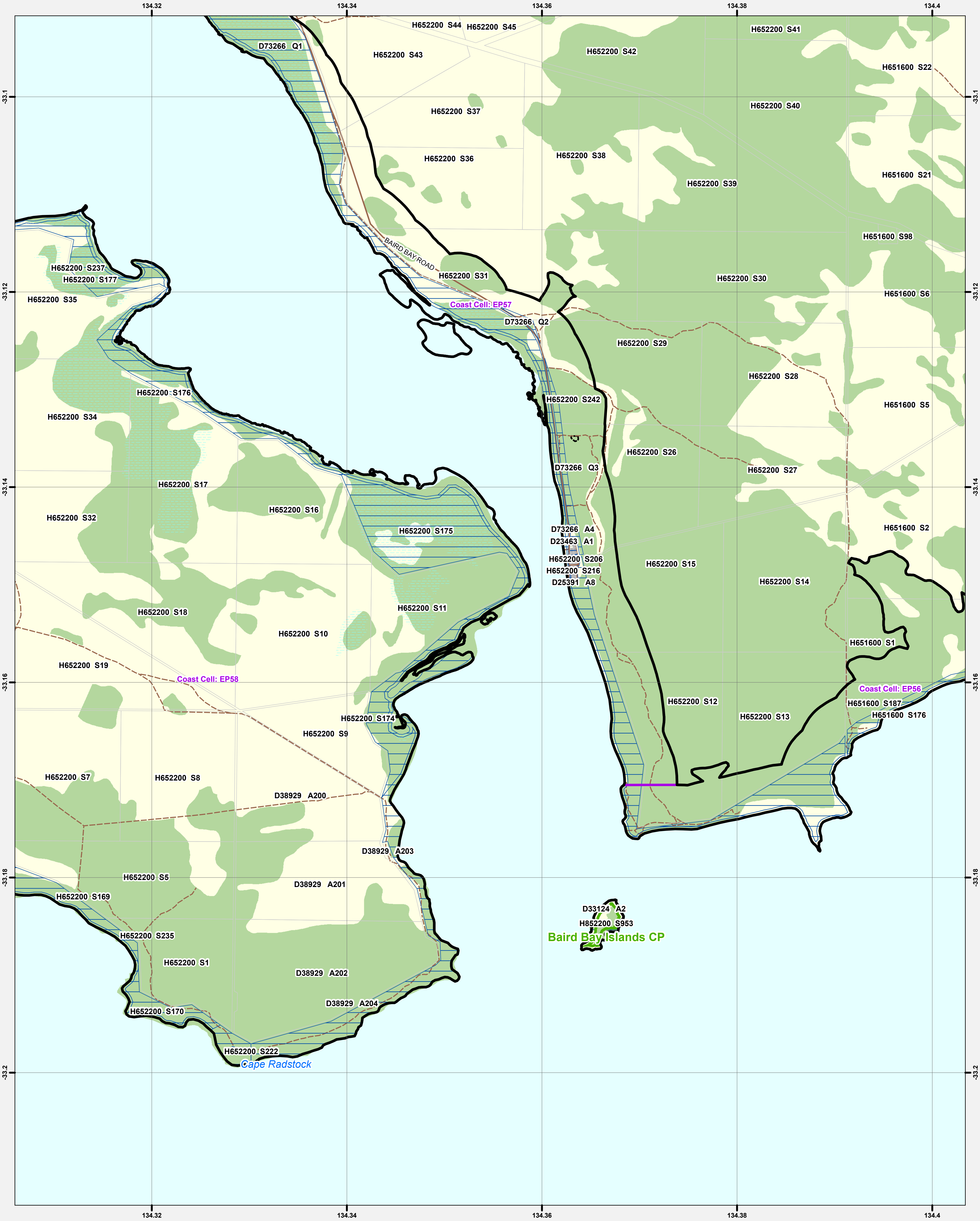
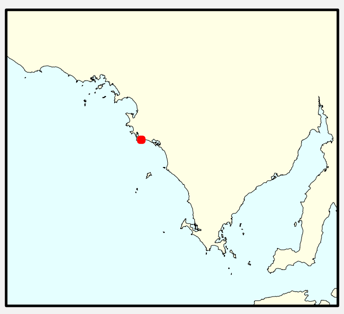
Eyre Peninsula Coastal Action Plan

Map Block 84





Navigation Marks

Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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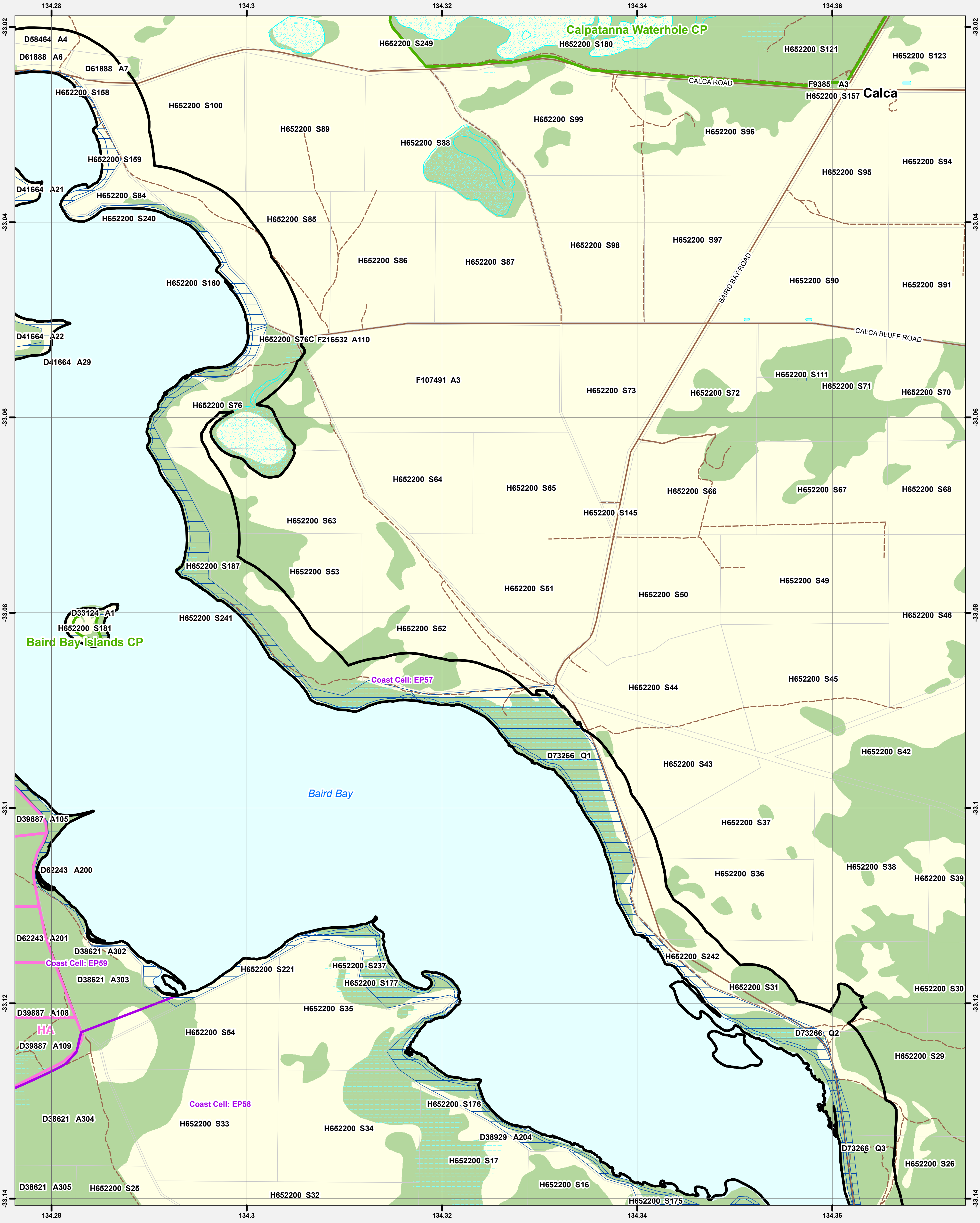
Eyre Peninsula Coastal Action Plan

Map Block 85



Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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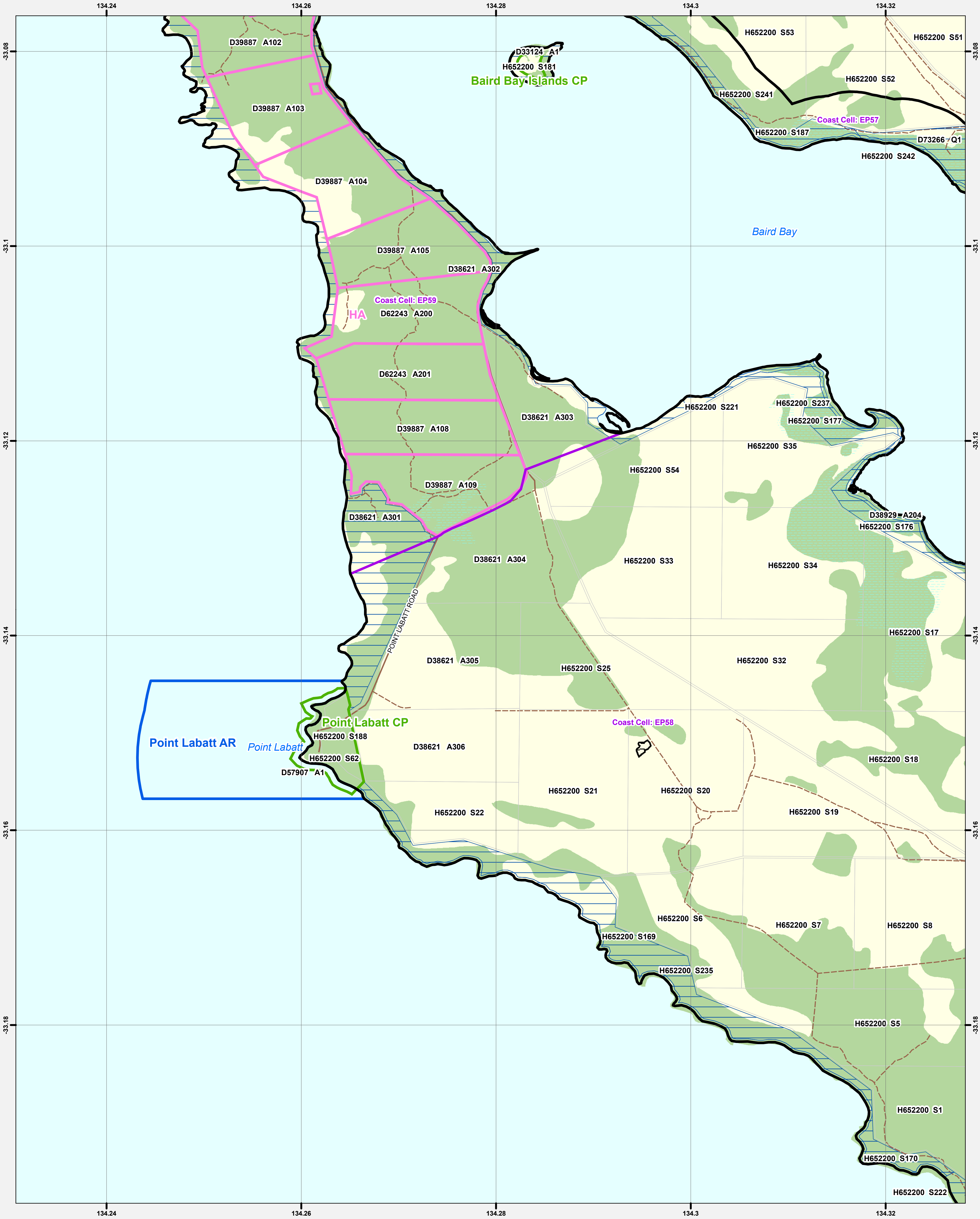
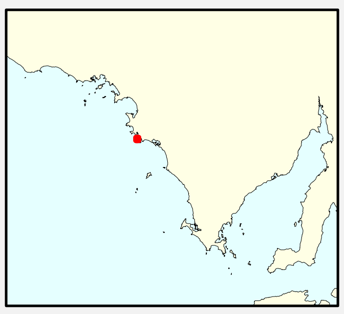
Map Block 86





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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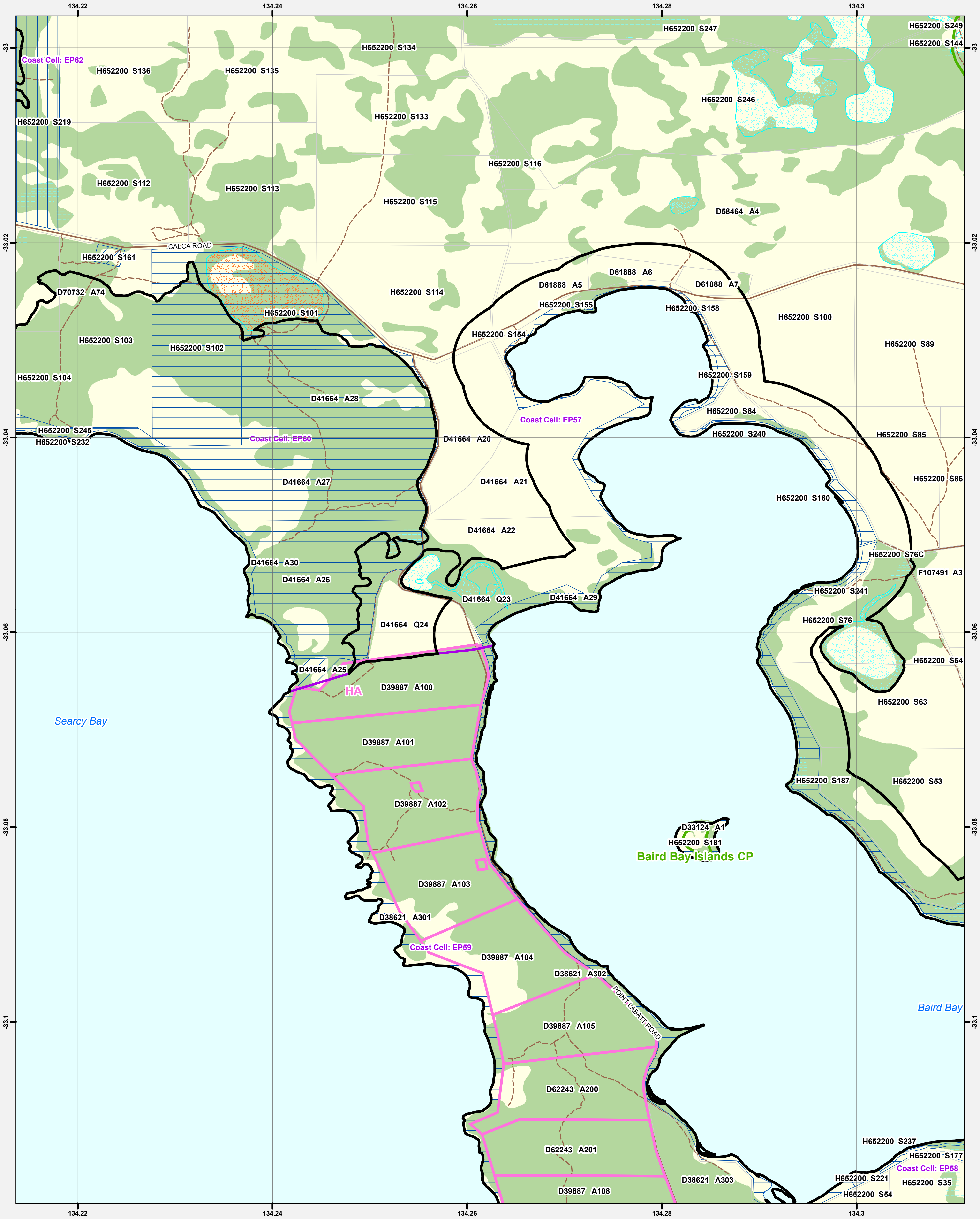
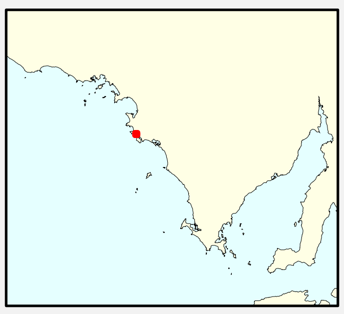
Eyre Peninsula Coastal Action Plan
Map Block 87





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Navigation Marks
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- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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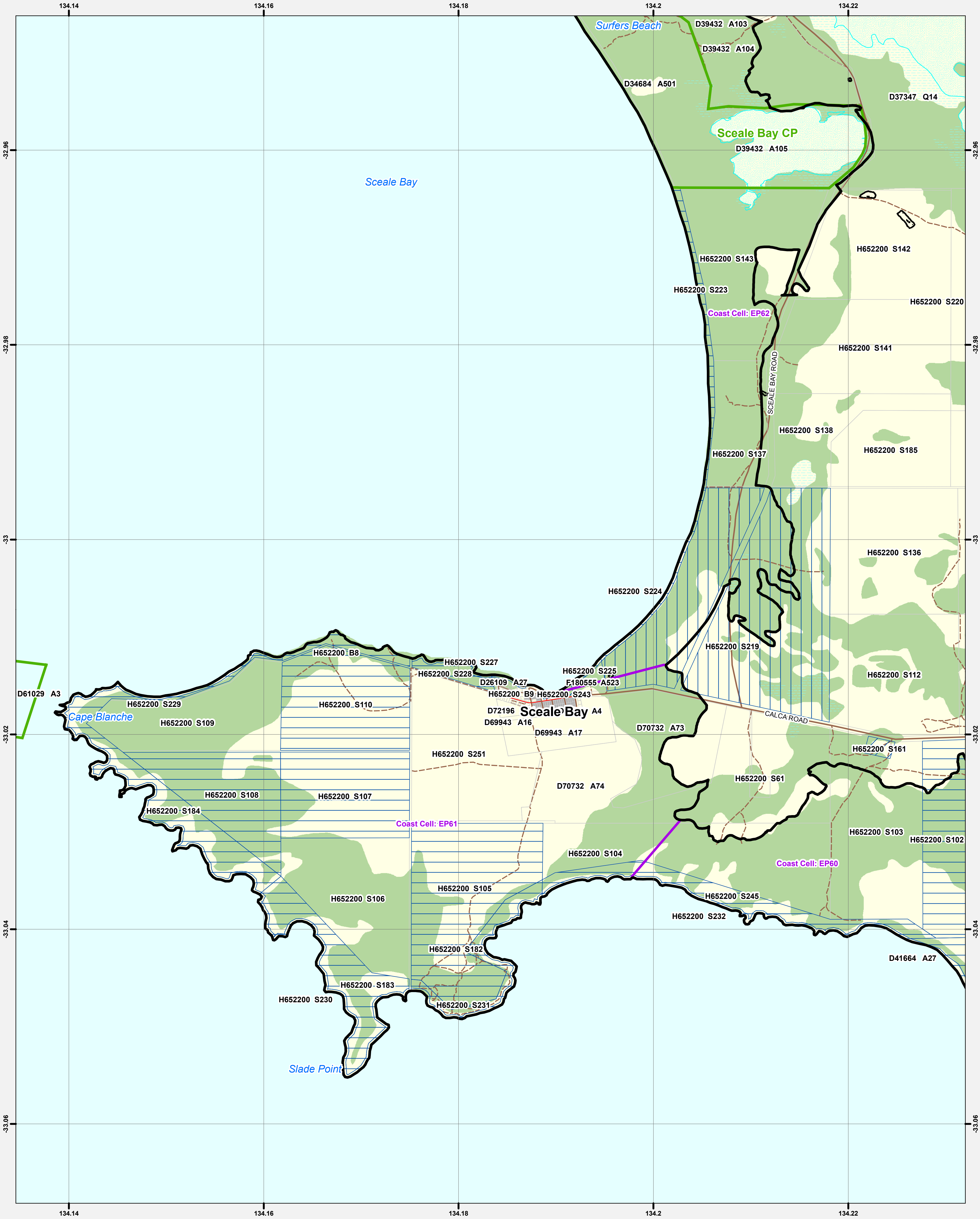
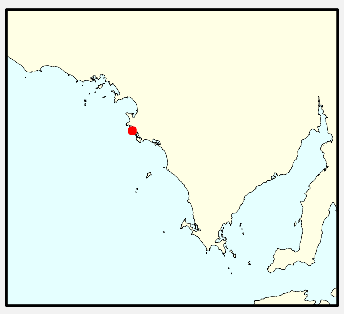
Map Block 88





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Navigation Marks
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Roads
Road Feature Codes
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Protected Areas
Reserve Type
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- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
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- Dam, Reservoir
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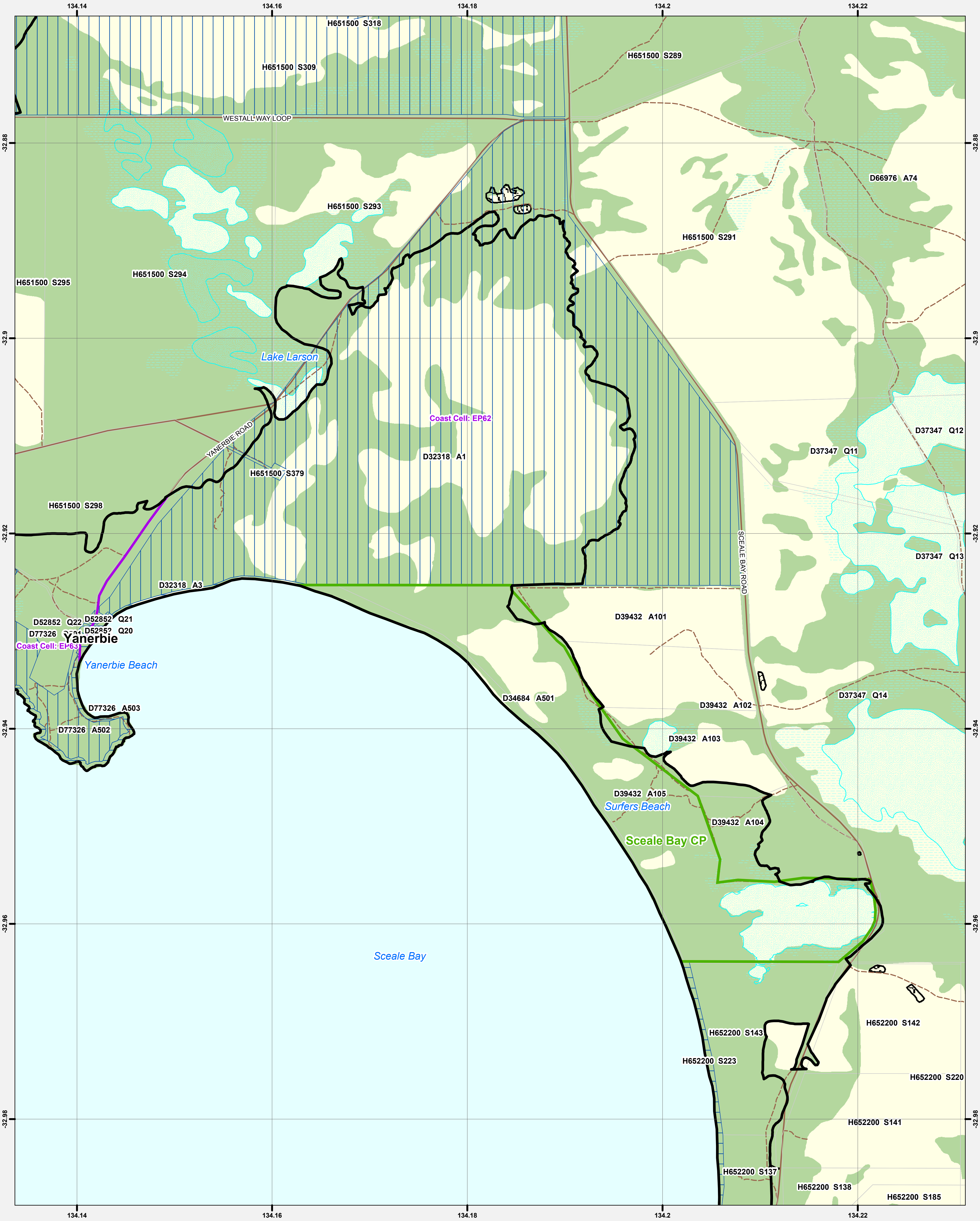
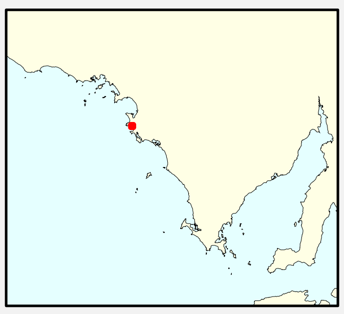
Map Block 89





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Navigation Marks
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- GREEN
- ORANGE
- RED
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- YELLOW

Roads
Road Feature Codes
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Protected Areas
Reserve Type
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DCDB Parcels

Waterbodies
Type
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- Dam, Reservoir
- Dam, Reservoir
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Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
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Native Vegetation

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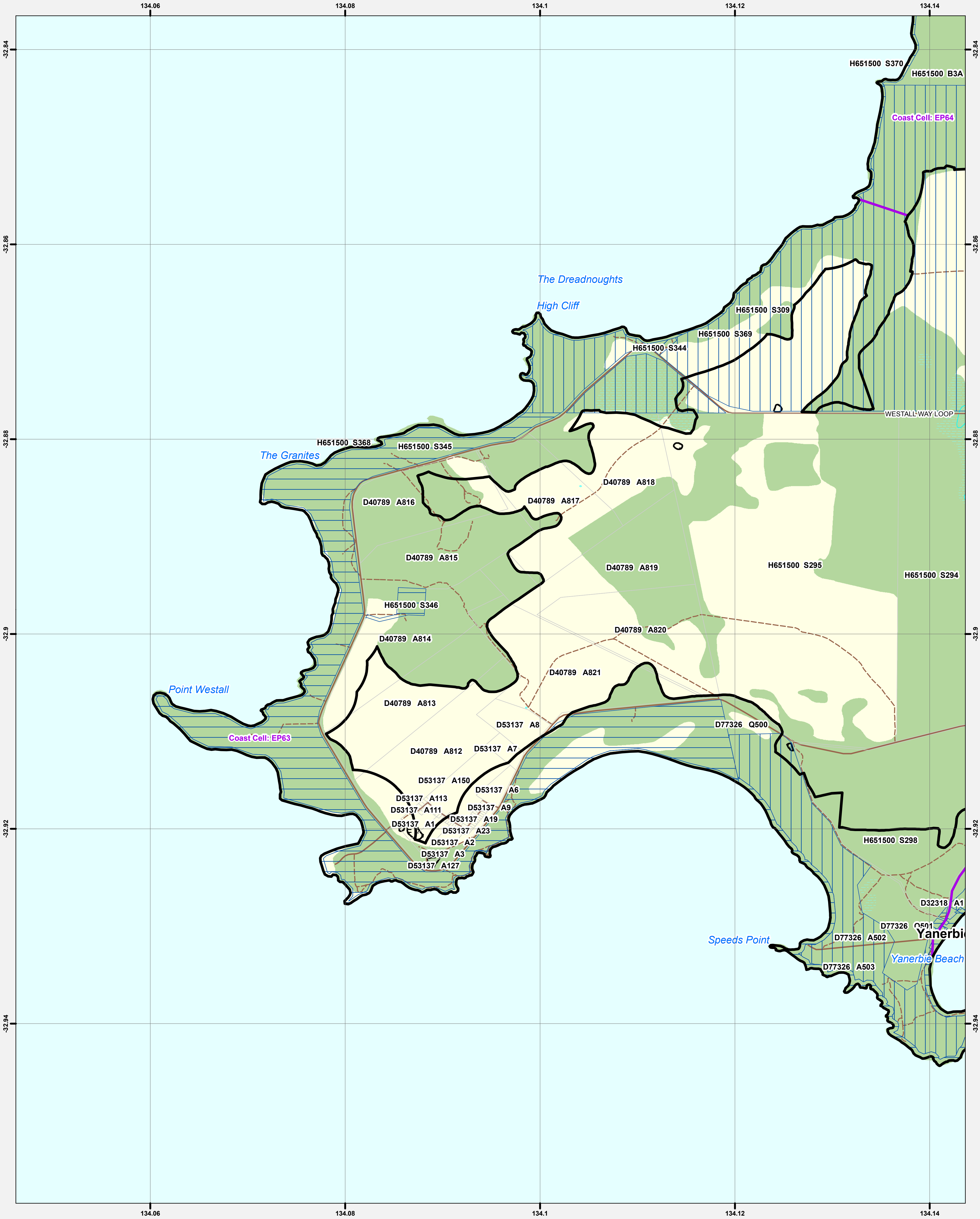
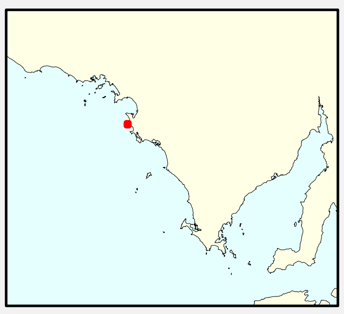
Map Block 90





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Navigation Marks

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Roads

Road Feature Codes

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Protected Areas

Reserve Type

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- Conservation Reserve
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- Aquatic Reserves
- DCDB Parcels

Waterbodies

Type

- Lake - Perennial
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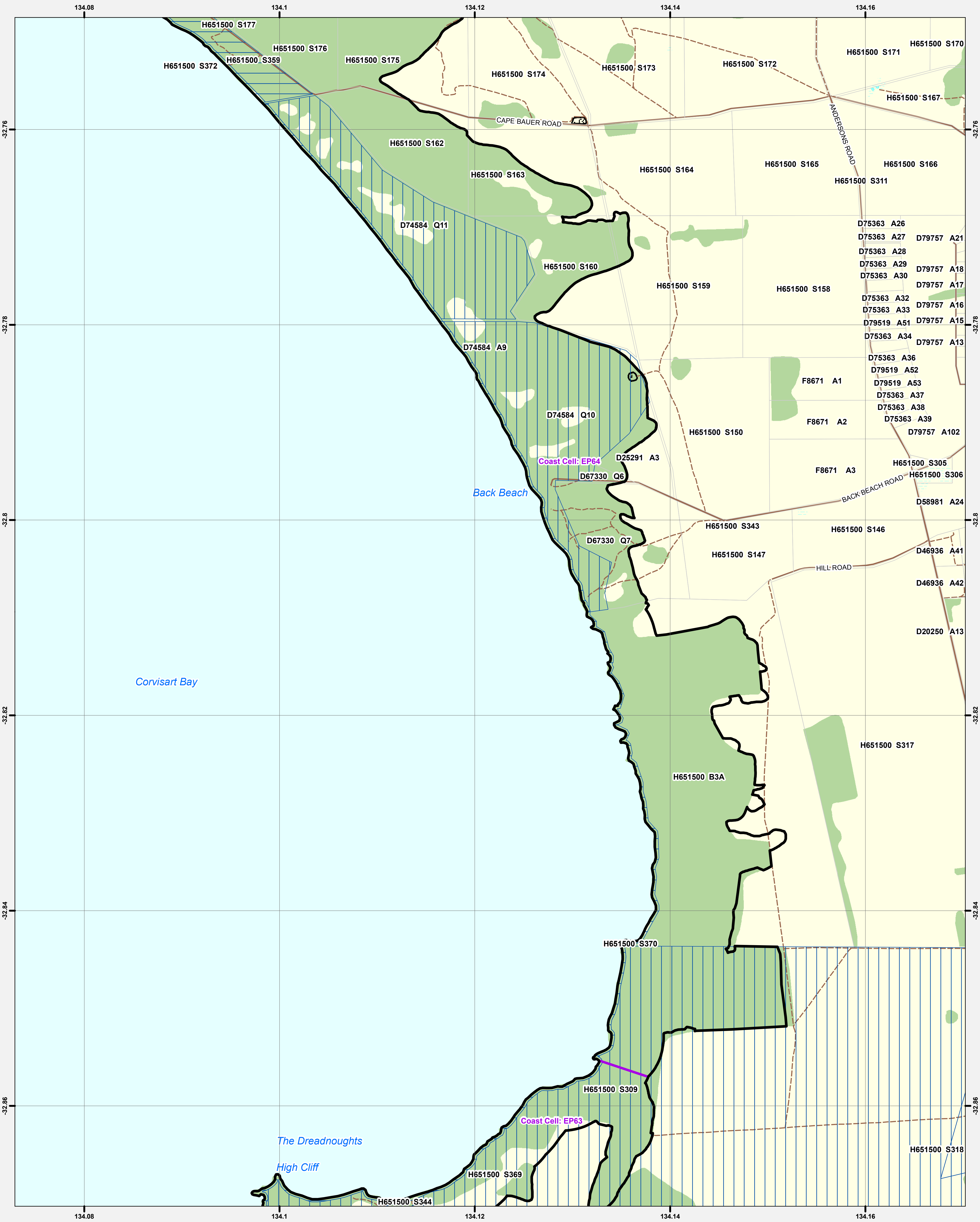
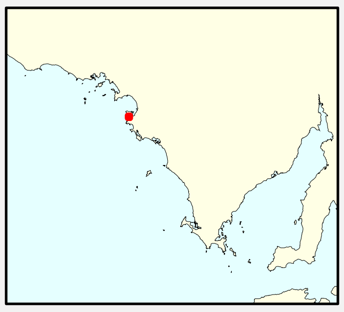
Map Block 91





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DCDB Parcels

Waterbodies
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Coastal Boundary
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Stockpile, Slag Heap, Storage Dump, Tailing Pond
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Reefs
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Native Vegetation

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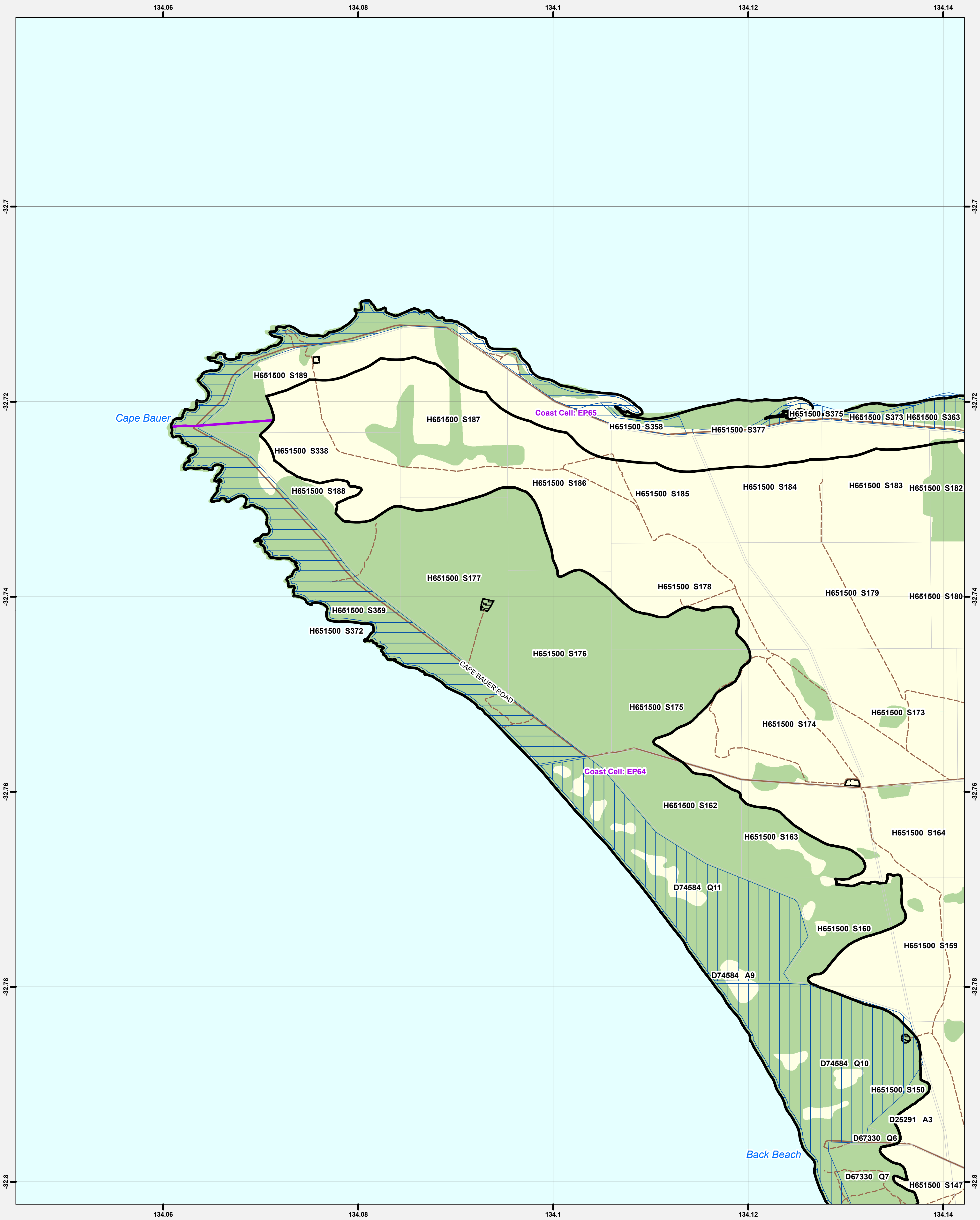
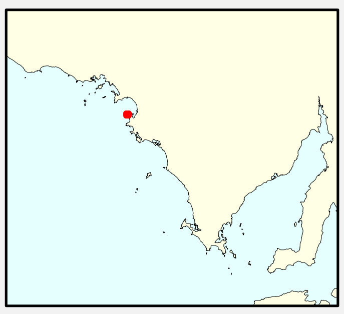
Map Block 92





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Navigation Marks
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Roads
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Protected Areas
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DCDB Parcels

Waterbodies
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Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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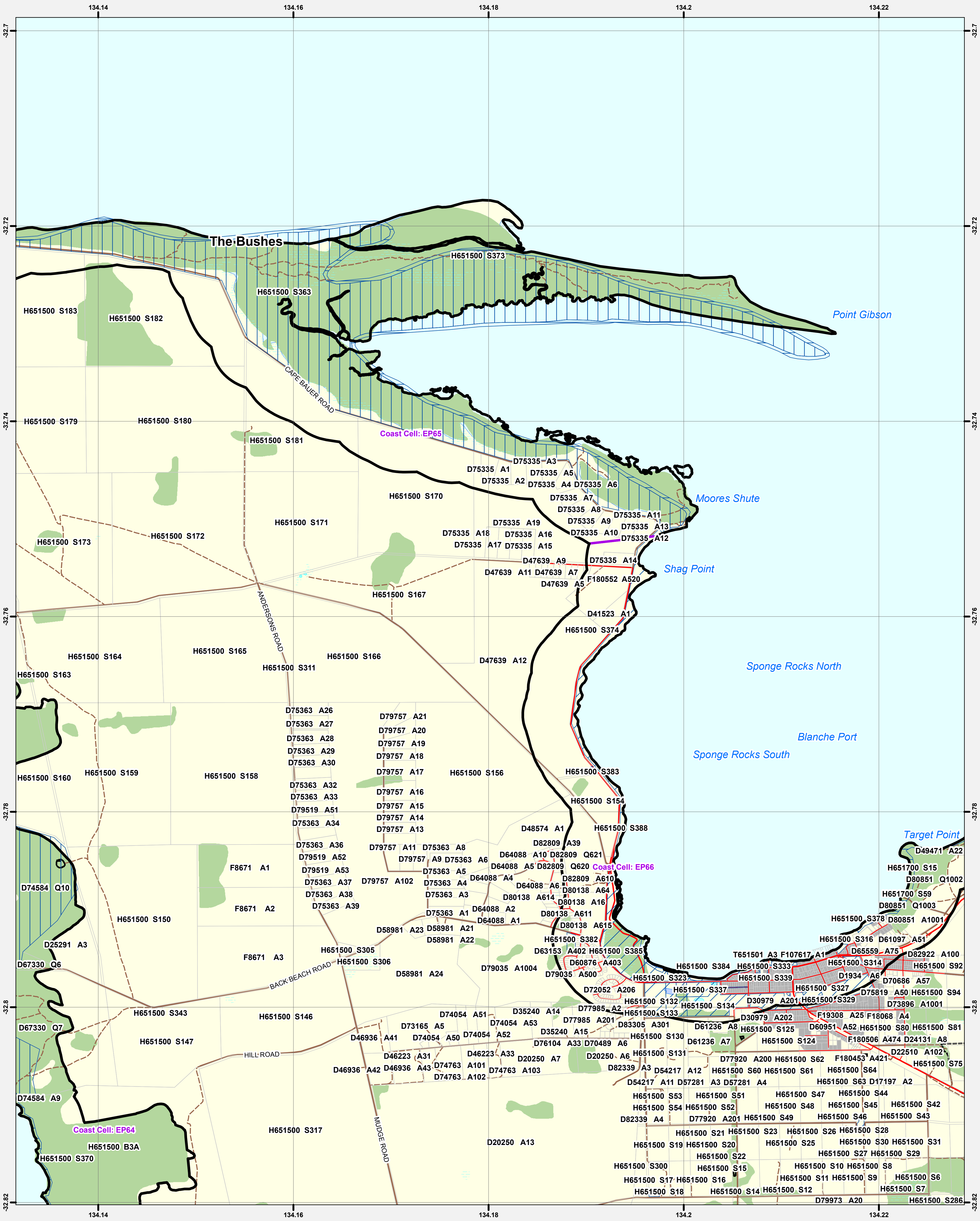
Map Block 93



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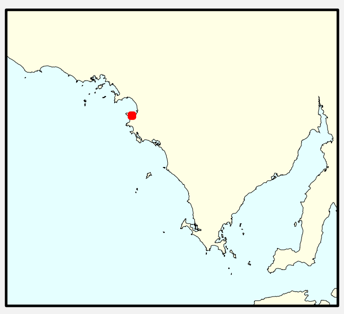

Navigation Marks
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Roads
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Protected Areas
Reserve Type
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- DCDB Parcels

Waterbodies
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- Coastal Boundary
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- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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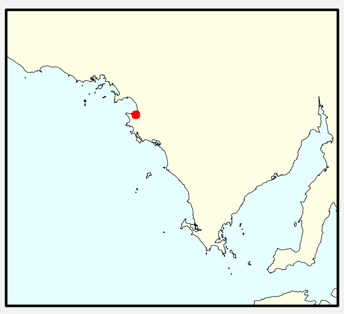
Eyre Peninsula Coastal Action Plan

Map Block 94



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Navigation Marks

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- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
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- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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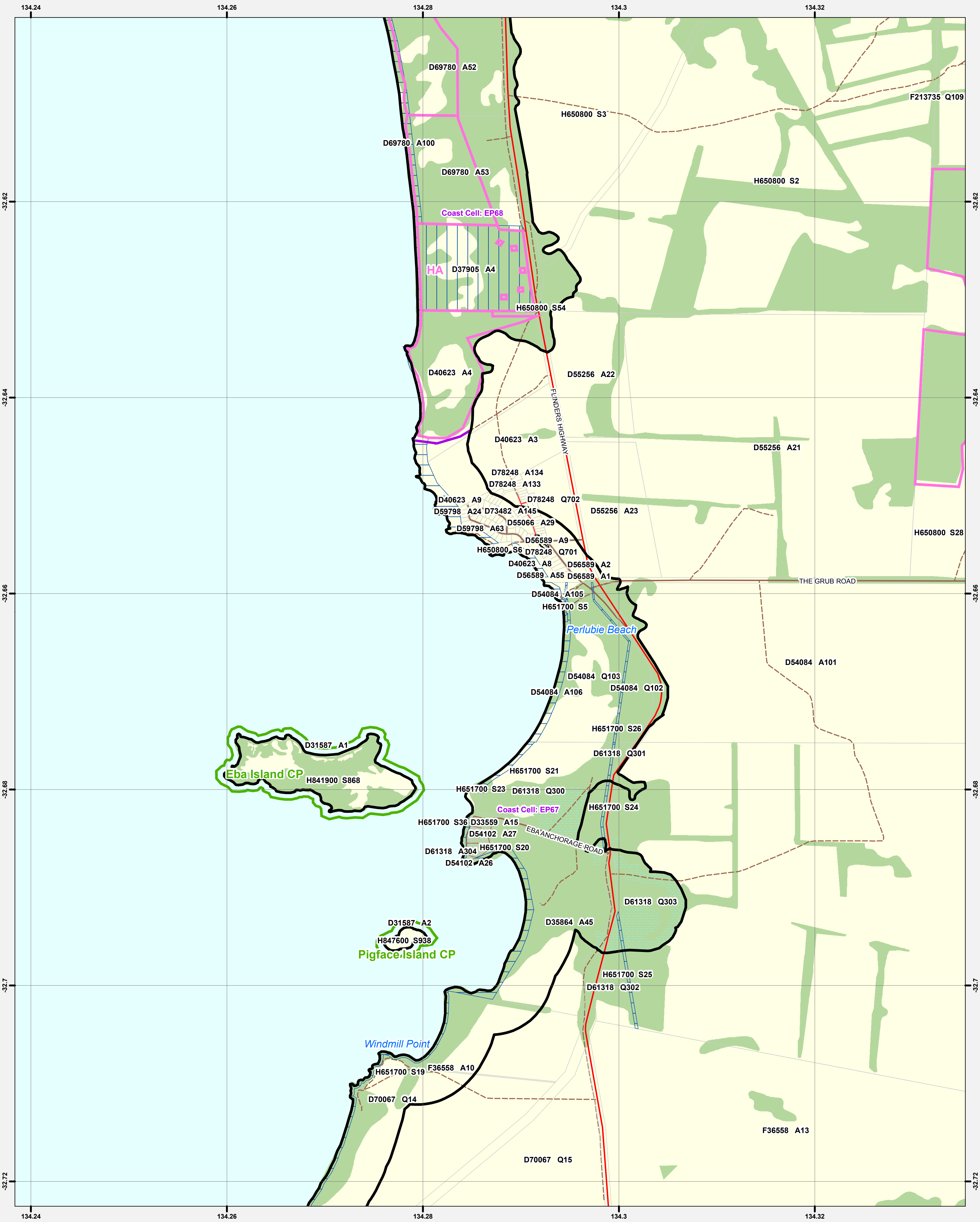
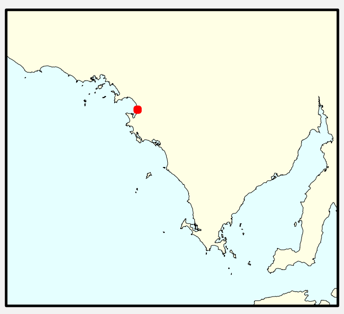
Eyre Peninsula Coastal Action Plan
Map Block 95





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Navigation Marks
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Roads
Road Feature Codes
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Protected Areas
Reserve Type
- National Park
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- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
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- **Coastal Boundary**
- **Coastal Cells**
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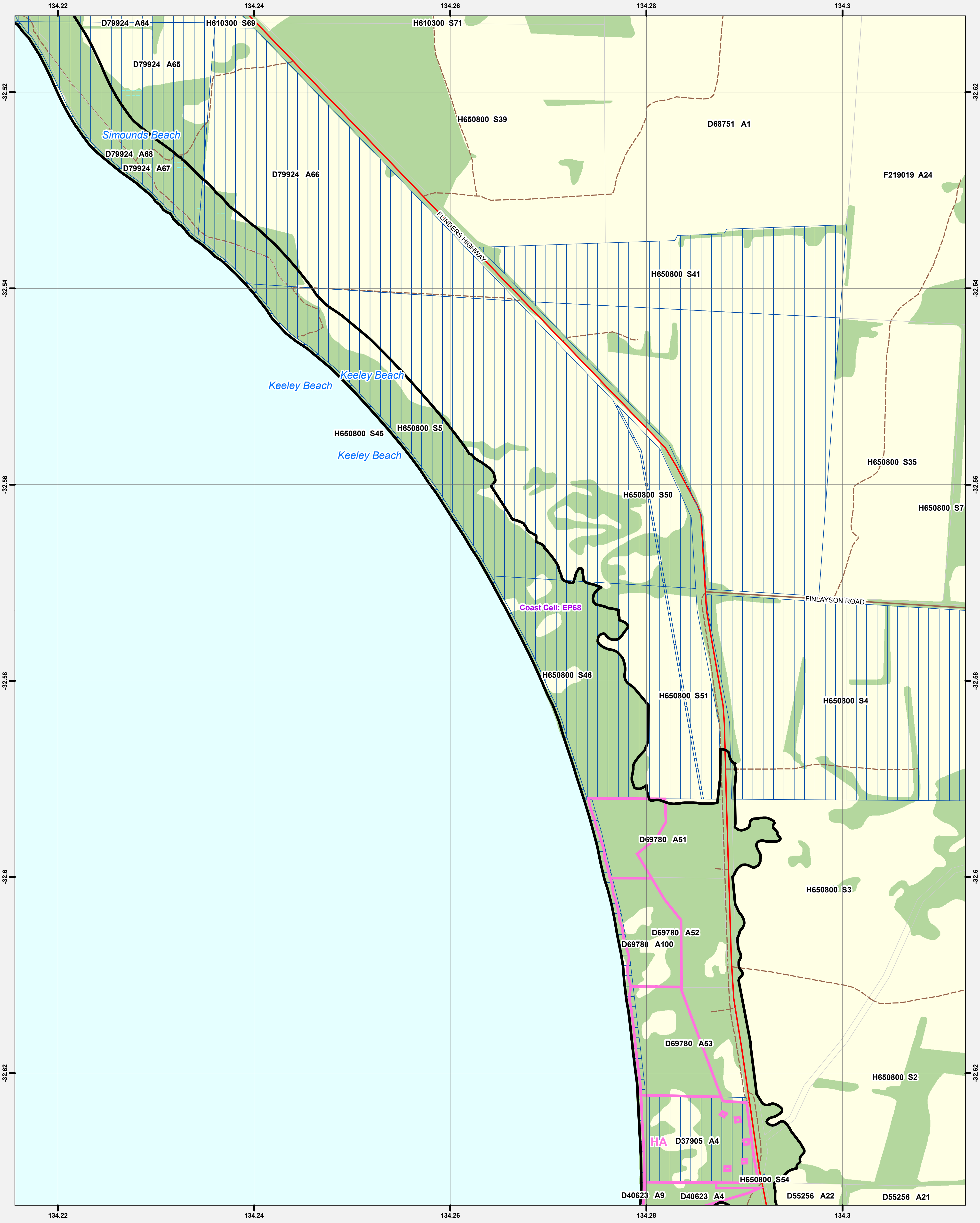
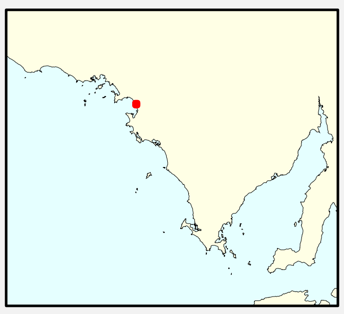
Map Block 96





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Roads
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Protected Areas
Reserve Type
- National Park
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- Conservation Reserve
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- Aquatic Reserves
- DCDB Parcels

Waterbodies
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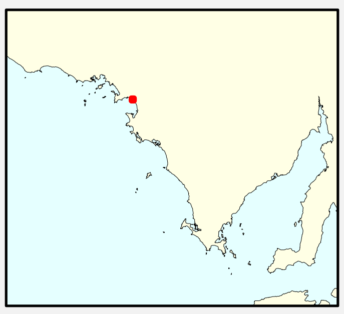
Map Block 97



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Reserve Type
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DCDB Parcels

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Coastal Cells
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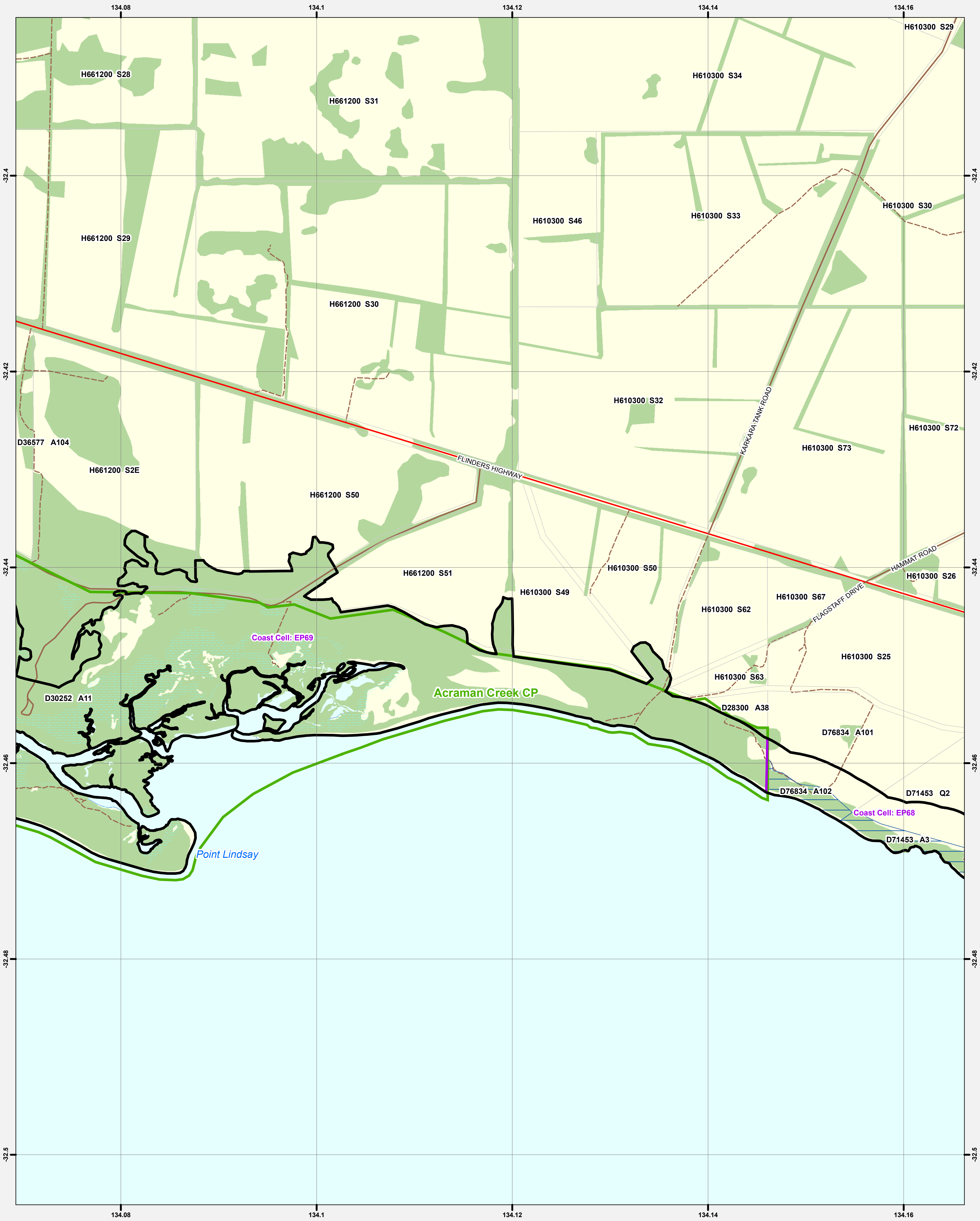
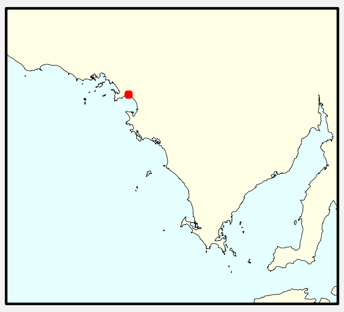
Map Block 98





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Protected Areas

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Waterbodies

Type

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- Dam, Reservoir
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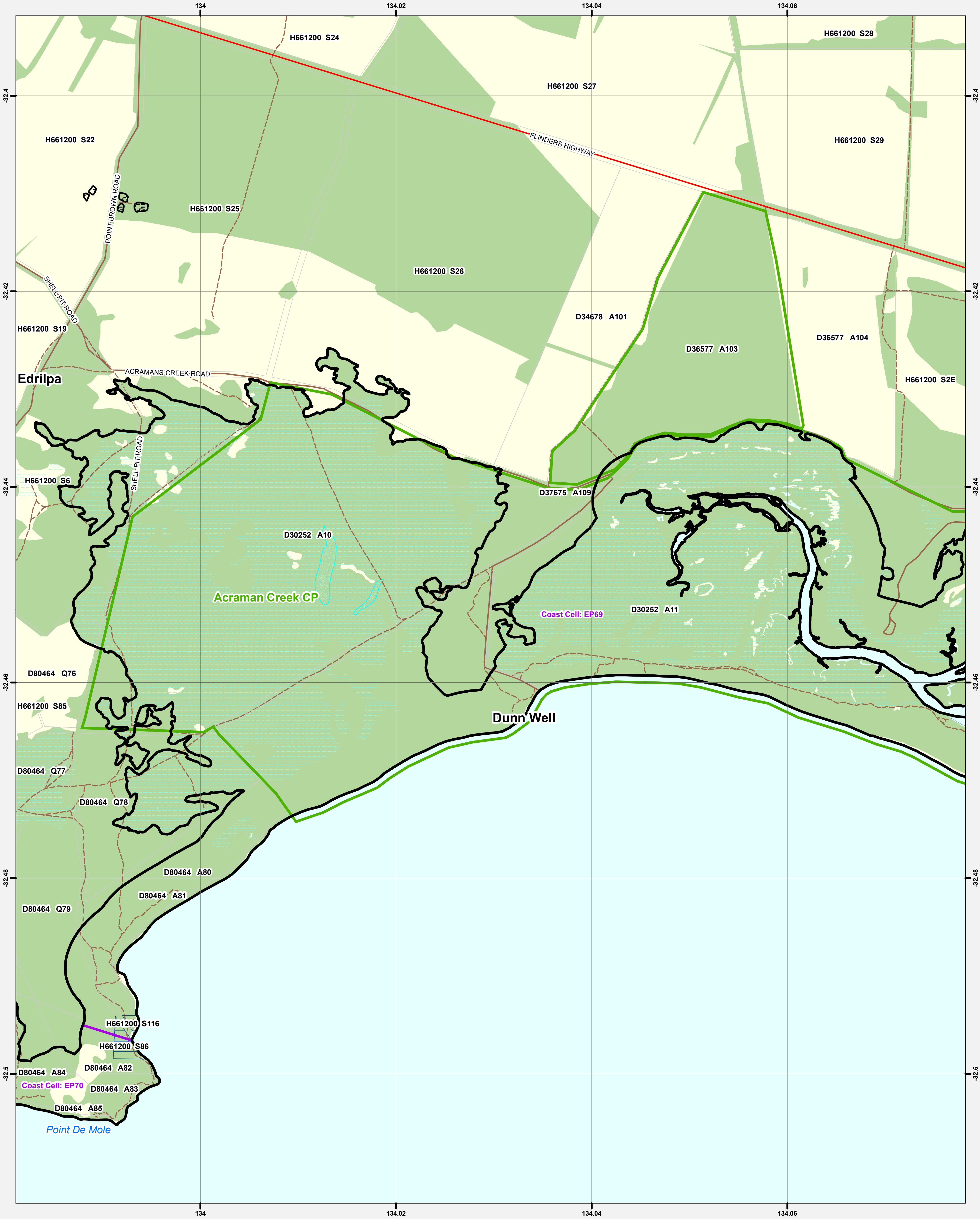

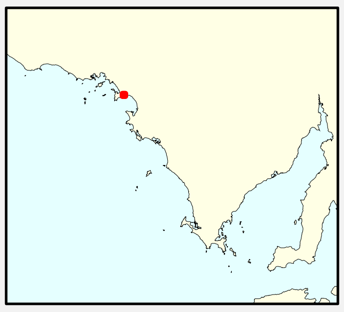

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- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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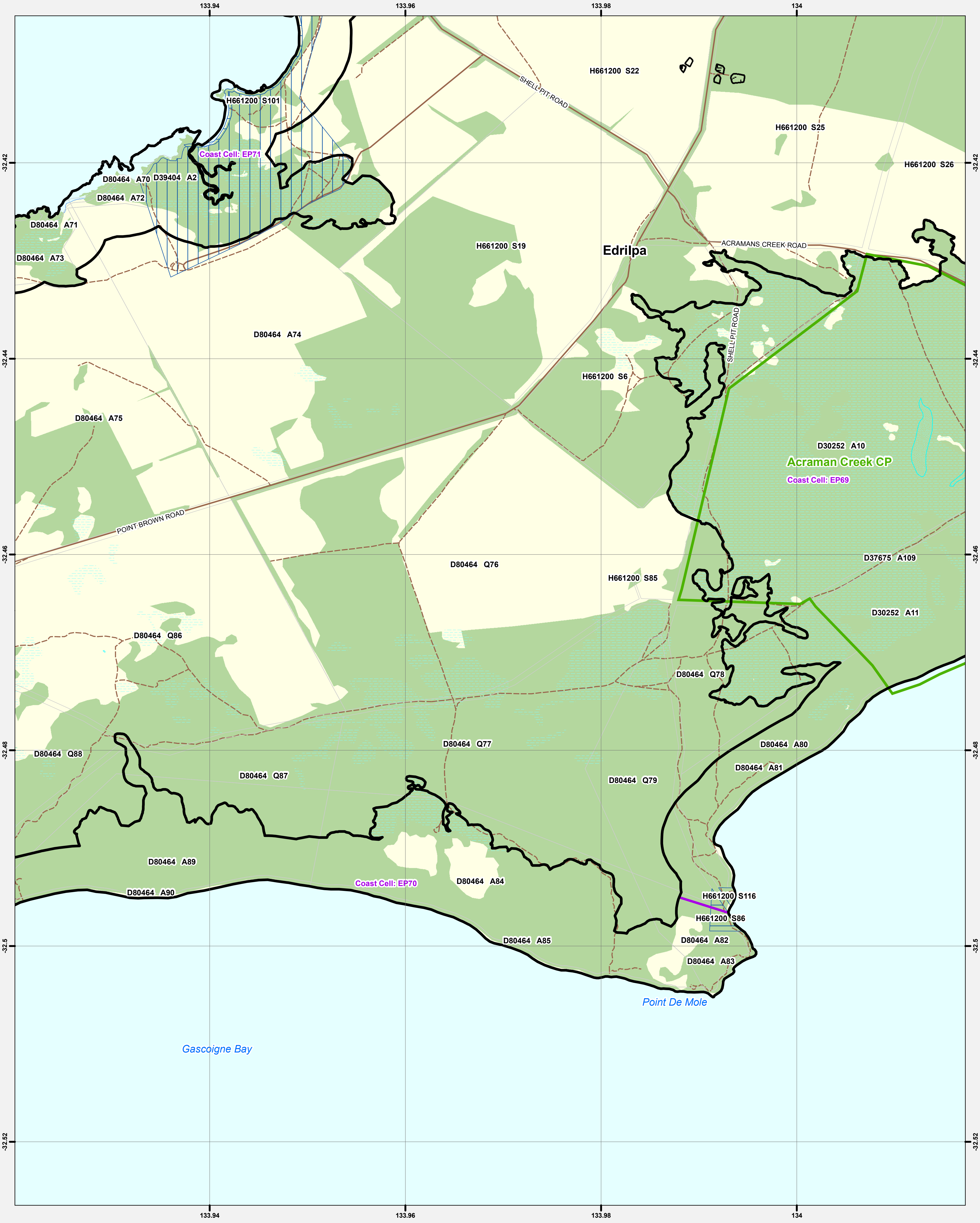
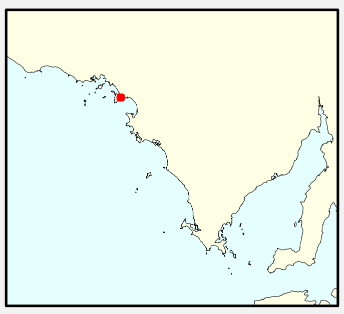
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 100





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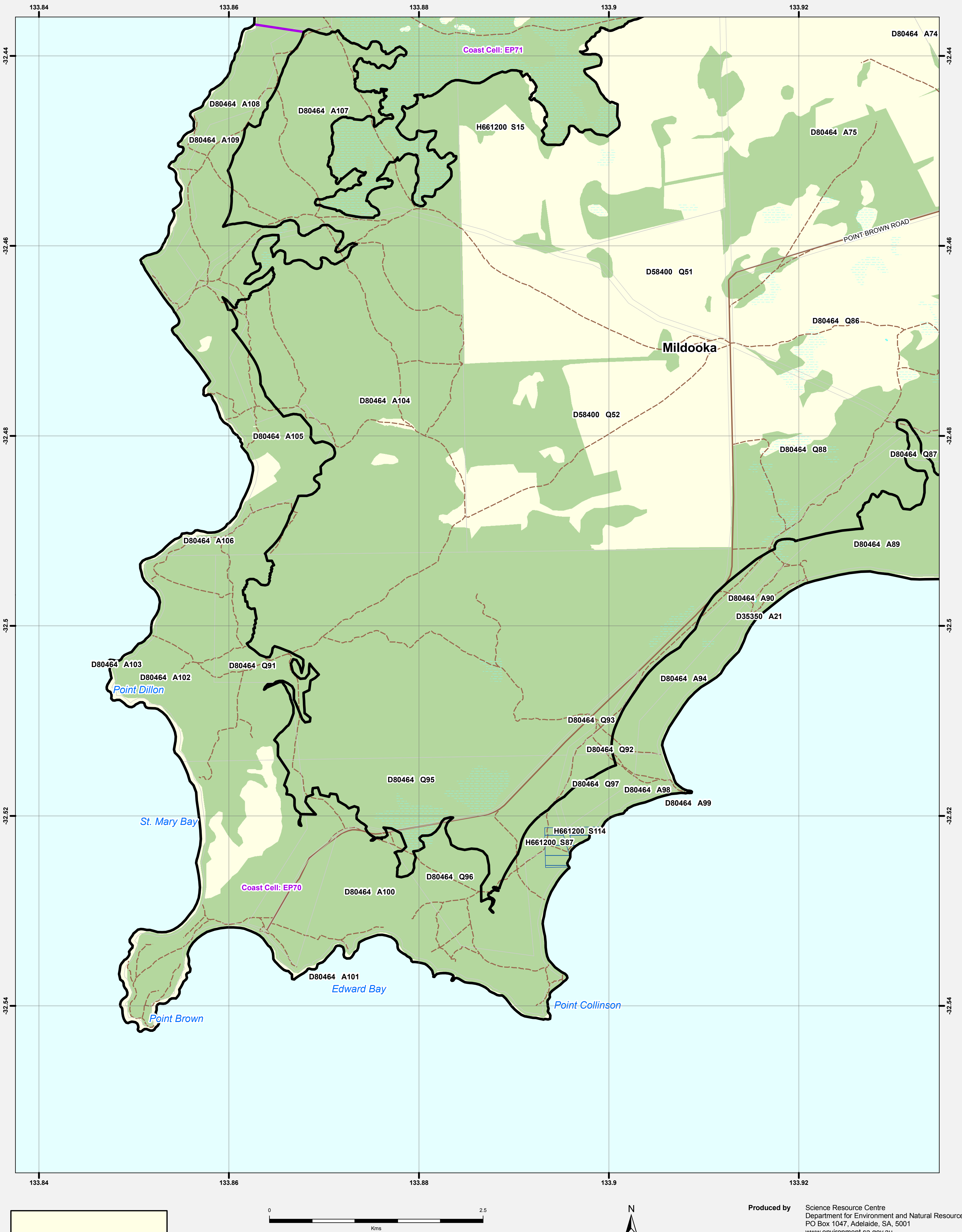
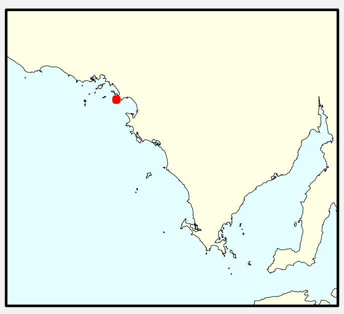
Projection Geographic
Datum Geocentric Datum of Australia, 1994

Eyre Peninsula Coastal Action Plan

Map Block 101





Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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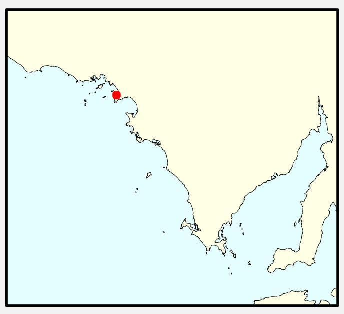
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan
Map Block 102



Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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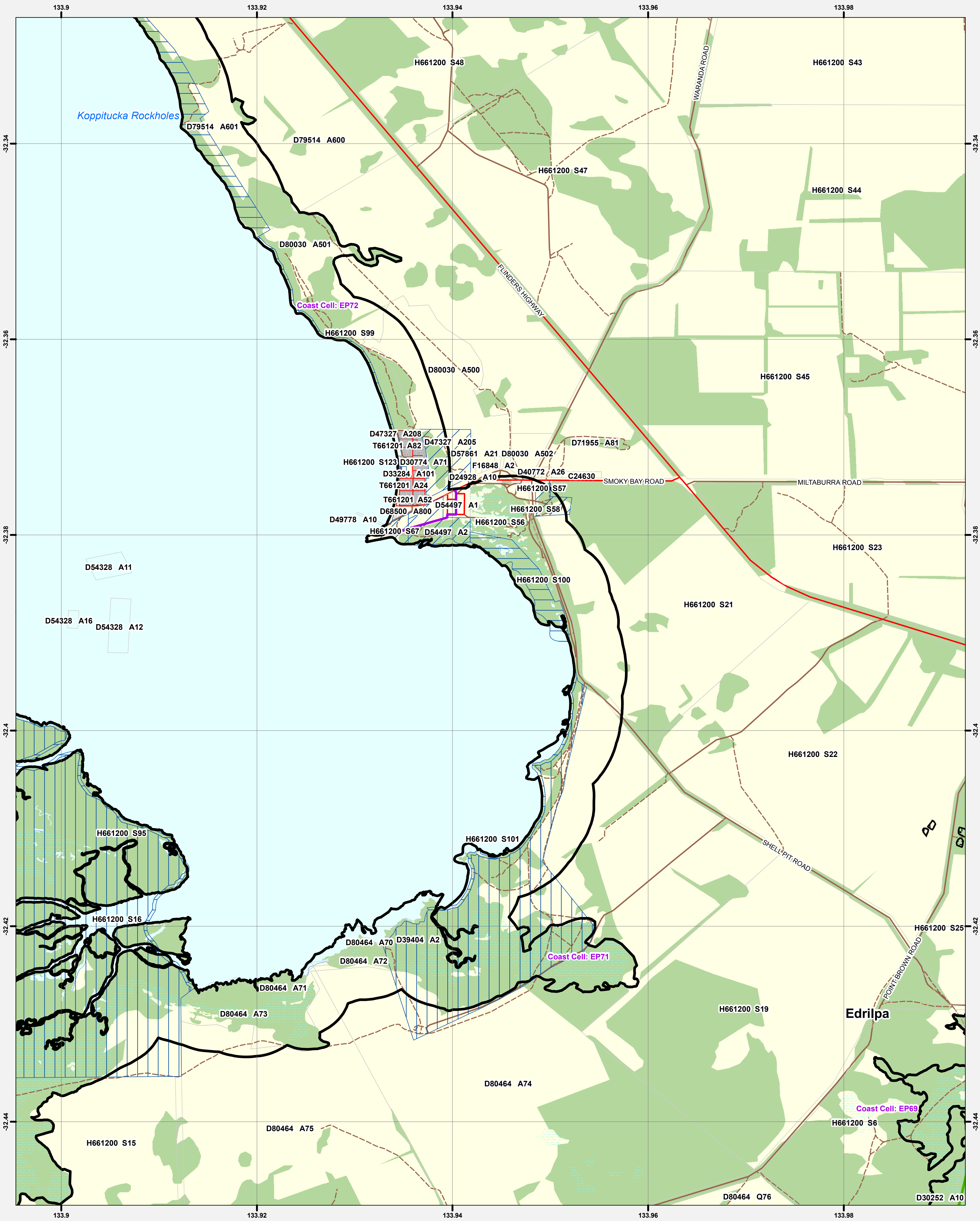
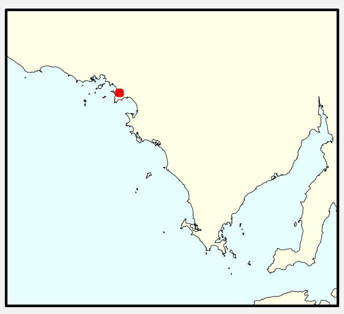
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 103





0 2.5

Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary

Coastal Cells

Sewerage Filtration Bed, Effluent Pond

Stockpile, Slag Heap, Storage Dump, Tailing Pond

Rubbish Dump

Quarries

Reefs

Built Up Area

Native Vegetation

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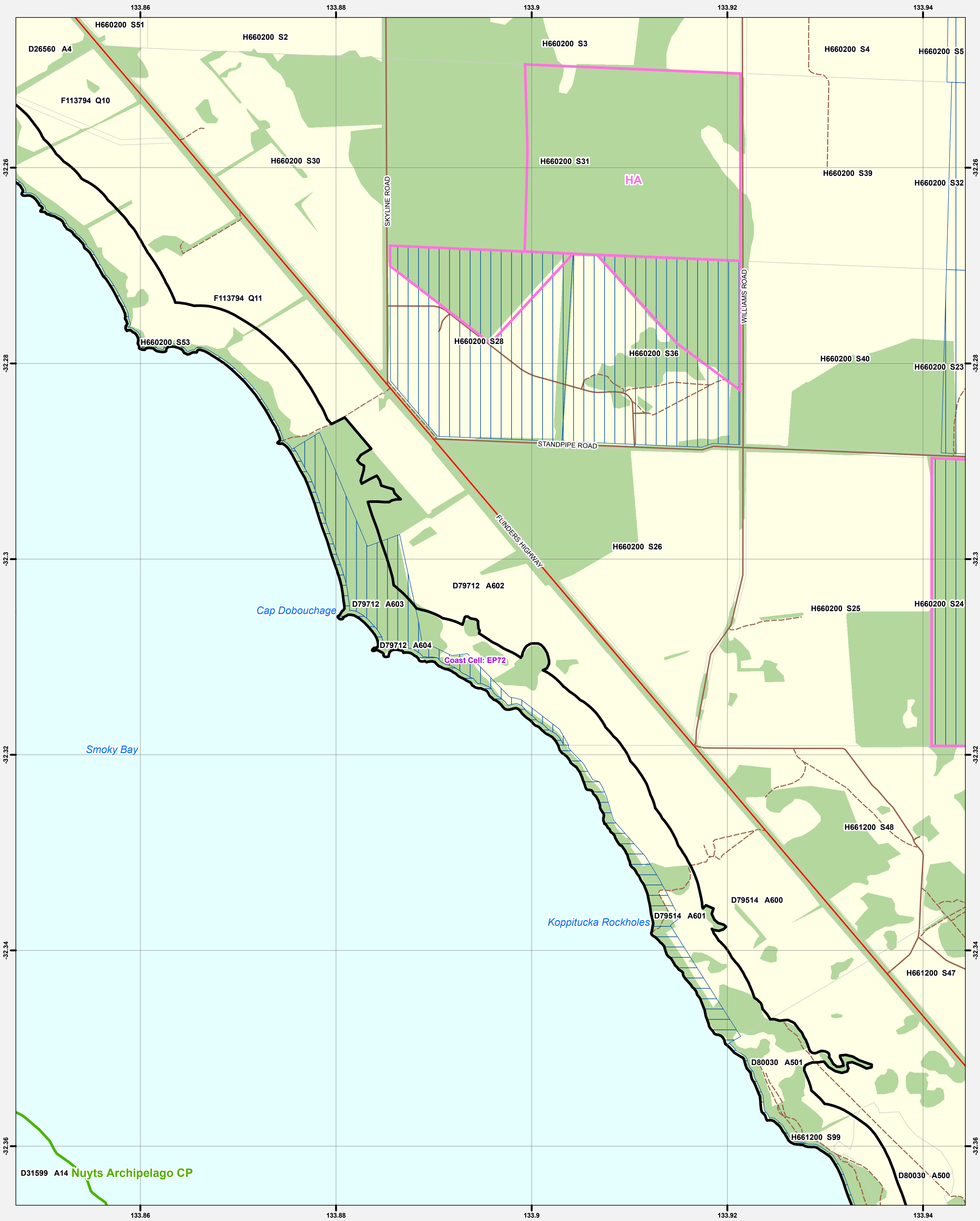
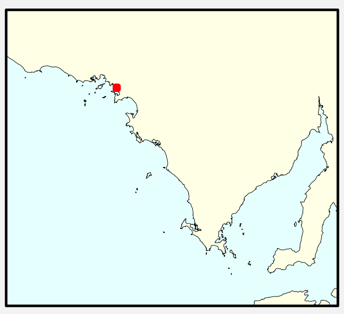
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 104





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Kms

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Compiled	12 October 2010
Projection	Geographic
Datum	Geocentric Datum of Australia, 1994

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

Government of South Australia
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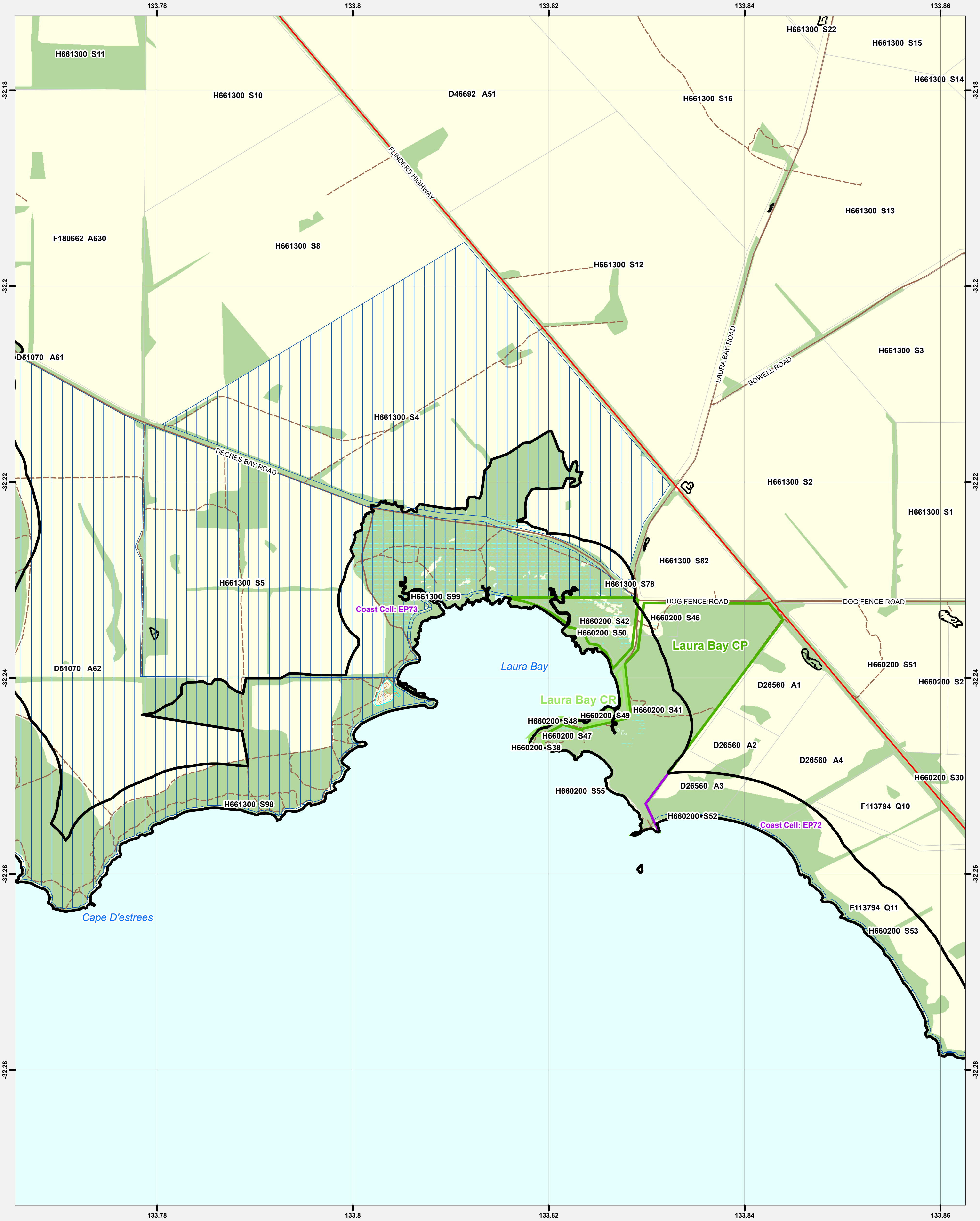
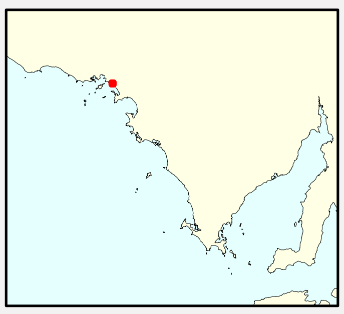
Eyre Peninsula Coastal Action Plan

Map Block 105





0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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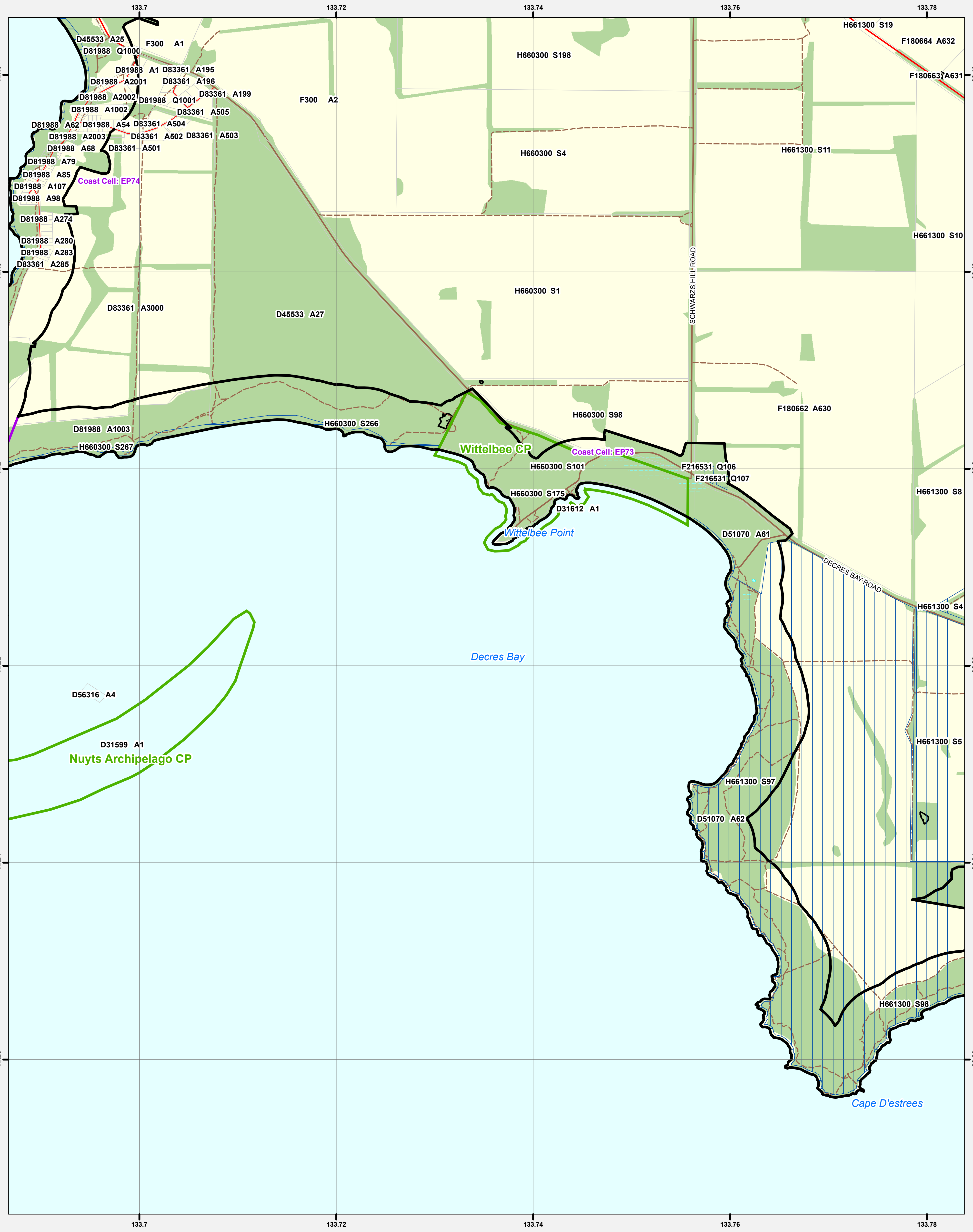
Eyre Peninsula Coastal Action Plan
Map Block 106



Navigation Marks
Light Colour
Unknown Light
CLEAR
CLEAR/RED
GREEN
ORANGE
RED
WHITE/RED
YELLOW

Roads
Road Feature Codes
Highway (divided)
Sealed
Unsealed
Vehicular Track
Sealed within Builtup Area
Unsealed within Builtup Area
Under Construction

Protected Areas
Reserve Type
National Park
Conservation Park
Conservation Reserve
Wilderness Protection Area
Vegetation Heritage Agreement
Aquatic Reserves
DCDB Parcels

Waterbodies
Type
Lake - Perennial
Dam, Reservoir
Dam, Reservoir
Inland Water Feature
Lake - Intermittent
Lake - Mainly Dry
Land Subject to Inundation (STI)
Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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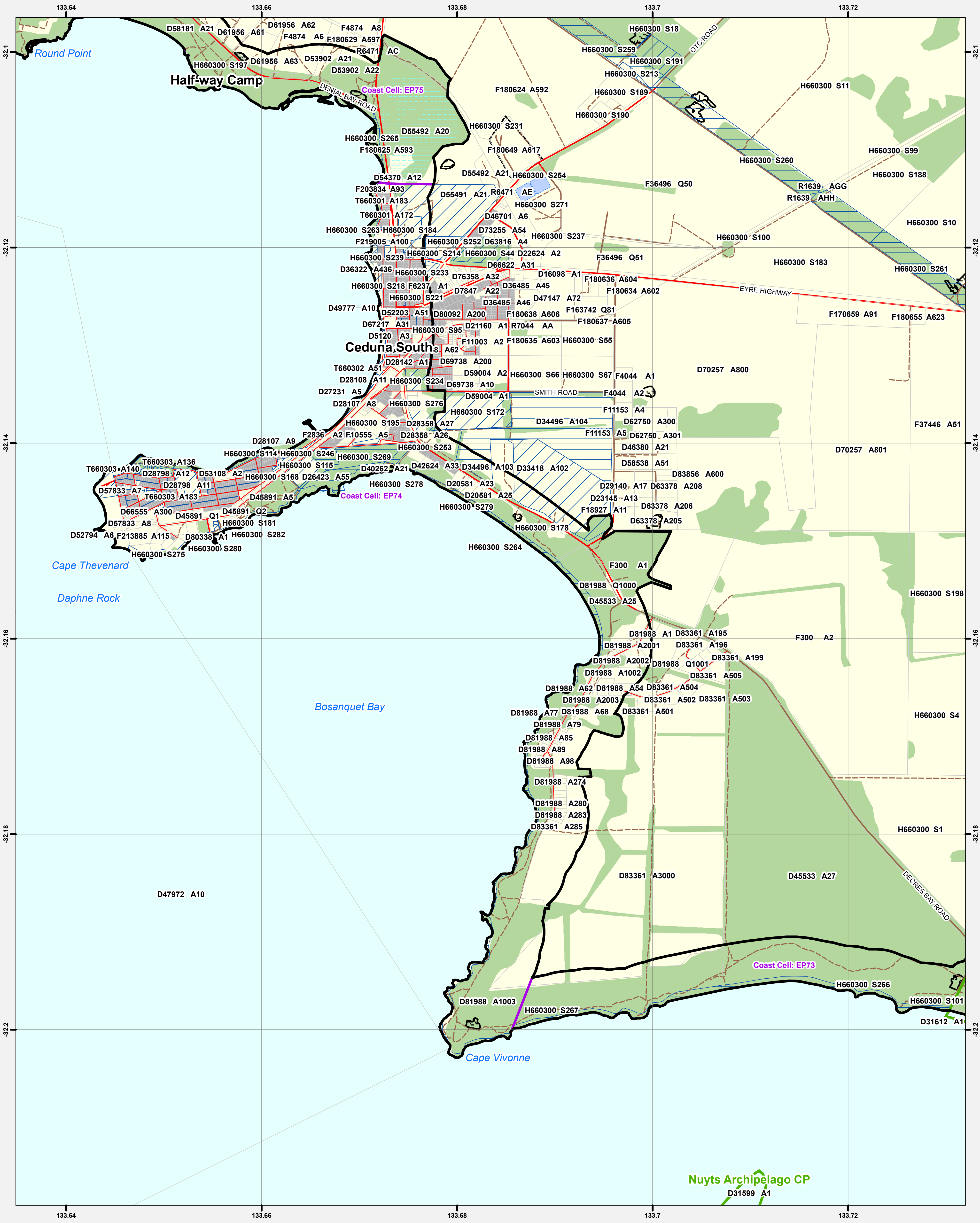
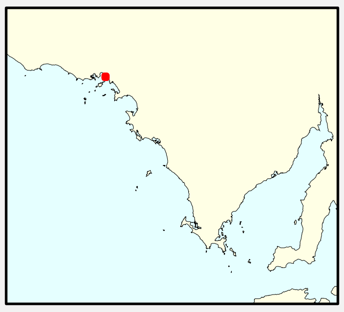
Eyre Peninsula Coastal Action Plan

Map Block 107





Navigation Marks	Roads	Protected Areas	Waterbodies	
Light Colour	Road Feature Codes	Reserve Type	Type	Coastal Boundary
Unknown Light	Highway (divided)	National Park	Lake - Perennial	Coastal Cells
CLEAR	Sealed	Conservation Park	Dam, Reservoir	Sewerage Filtration Bed, Effluent Pond
CLEAR/RED	Unsealed	Conservation Reserve	Dam, Reservoir	Stockpile, Slag Heap, Storage Dump, Tailing Pond
GREEN	Vehicular Track	Wilderness Protection Area	Inland Water Feature	Rubbish Dump
ORANGE	Sealed within Builtup Area	Vegetation Heritage Agreement	Lake - Intermittent	Quarries
RED	Unsealed within Builtup Area	Aquatic Reserves	Lake - Mainly Dry	Reefs
WHITE/RED	Under Construction	DCDB Parcels	Land Subject to Inundation (STI)	Built Up Area
YELLOW			Land Subject to Flooding (STF)	Native Vegetation

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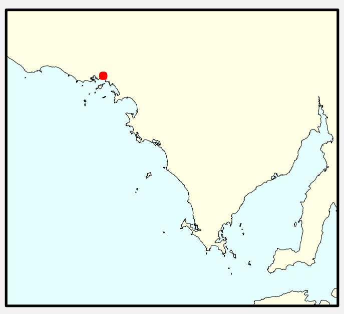
Eyre Peninsula Coastal Action Plan
Map Block 108



0 2.5
Kms

N

Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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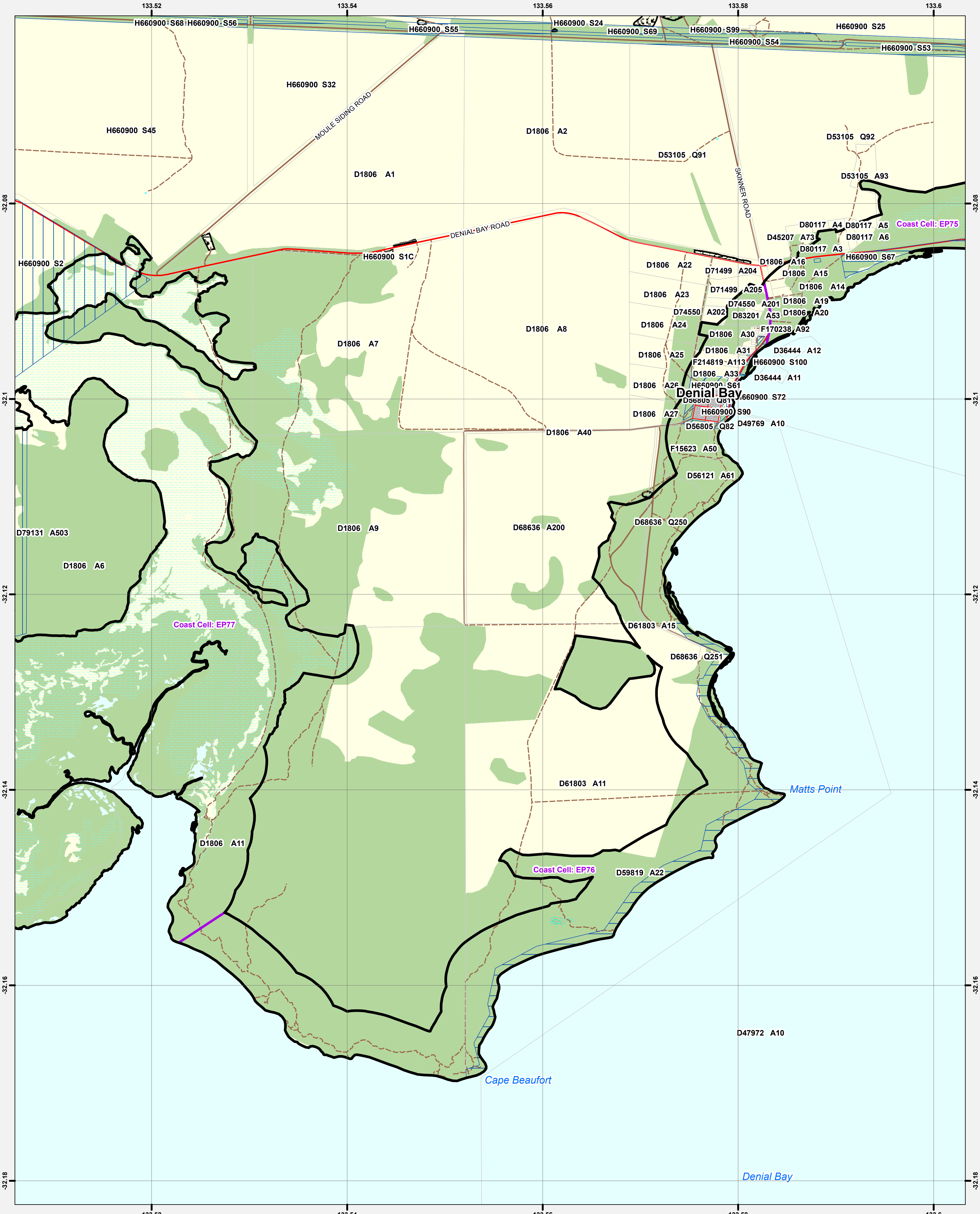
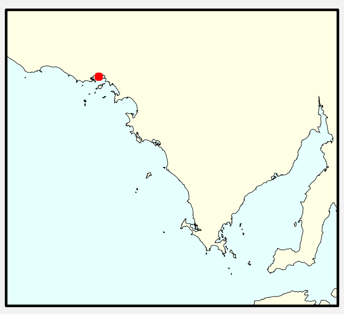
Eyre Peninsula Coastal Action Plan

Map Block 109





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Projection: Geographic

Datum: Geocentric Datum of Australia, 1994

Navigation Marks – Light Colour: Unknown Light; CLEAR; CLEAR/RED; GREEN; ORANGE; RED; WHITE/RED; YELLOW

Roads – Road Feature Codes: Highway (divided); Sealed; Unsealed; Vehicular Track; Sealed within Builtup Area; Unsealed within Builtup Area; Under Construction

Protected Areas – Reserve Type: National Park; Conservation Park; Conservation Reserve; Wilderness Protection Area; Vegetation Heritage Agreement; Aquatic Reserves; **DCDB Parcels**

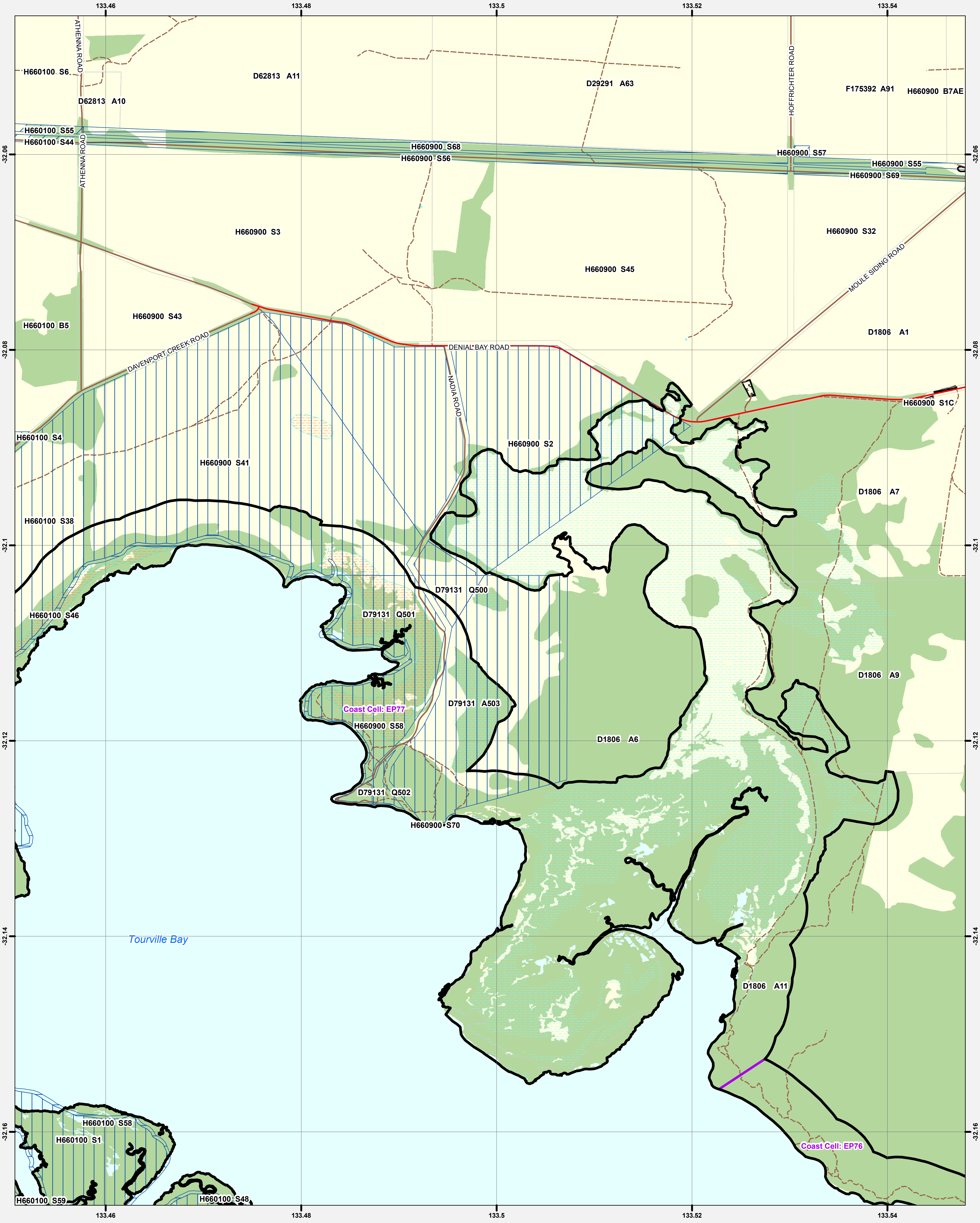
Waterbodies – Type: Lake - Perennial; Dam, Reservoir; Dam, Reservoir; Inland Water Feature; Lake - Intermittent; Lake - Mainly Dry; Land Subject to Inundation (STI); Land Subject to Flooding (STF)

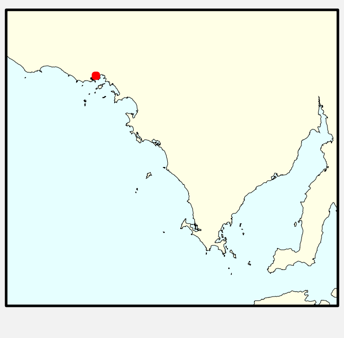
Coastal Boundary; **Coastal Cells**; **Sewerage Filtration Bed, Effluent Pond**; **Stockpile, Slag Heap, Storage Dump, Tailing Pond**; **Rubbish Dump**; **Quarries**; **Reefs**; **Built Up Area**; **Native Vegetation**

Government of South Australia
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 110





Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
- Rubbish Dump
- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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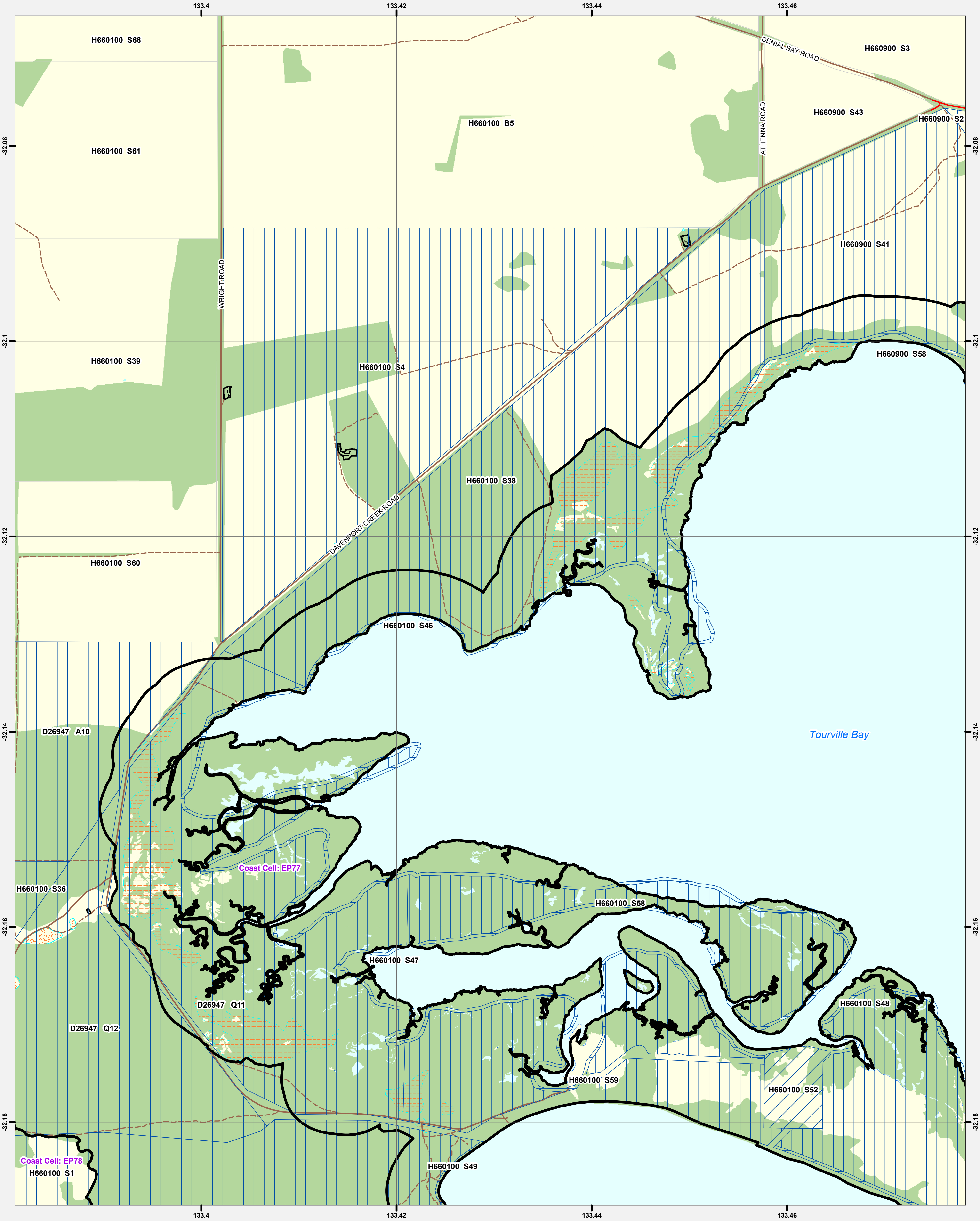
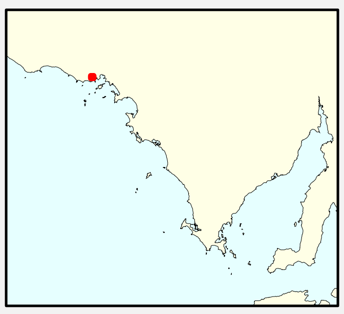
Eyre Peninsula Coastal Action Plan

Map Block 111





0 2.5

Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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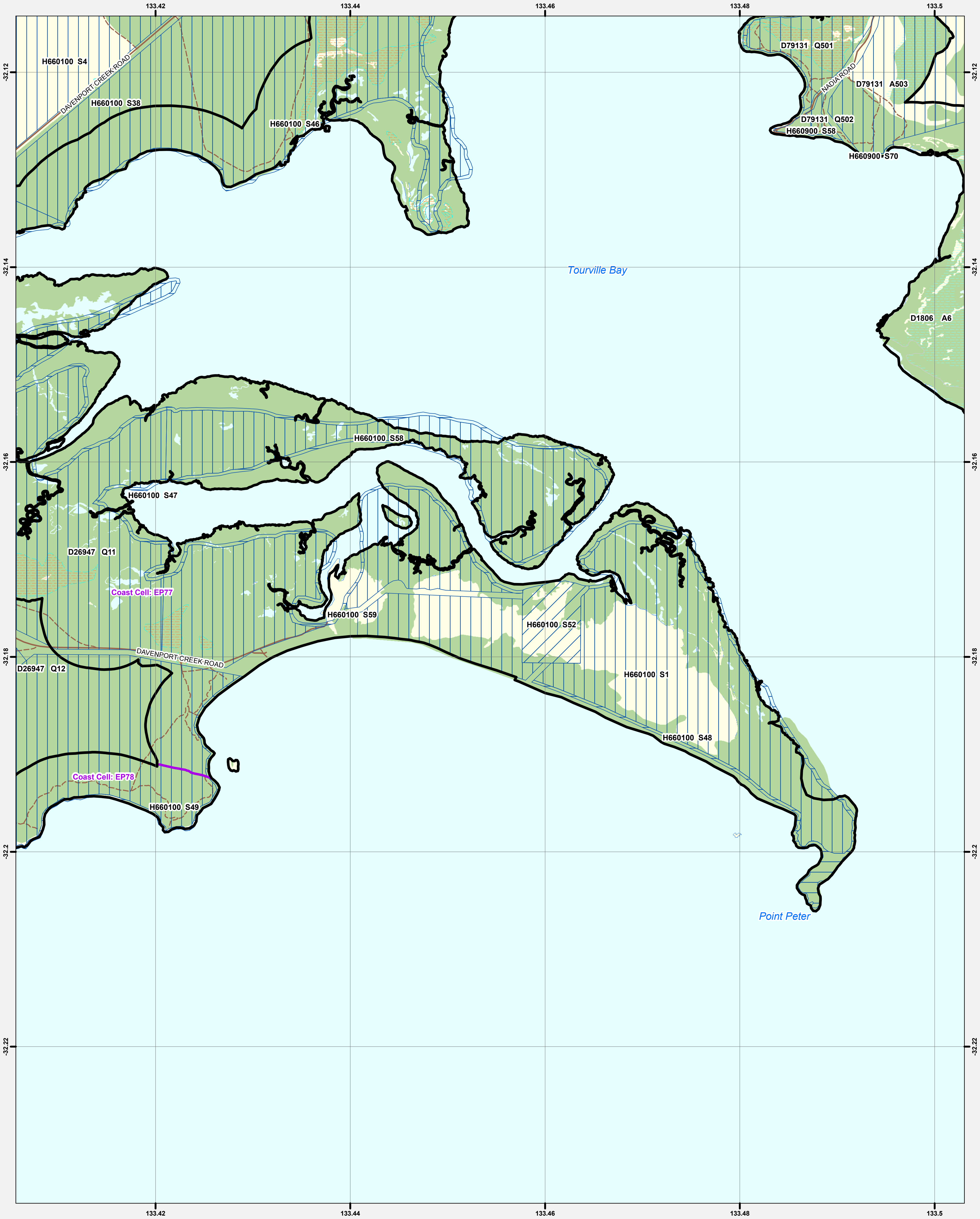
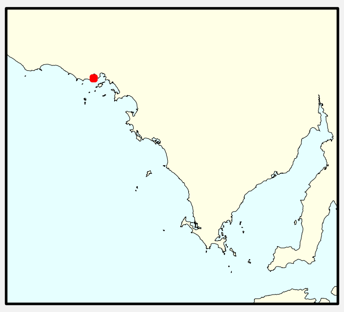
Eyre Peninsula Coastal Action Plan

Map Block 112





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Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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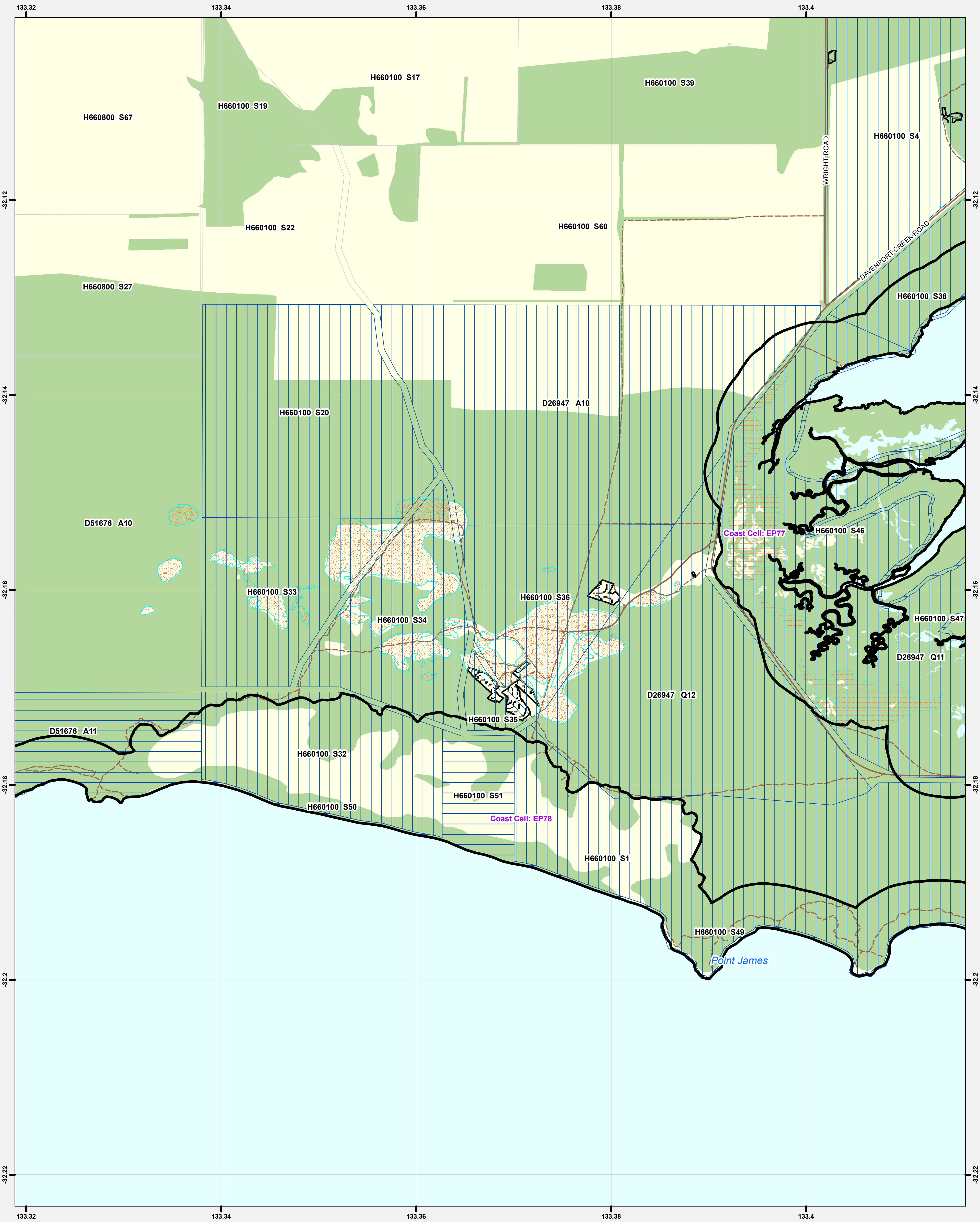
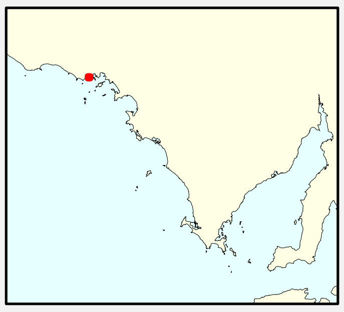
Eyre Peninsula Coastal Action Plan

Map Block 113





0 2.5

Kms

N

Navigation Marks

Light Colour

- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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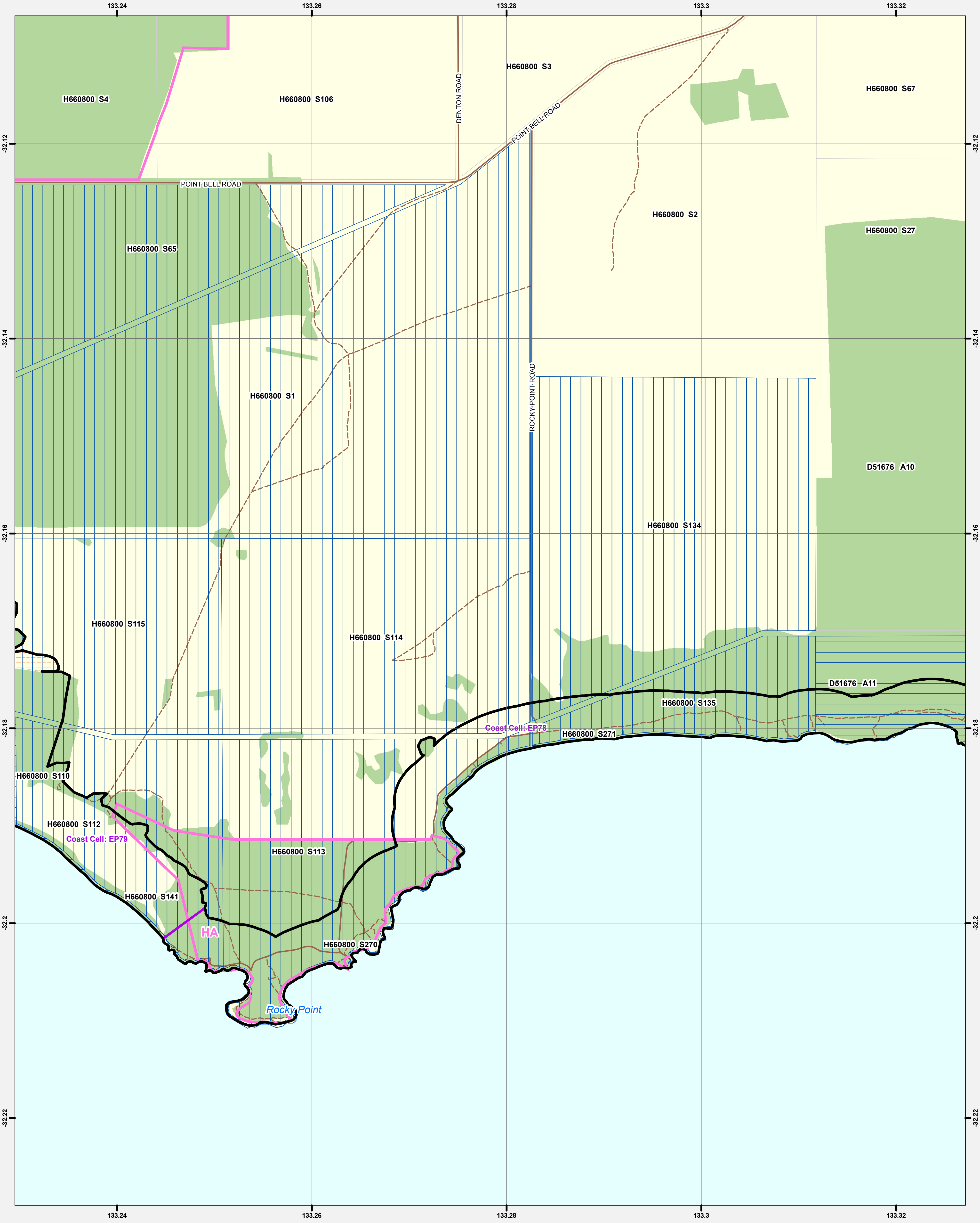
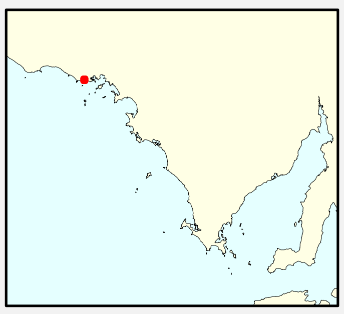
Eyre Peninsula Coastal Action Plan

Map Block 114





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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
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- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
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- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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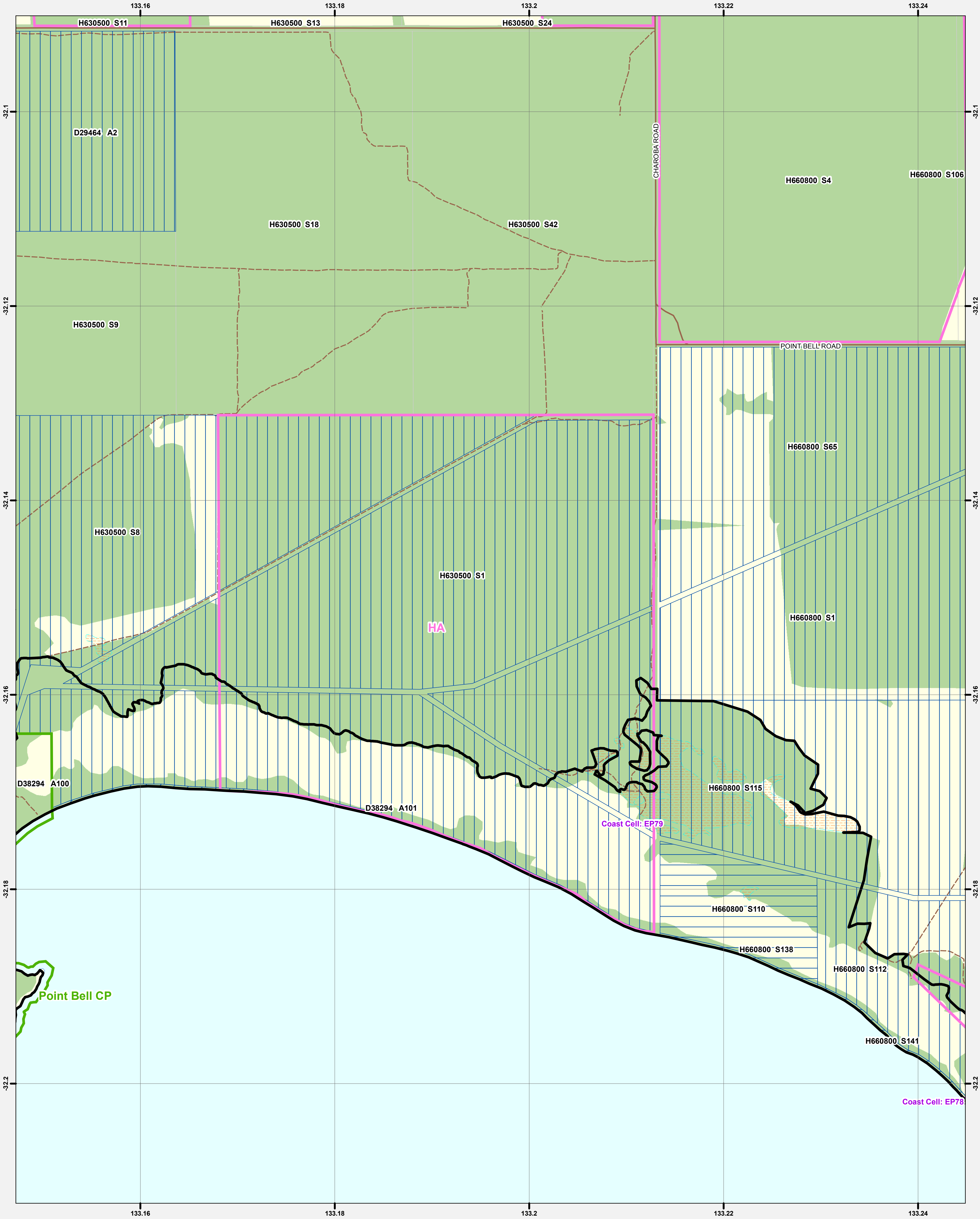
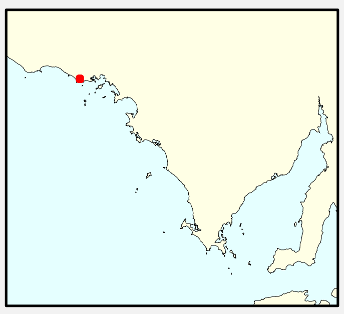
Eyre Peninsula Coastal Action Plan

Map Block 115





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Navigation Marks
Light Colour
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- CLEAR/RED
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- ORANGE
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- YELLOW

Roads
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- Aquatic Reserves
- DCDB Parcels

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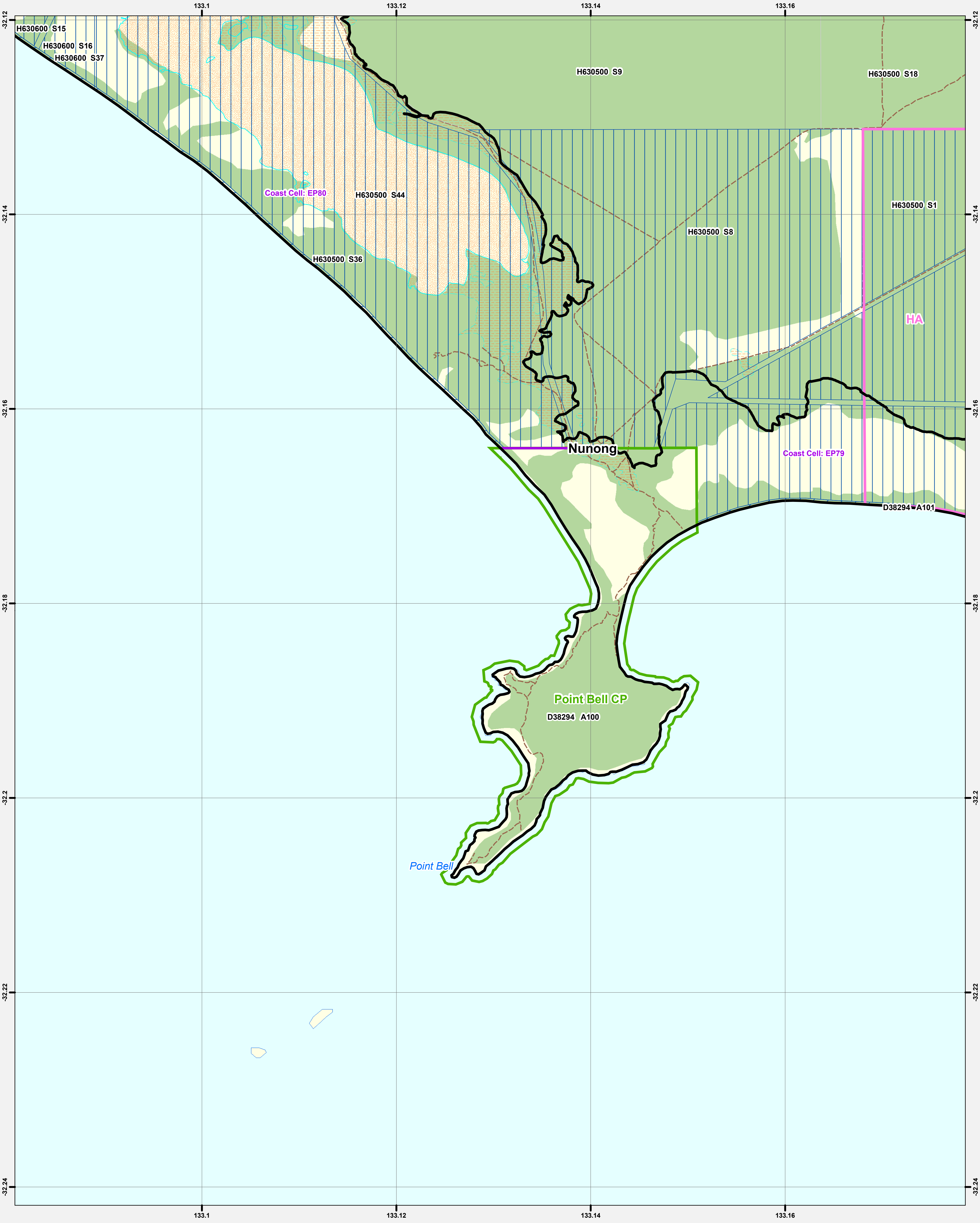
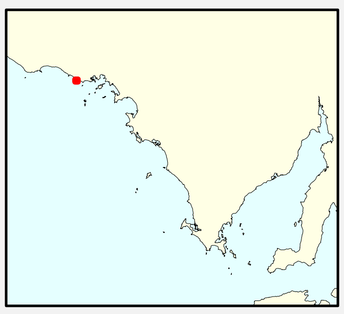
Map Block 116





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Navigation Marks
Light Colour
- Unknown Light
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- YELLOW

Roads
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Protected Areas
Reserve Type
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- **DCDB Parcels**

Waterbodies
Type
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- **Coastal Boundary**
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- **Native Vegetation**

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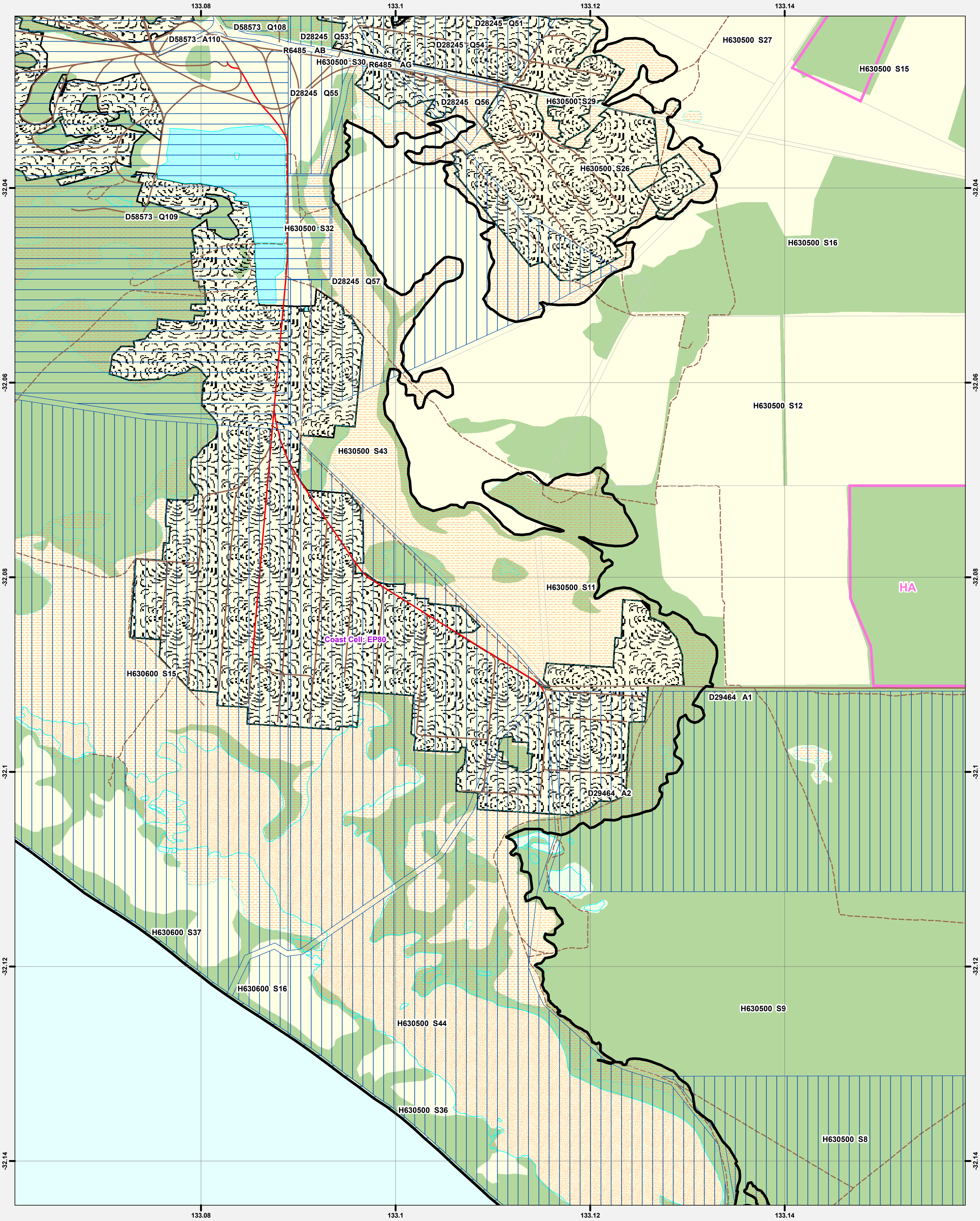
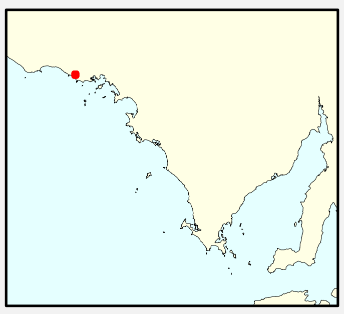
Eyre Peninsula Coastal Action Plan
Map Block 117





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Protected Areas
Reserve Type
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- Conservation Reserve
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DCDB Parcels

Waterbodies
Type
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- Land Subject to Flooding (STF)

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- Quarries
- Reefs
- Built Up Area
- Native Vegetation

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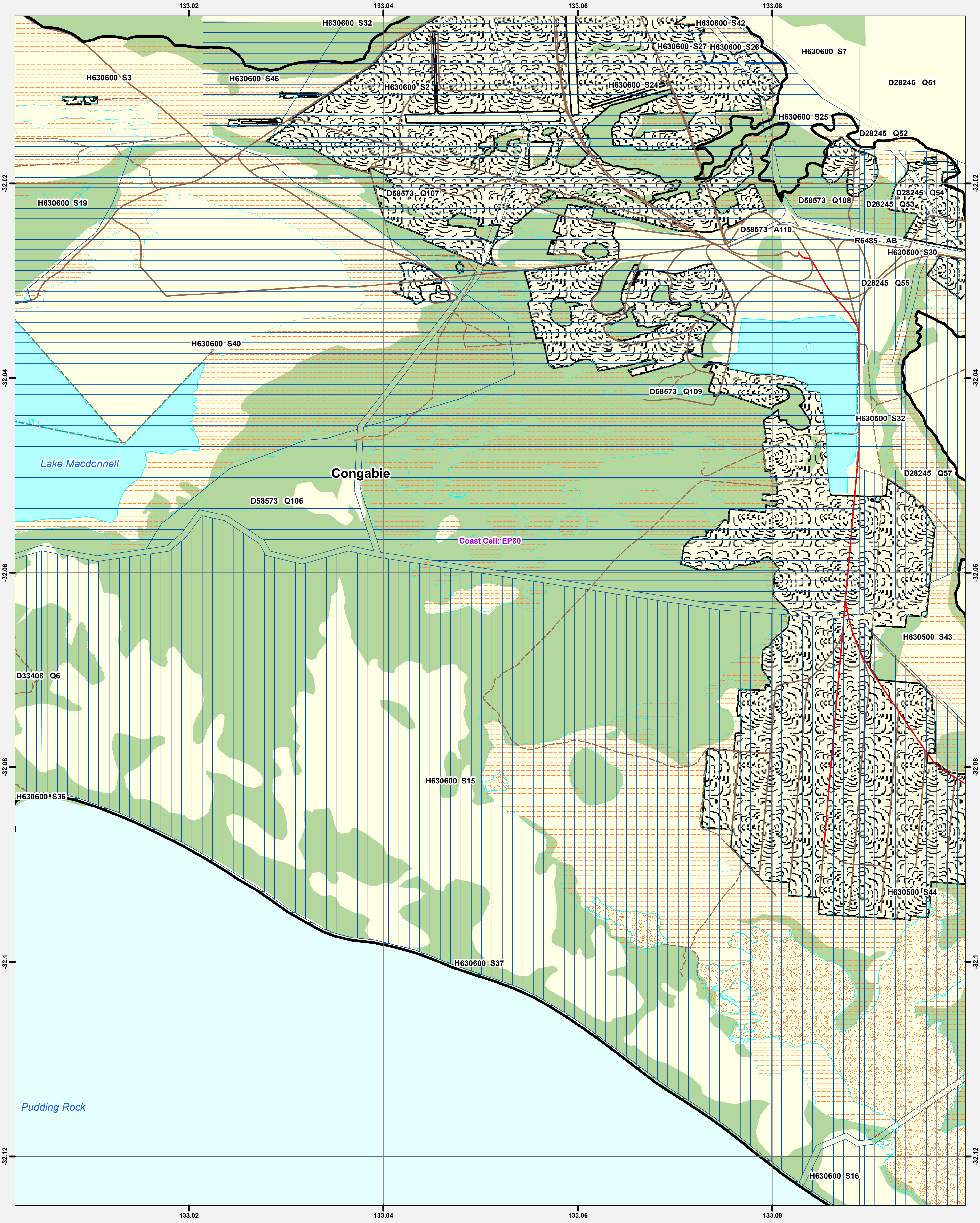
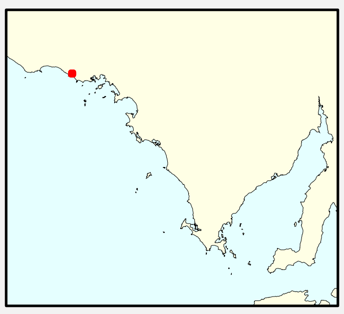
Eyre Peninsula Coastal Action Plan

Map Block 118





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Navigation Marks

Light Colour

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- CLEAR/RED
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- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
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- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

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- Conservation Reserve
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- **DCDB Parcels**

Waterbodies

Type

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- Dam, Reservoir
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- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
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- **Native Vegetation**

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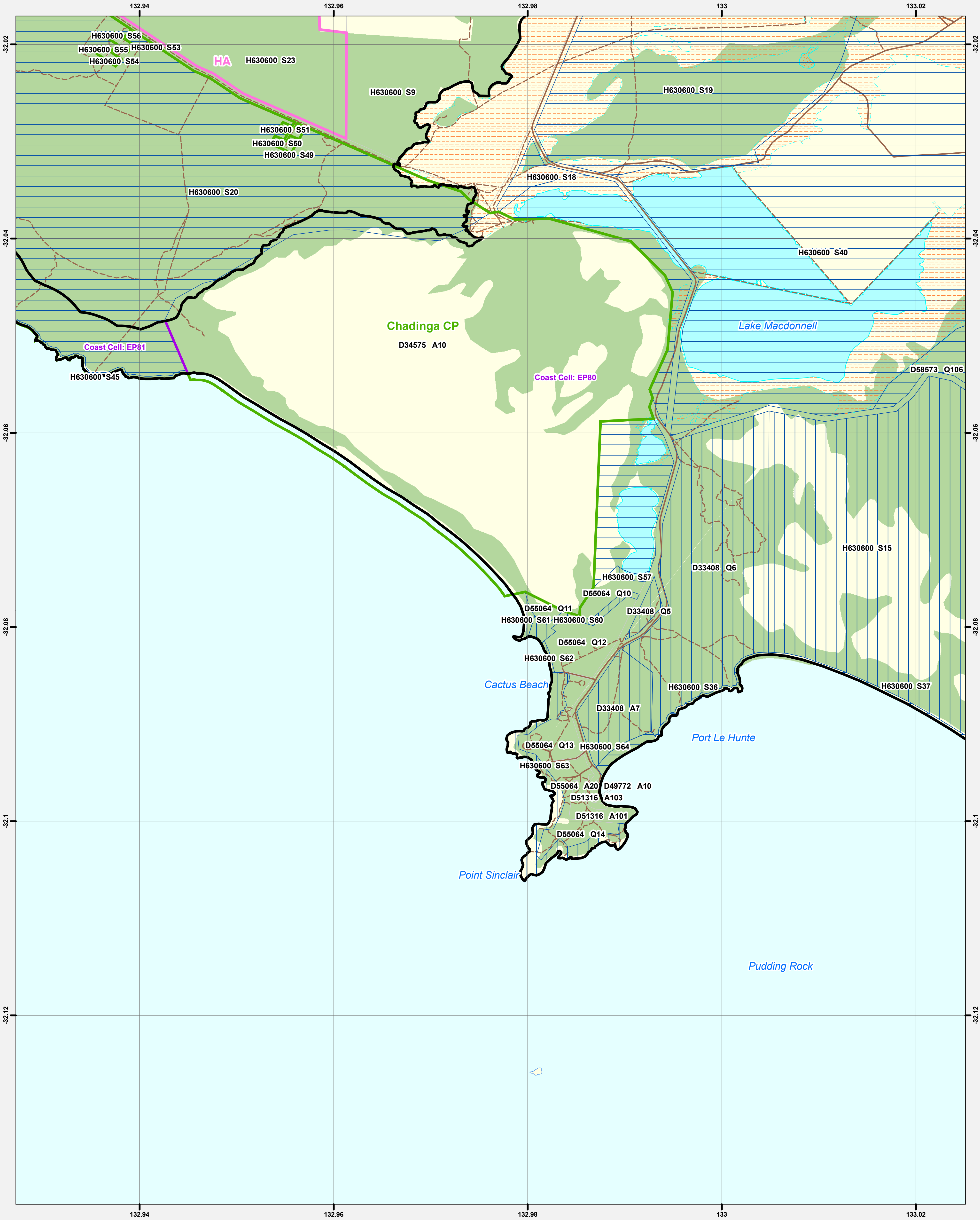
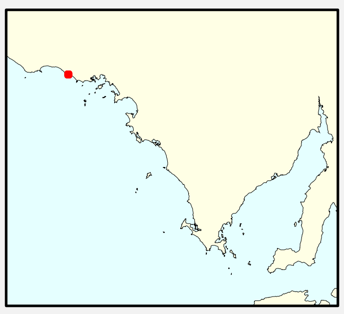
Map Block 119





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Navigation Marks
Light Colour
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- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
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- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
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- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
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- Dam, Reservoir
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- **Coastal Boundary**
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- **Sewerage Filtration Bed, Effluent Pond**
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- **Reefs**
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- **Native Vegetation**

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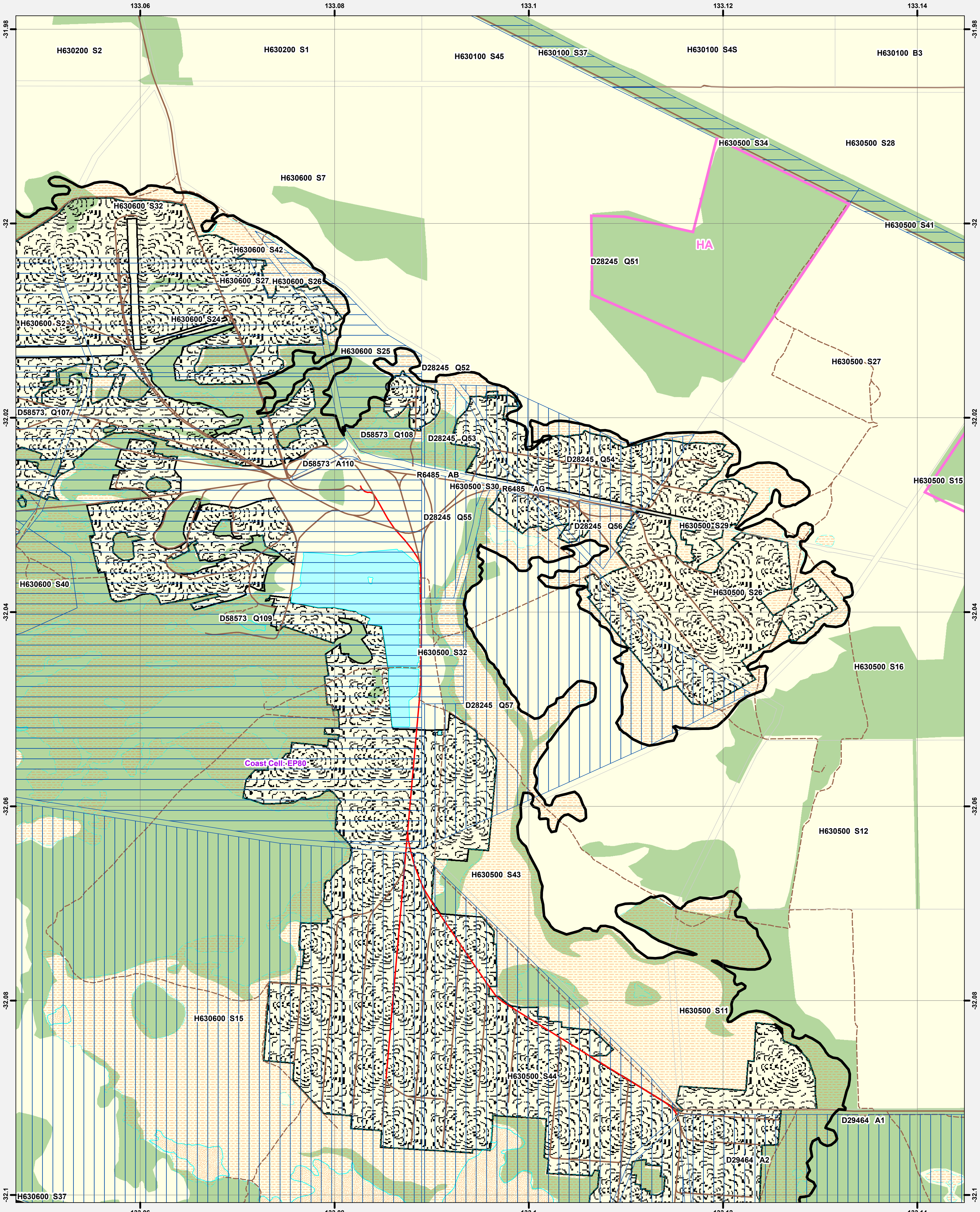
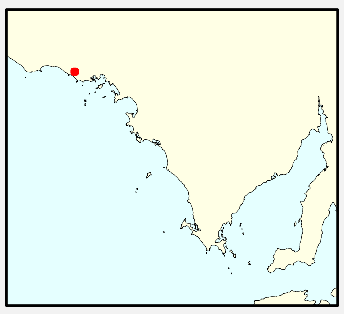
Map Block 120





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Navigation Marks
Light Colour
- Unknown Light
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- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
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- Vehicular Track
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- Unsealed within Builtup Area
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Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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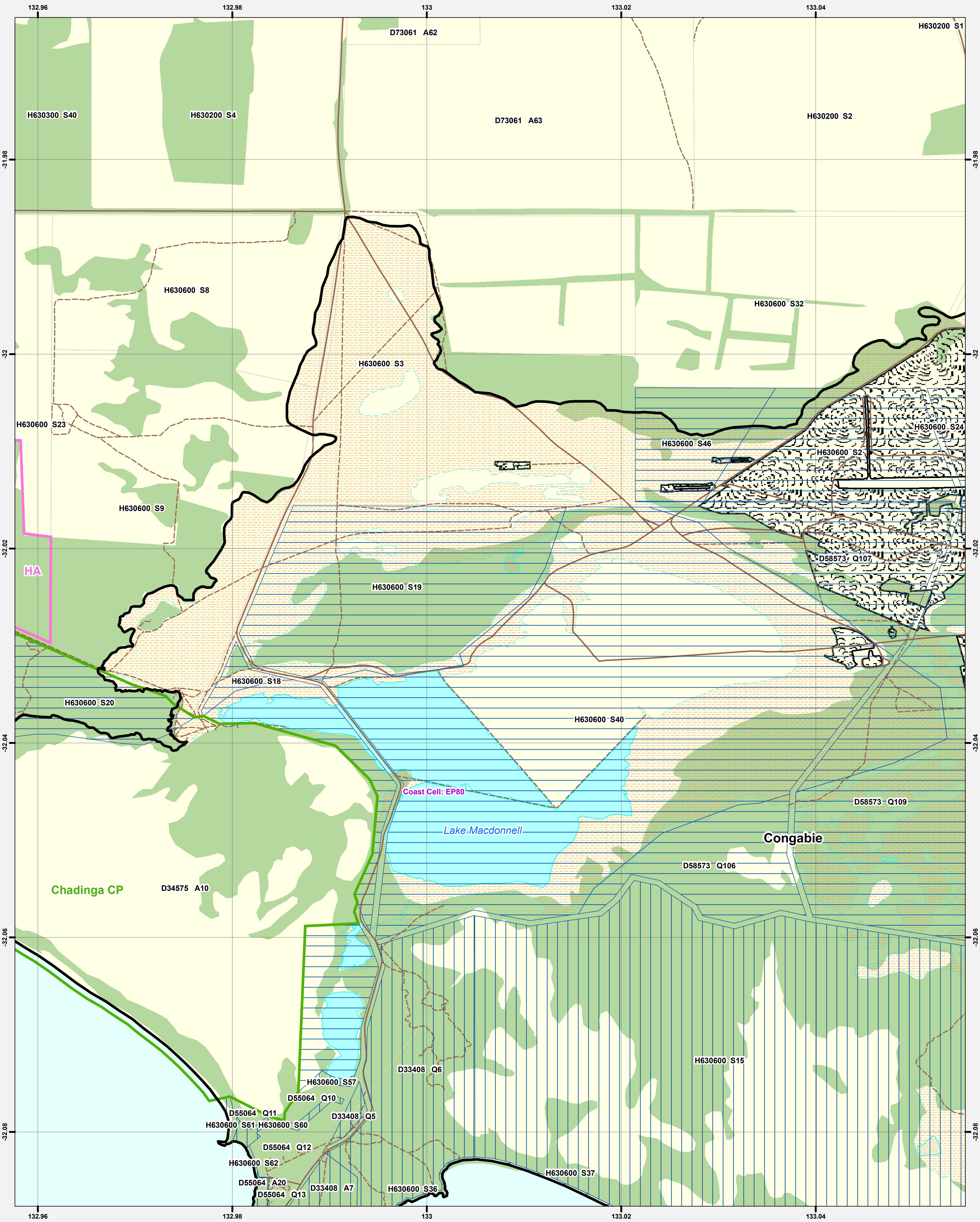
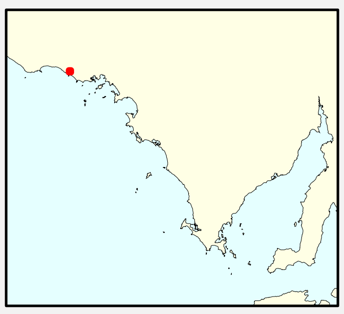
Map Block 121





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Navigation Marks
Light Colour
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- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
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DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
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- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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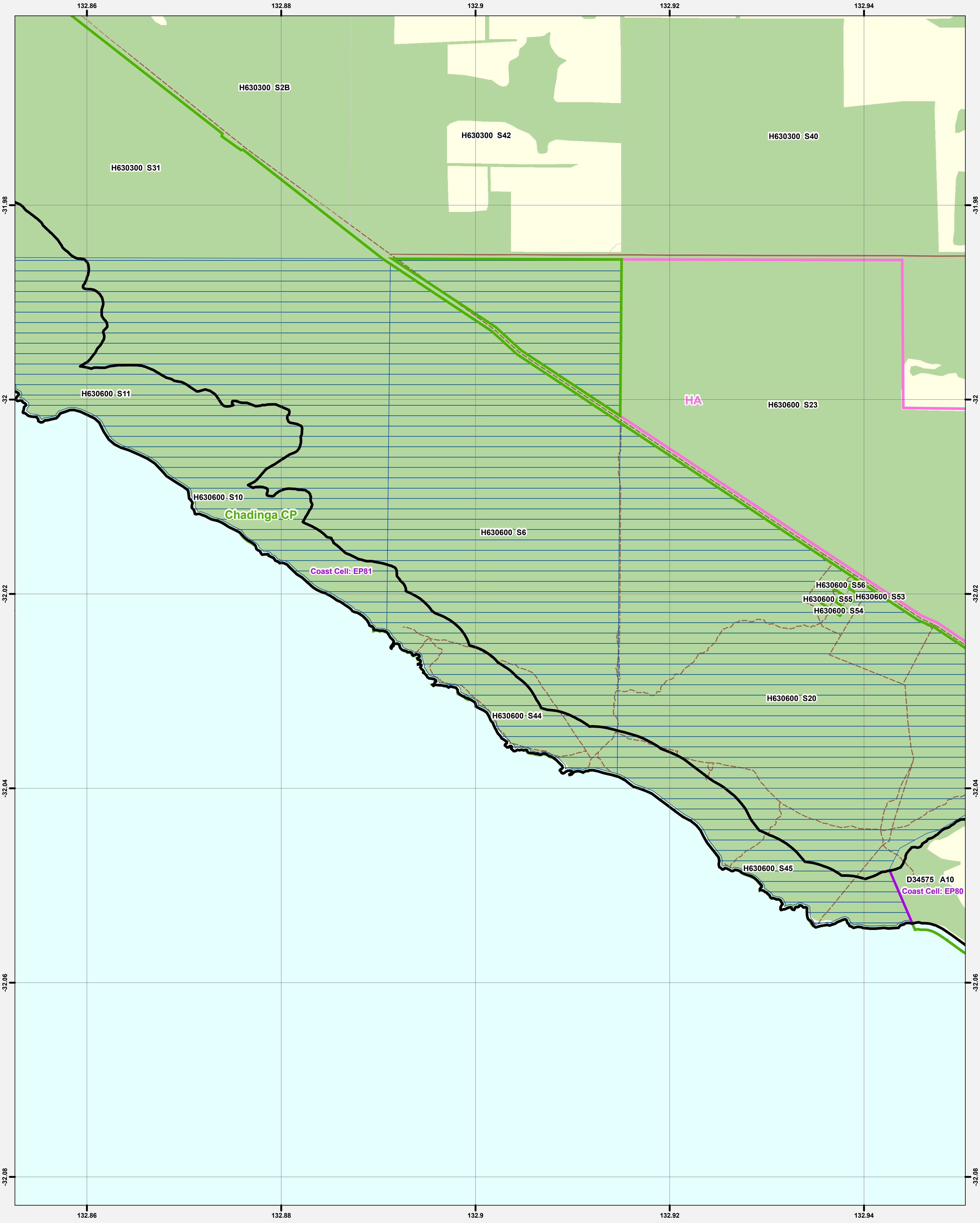
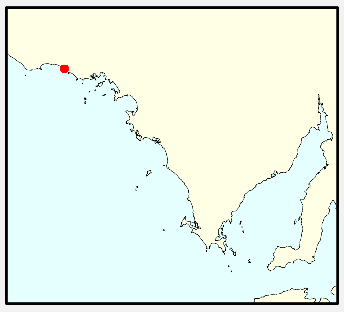
Eyre Peninsula Coastal Action Plan

Map Block 122





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Kms

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Navigation Marks

Light Colour

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- CLEAR/RED
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- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads

Road Feature Codes

- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas

Reserve Type

- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves
- **DCDB Parcels**

Waterbodies

Type

- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
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- **Coastal Boundary**
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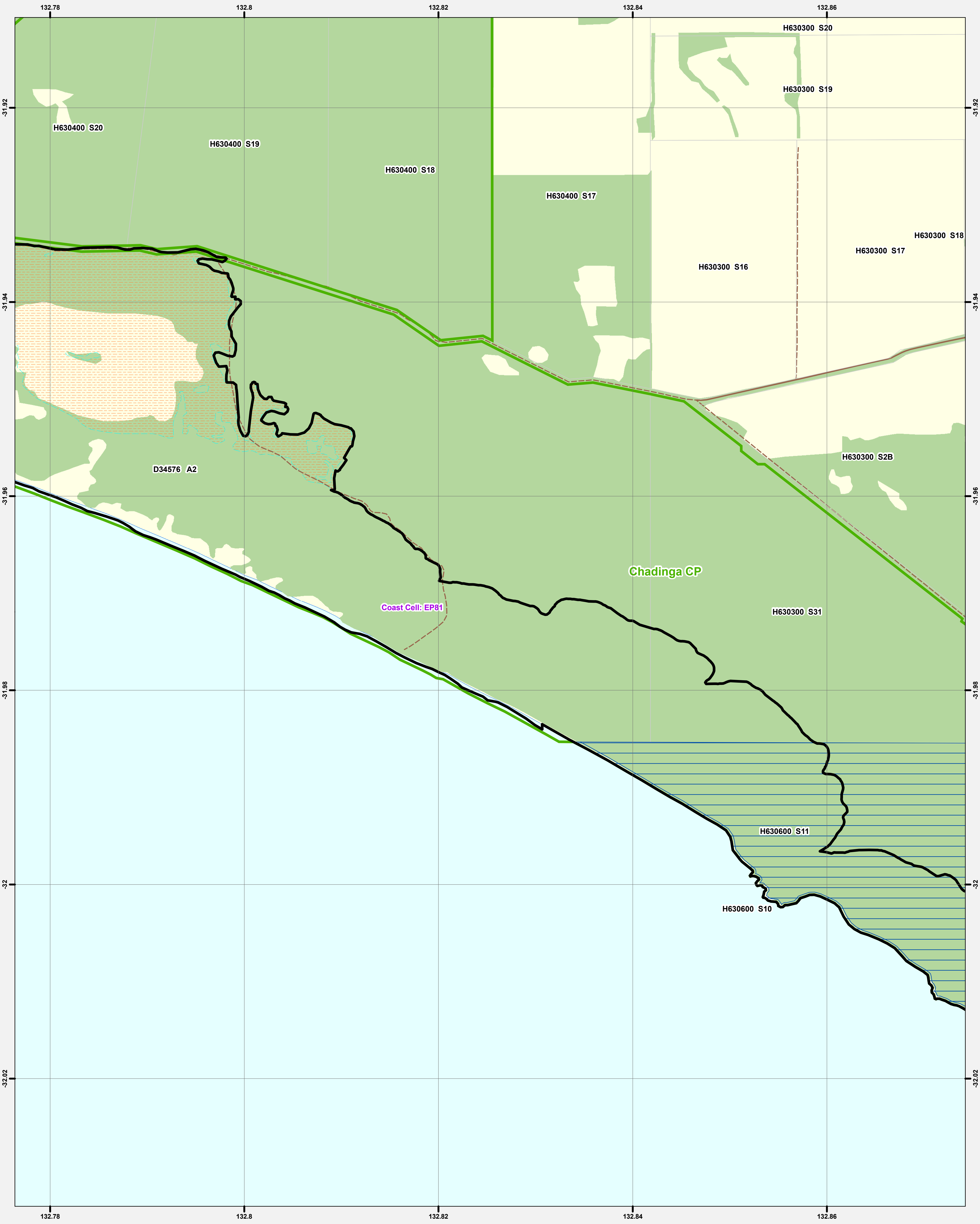
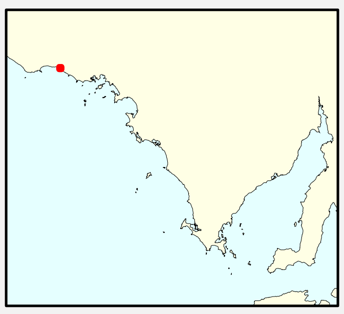
Eyre Peninsula Coastal Action Plan
Map Block 123





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Navigation Marks
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Protected Areas
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DCDB Parcels

Waterbodies
Type
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- Dam, Reservoir
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- Coastal Cells
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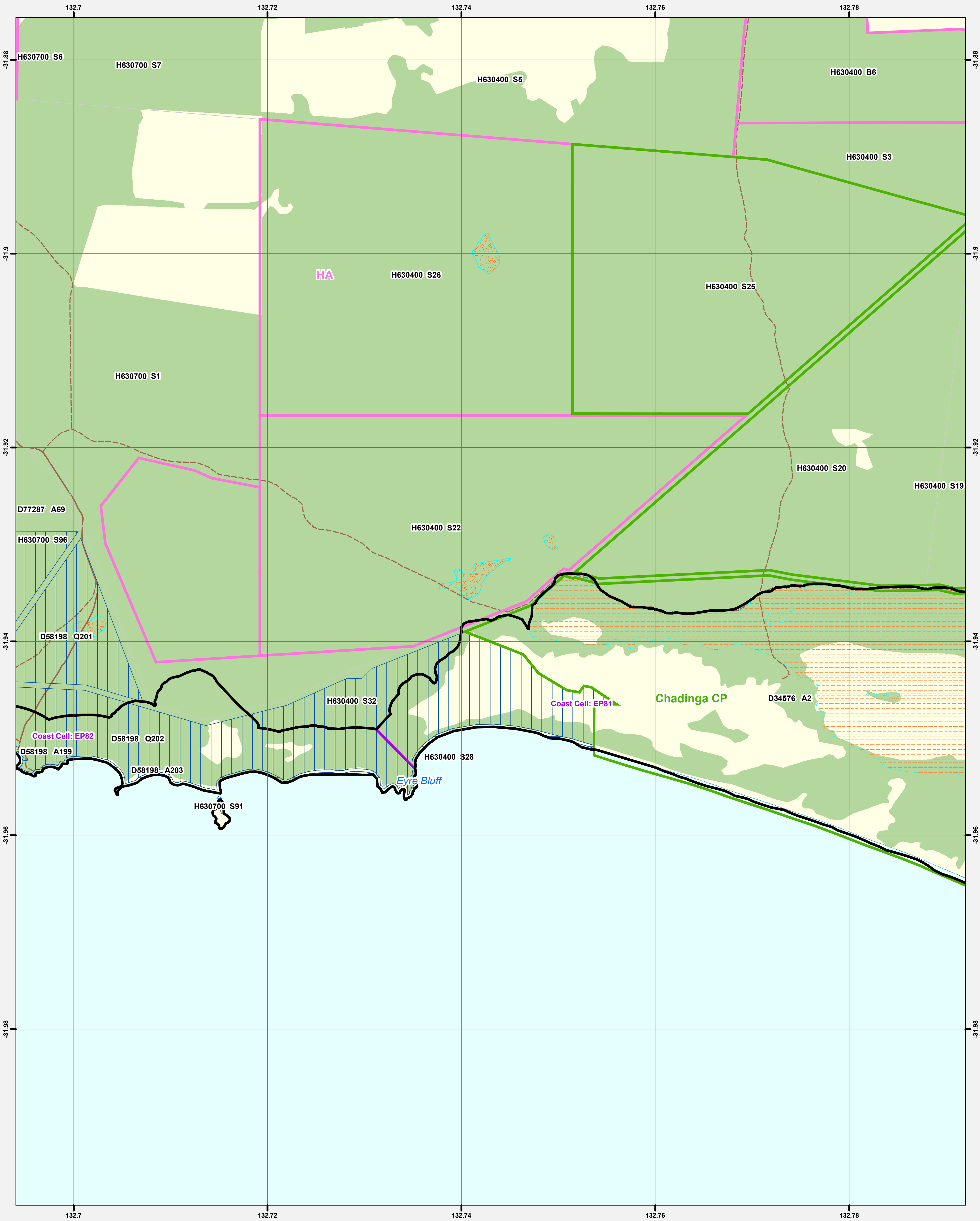
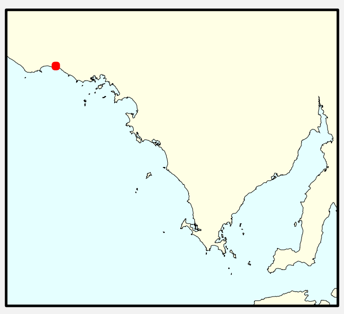
Map Block 124





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Navigation Marks
Light Colour
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Roads
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- Vehicular Track
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- Unsealed within Builtup Area
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Protected Areas
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- Wilderness Protection Area
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- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
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- Dam, Reservoir
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- **Coastal Boundary**
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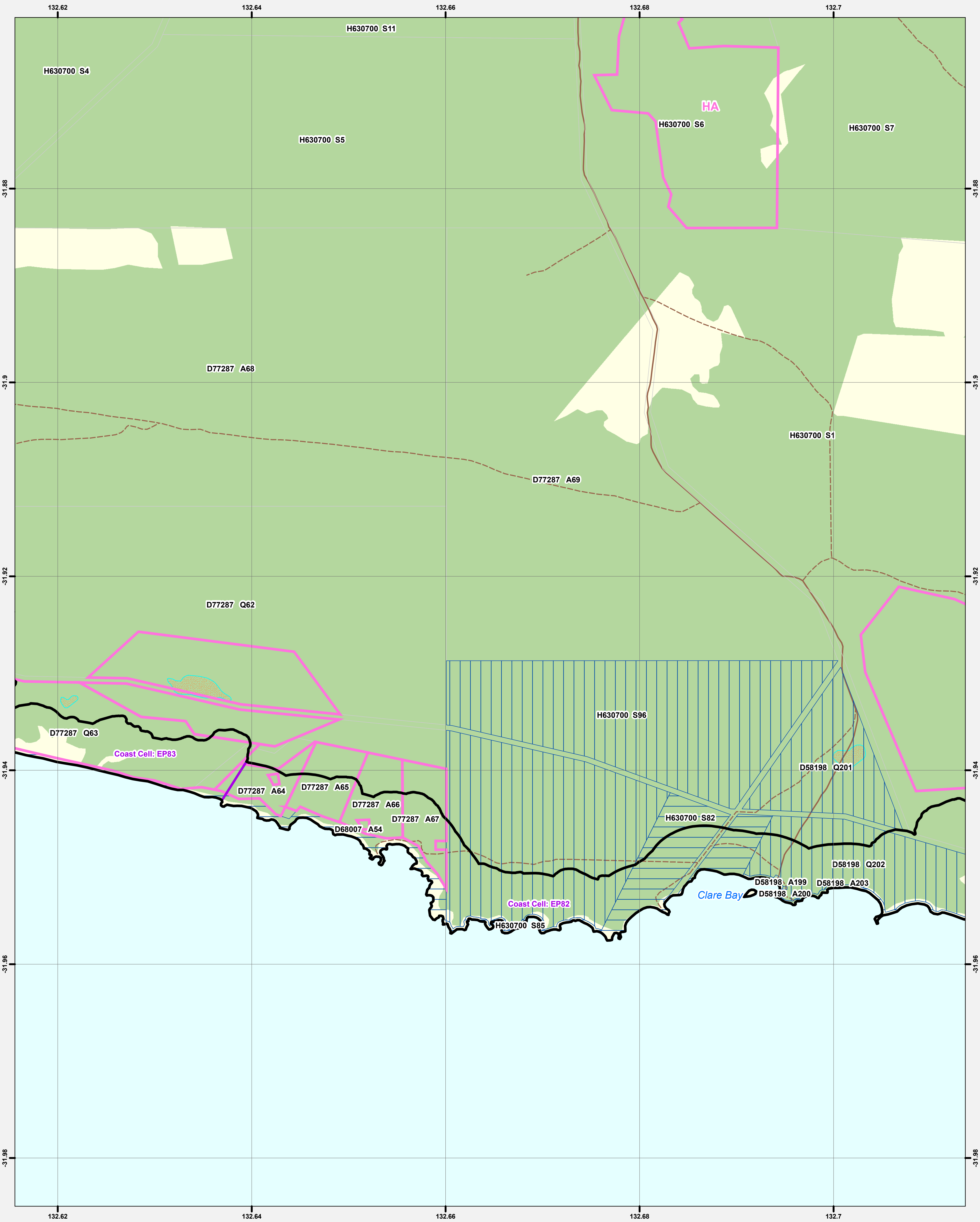
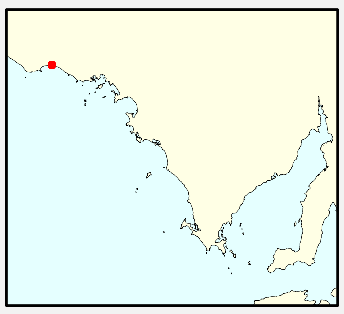
Eyre Peninsula Coastal Action Plan

Map Block 125





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Kms

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Navigation Marks
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- Aquatic Reserves
- DCDB Parcels

Waterbodies
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- Dam, Reservoir
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- Land Subject to Flooding (STF)

- Coastal Boundary
- Coastal Cells
- Sewerage Filtration Bed, Effluent Pond
- Stockpile, Slag Heap, Storage Dump, Tailing Pond
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- Quarries
- Reefs
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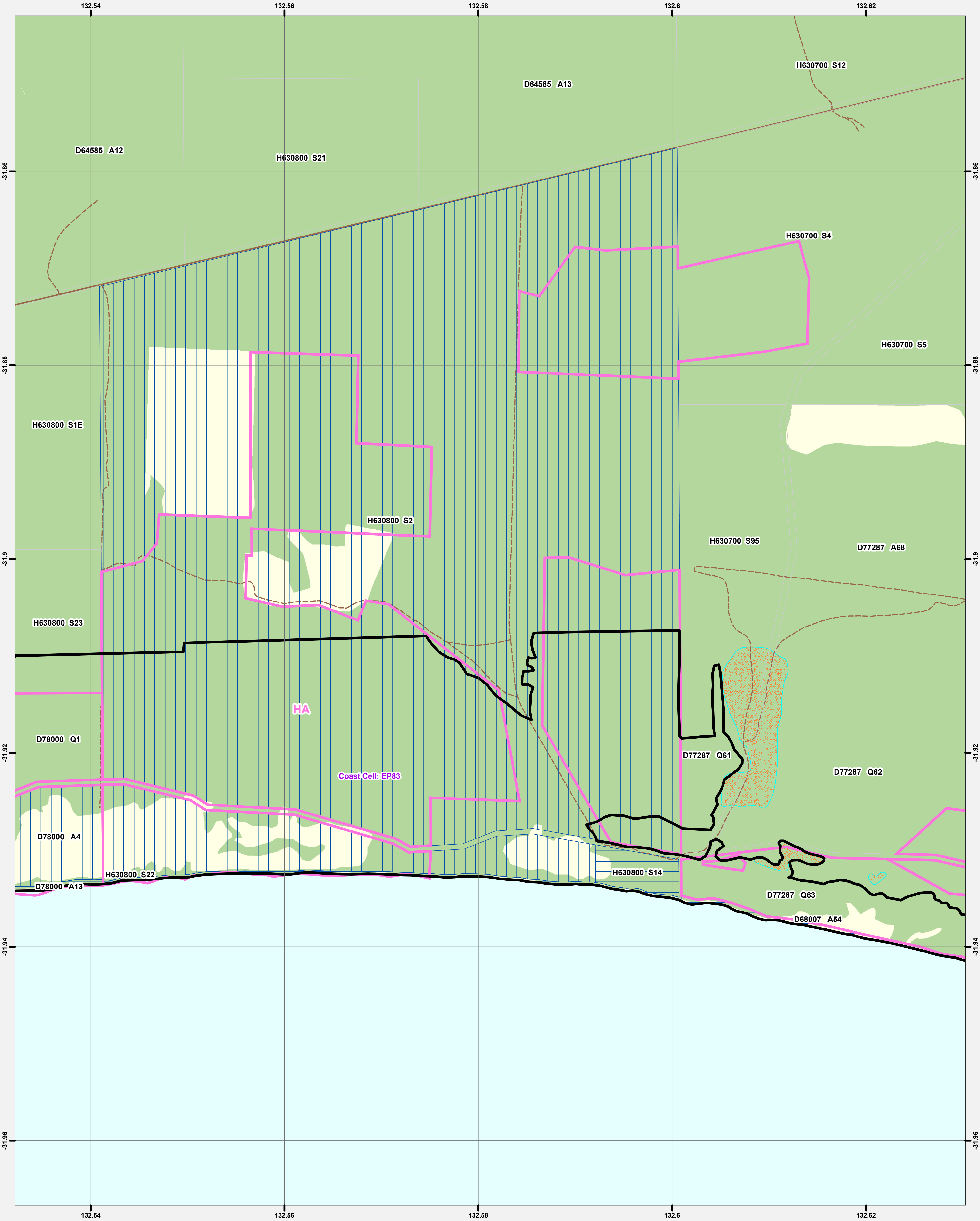
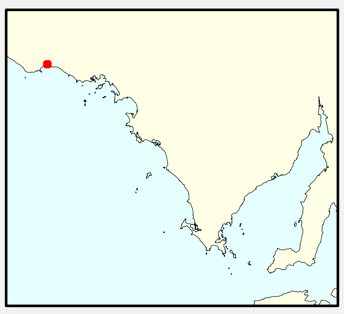
Eyre Peninsula Coastal Action Plan

Map Block 126





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Kms

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Navigation Marks
Light Colour
- Unknown Light
- CLEAR
- CLEAR/RED
- GREEN
- ORANGE
- RED
- WHITE/RED
- YELLOW

Roads
Road Feature Codes
- Highway (divided)
- Sealed
- Unsealed
- Vehicular Track
- Sealed within Builtup Area
- Unsealed within Builtup Area
- Under Construction

Protected Areas
Reserve Type
- National Park
- Conservation Park
- Conservation Reserve
- Wilderness Protection Area
- Vegetation Heritage Agreement
- Aquatic Reserves

DCDB Parcels

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
Sewerage Filtration Bed, Effluent Pond
Stockpile, Slag Heap, Storage Dump, Tailing Pond
Rubbish Dump
Quarries
Reefs
Built Up Area
Native Vegetation

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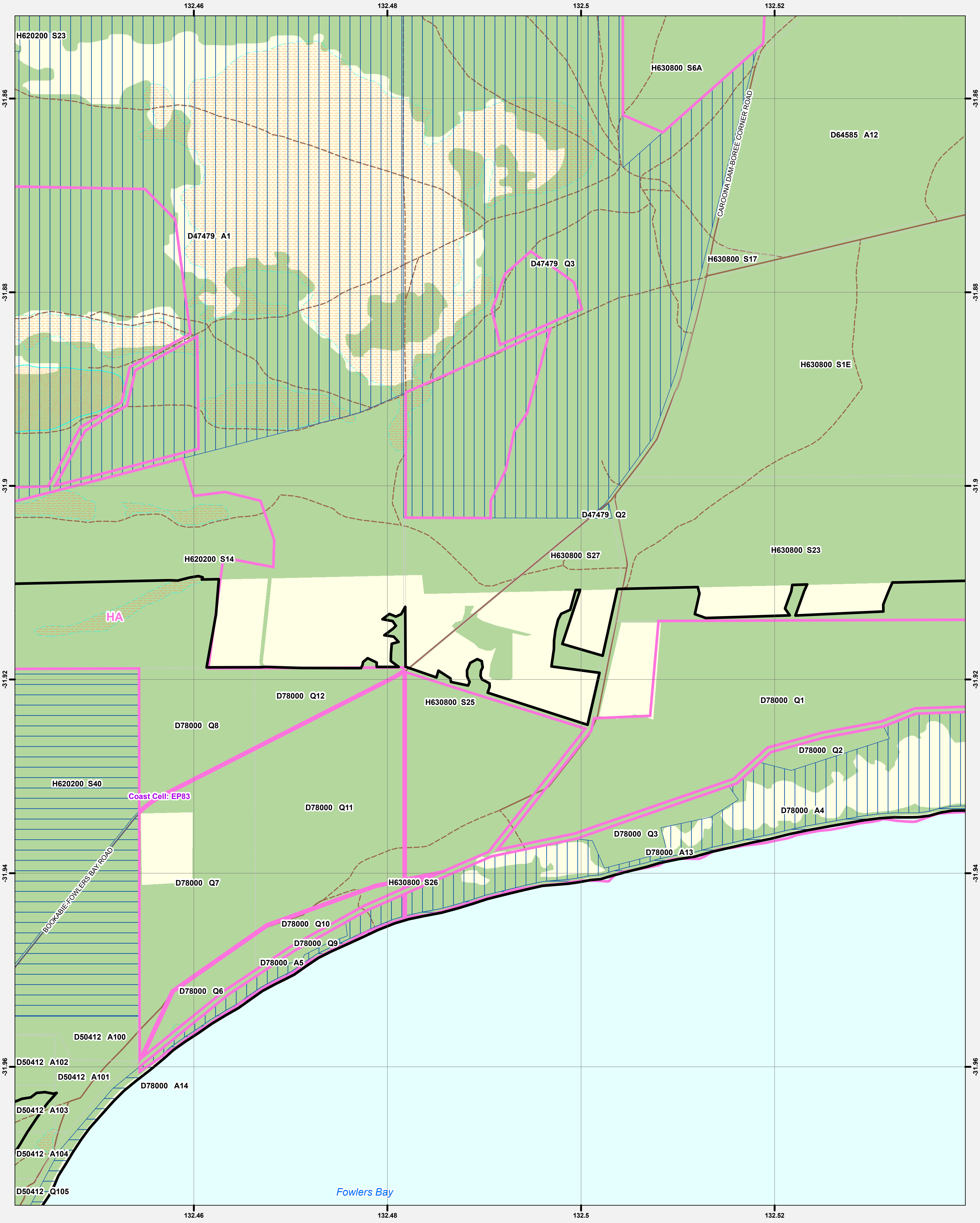
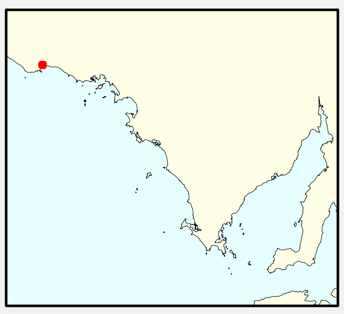
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 127





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Navigation Marks
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Roads
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- Unsealed within Builtup Area
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Protected Areas
Reserve Type
- National Park
- Conservation Park
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- Wilderness Protection Area
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- Aquatic Reserves
- **DCDB Parcels**

Waterbodies
Type
- Lake - Perennial
- Dam, Reservoir
- Dam, Reservoir
- Inland Water Feature
- Lake - Intermittent
- Lake - Mainly Dry
- Land Subject to Inundation (STI)
- Land Subject to Flooding (STF)

- **Coastal Boundary**
- **Coastal Cells**
- **Sewerage Filtration Bed, Effluent Pond**
- **Stockpile, Slag Heap, Storage Dump, Tailing Pond**
- **Rubbish Dump**
- **Quarries**
- **Reefs**
- **Built Up Area**
- **Native Vegetation**

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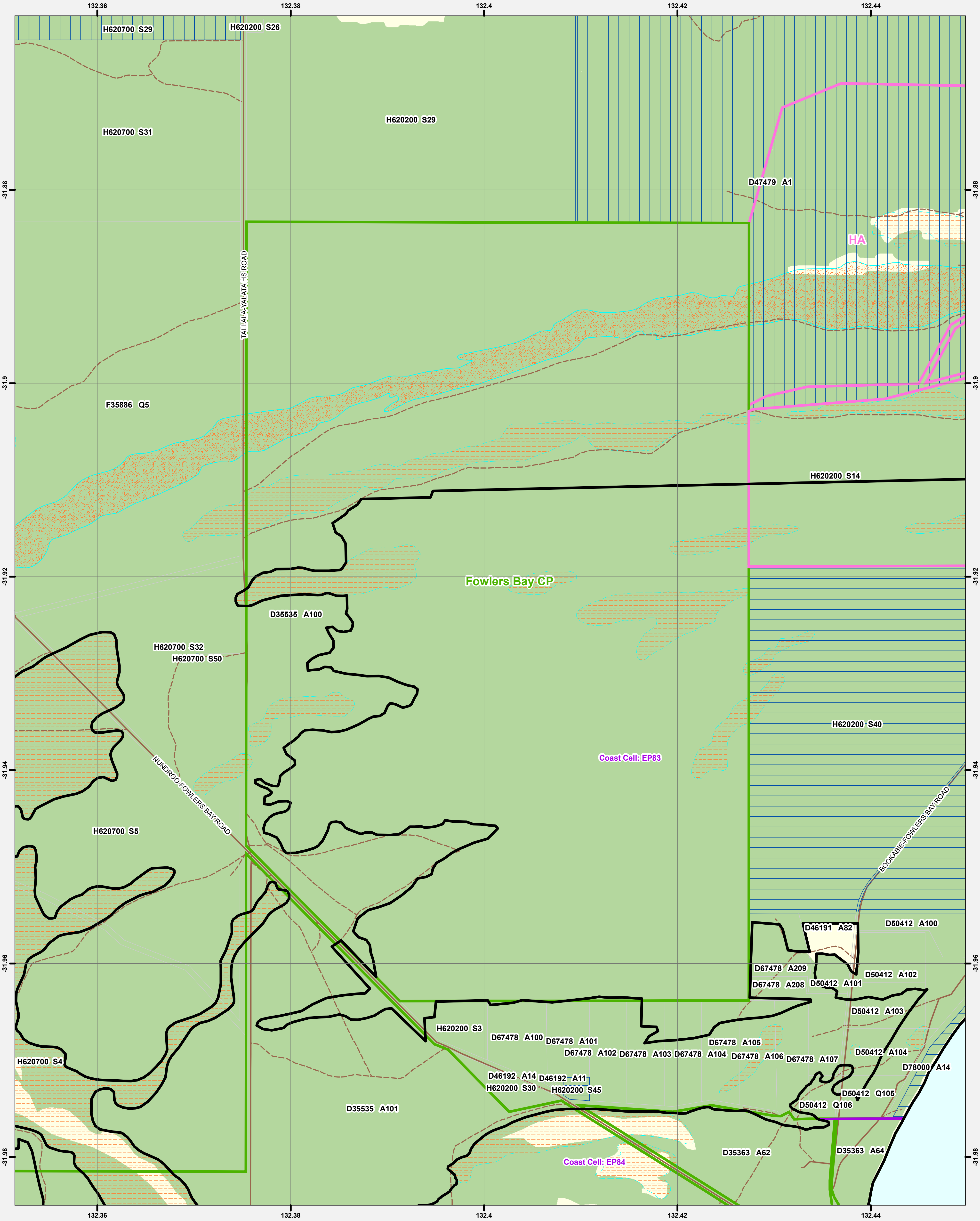
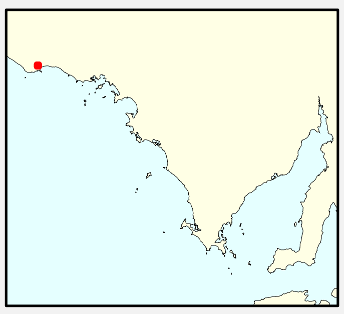
Eyre Peninsula Coastal Action Plan

Map Block 128





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Navigation Marks
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Roads
Road Feature Codes
Highway (divided)
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Vehicular Track
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Under Construction

Protected Areas
Reserve Type
National Park
Conservation Park
Conservation Reserve
Wilderness Protection Area
Vegetation Heritage Agreement
Aquatic Reserves
DCDB Parcels

Waterbodies
Type
Lake - Perennial
Dam, Reservoir
Dam, Reservoir
Inland Water Feature
Lake - Intermittent
Lake - Mainly Dry
Land Subject to Inundation (STI)
Land Subject to Flooding (STF)

Coastal Boundary
Coastal Cells
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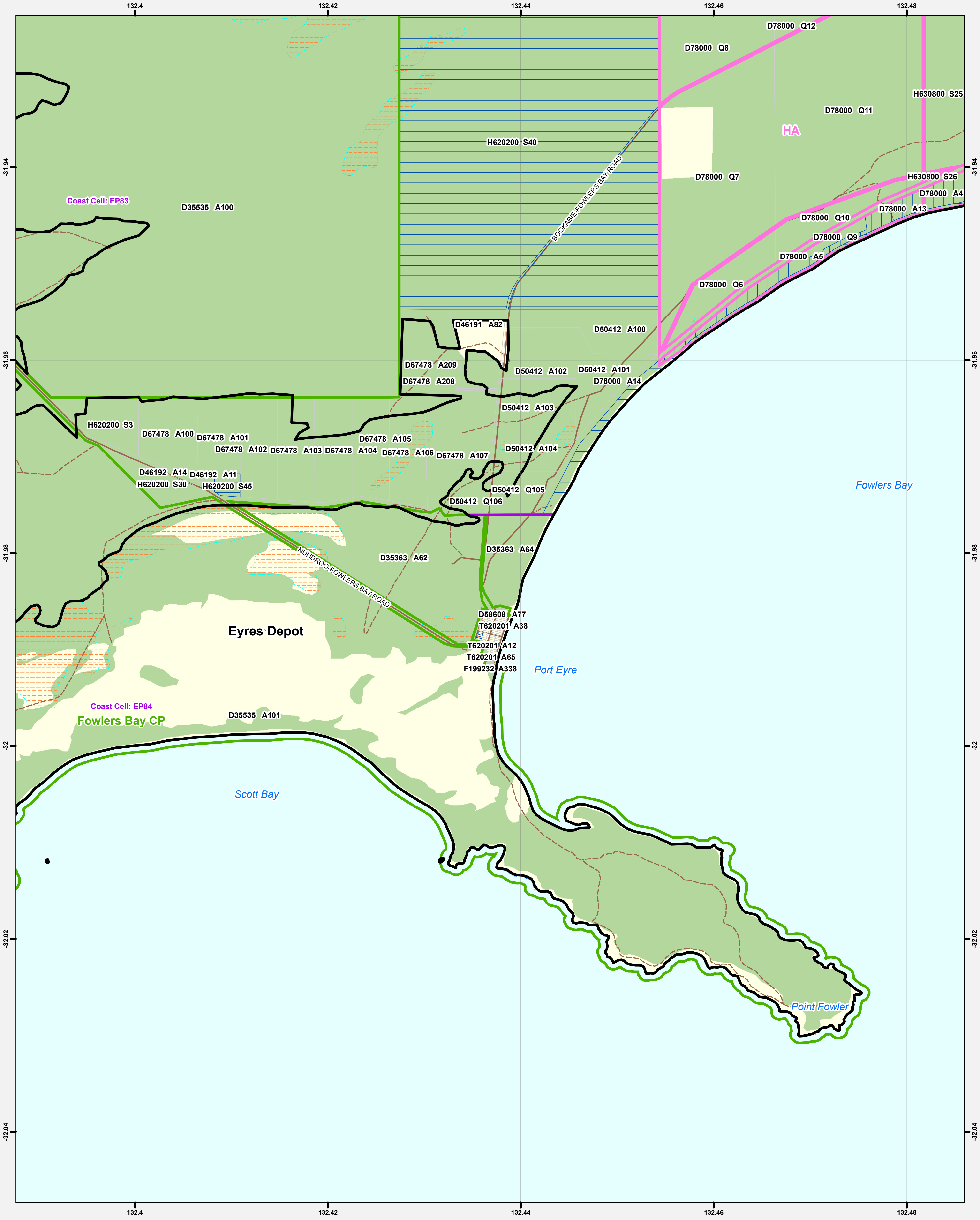
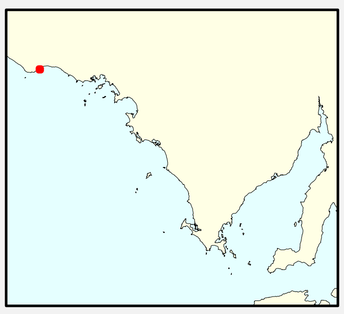
Eyre Peninsula Coastal Action Plan
Map Block 129





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DCDB Parcels

Waterbodies
Type
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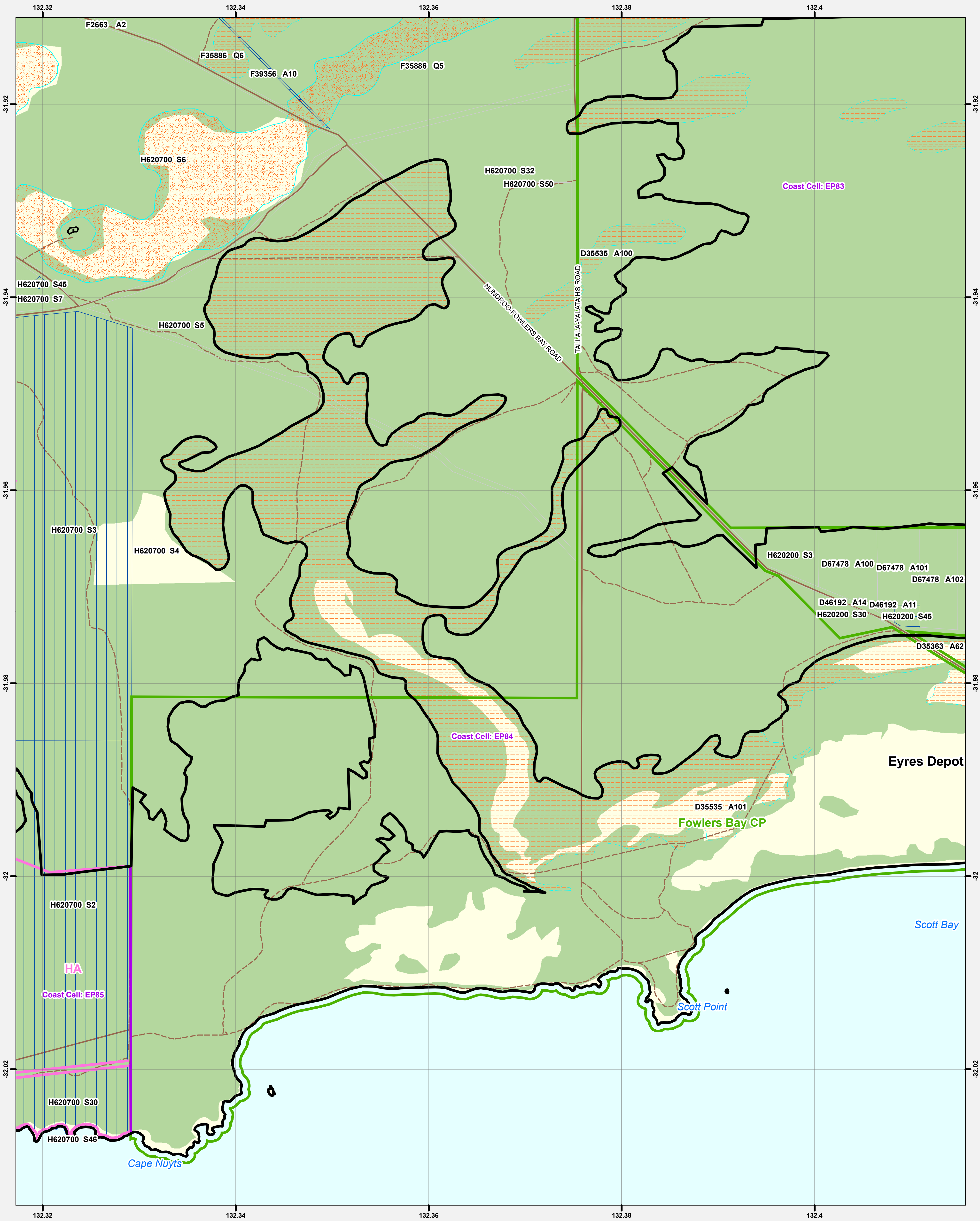
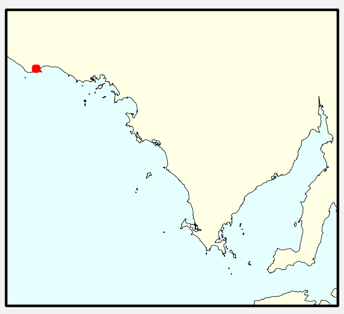
Quarries
Reefs
Built Up Area
Native Vegetation

Government of South Australia
Department of Environment and Natural Resources

Eyre Peninsula Coastal Action Plan

Map Block 130





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Navigation Marks

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Roads

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- **DCDB Parcels**

Waterbodies

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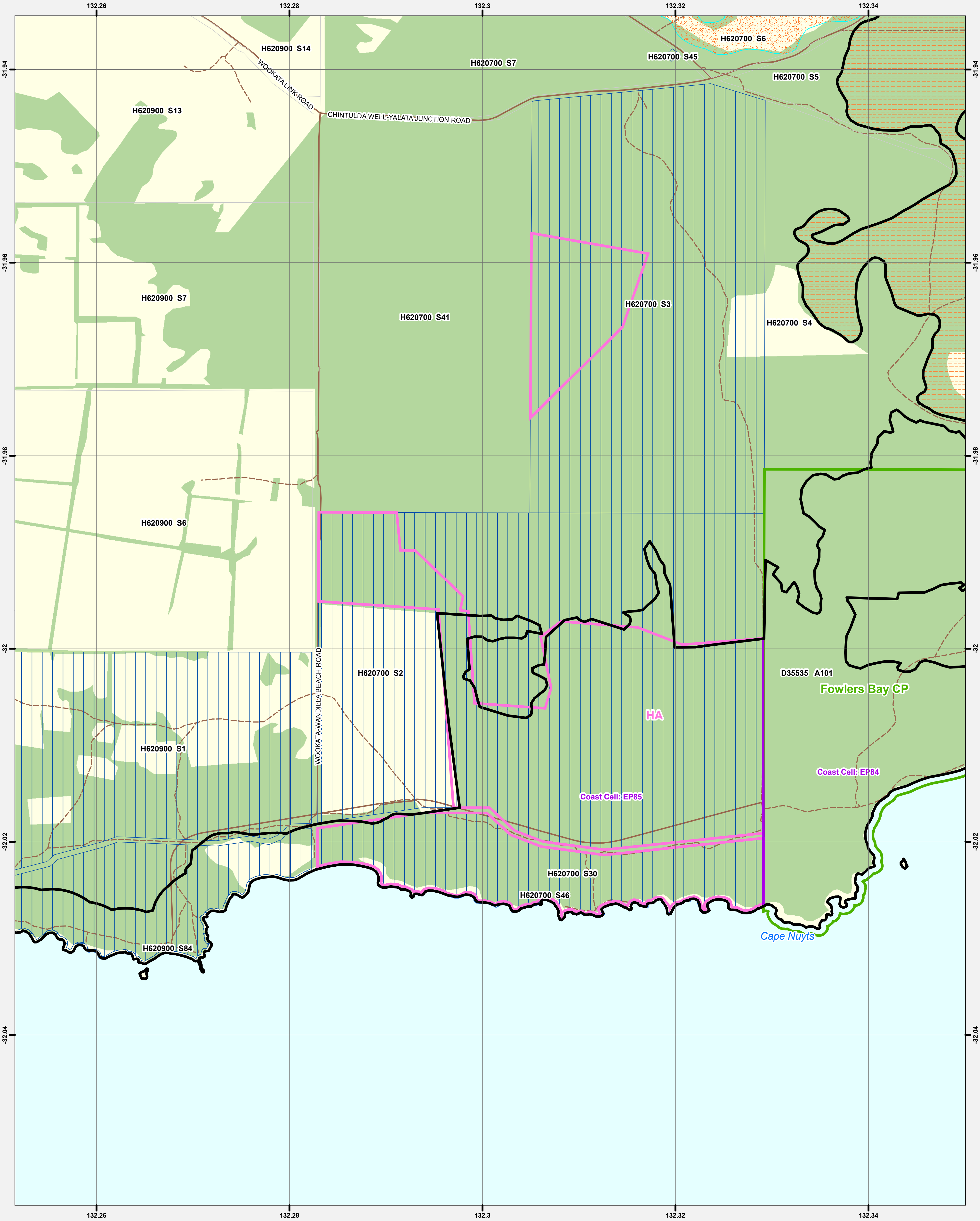
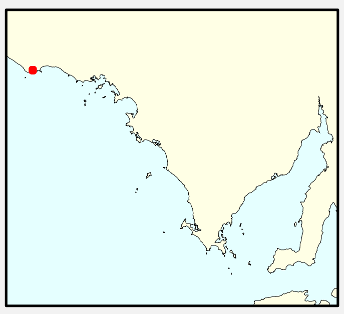
Eyre Peninsula Coastal Action Plan

Map Block 131





Navigation Marks
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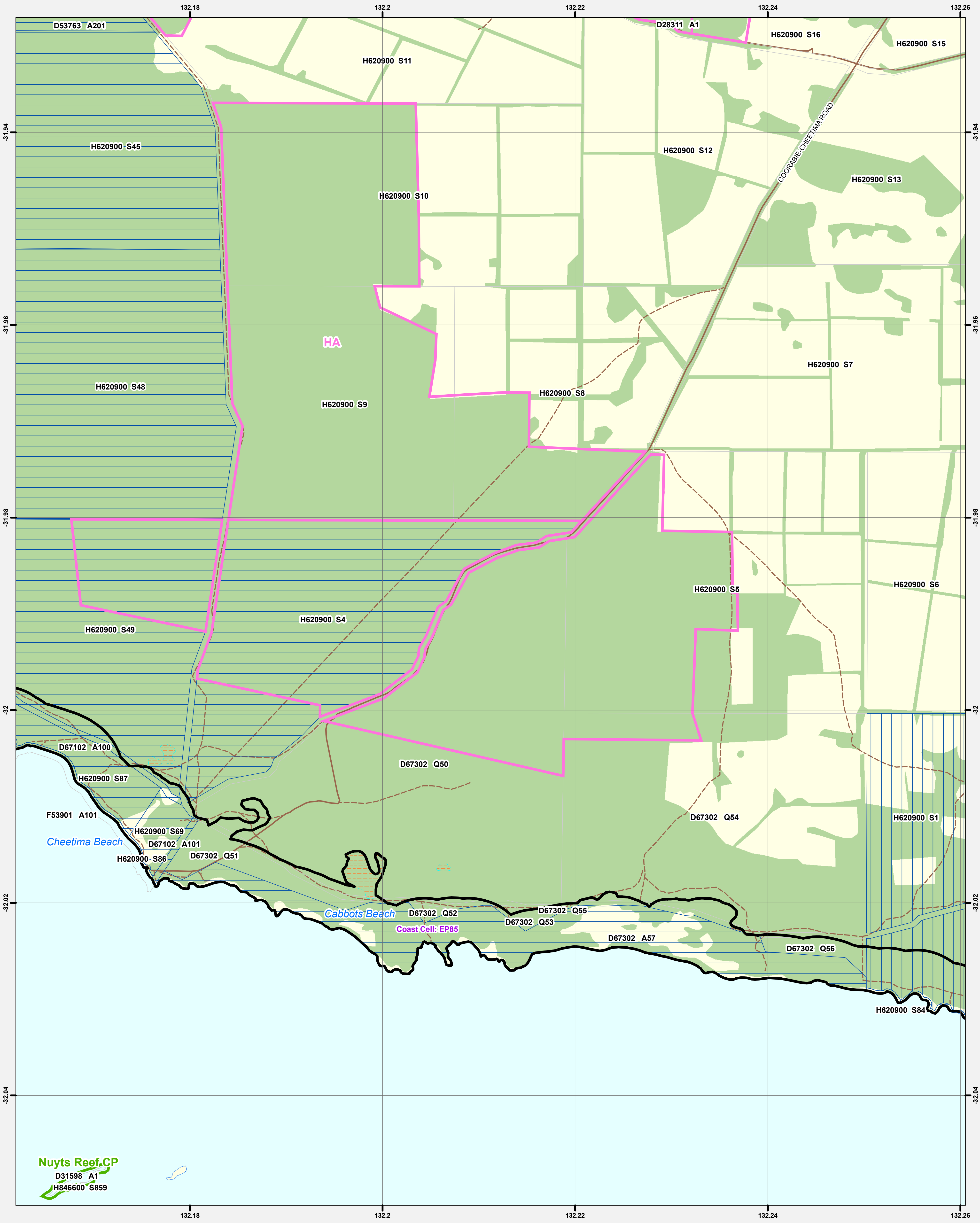
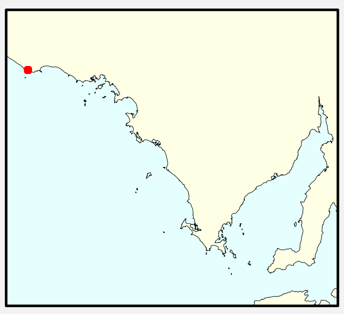
Eyre Peninsula Coastal Action Plan

Map Block 132





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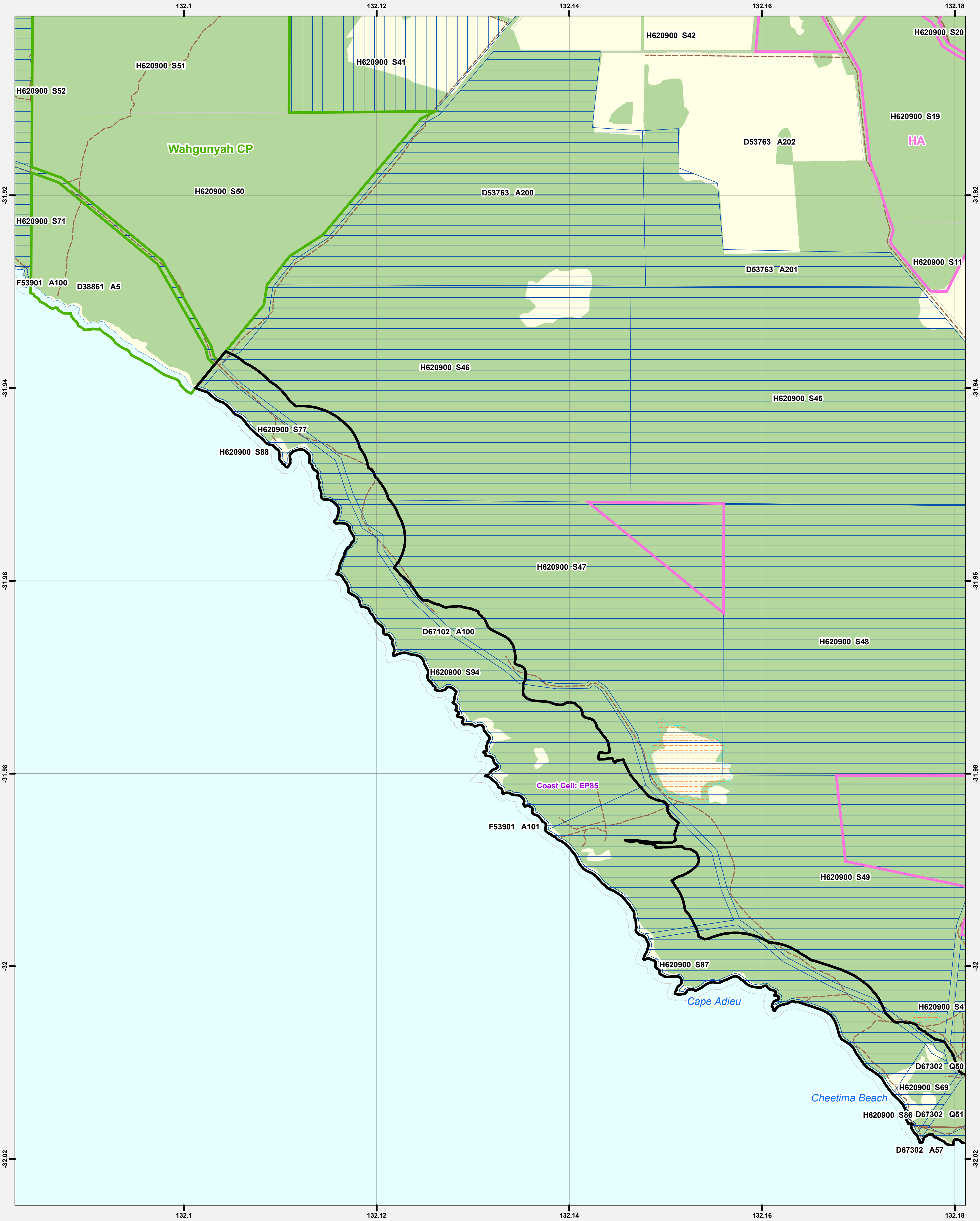
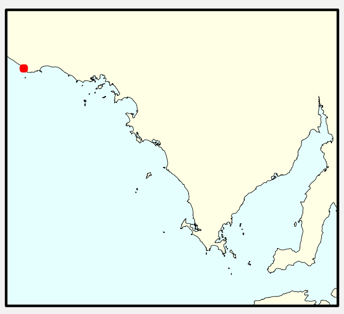
Eyre Peninsula Coastal Action Plan

Map Block 133





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Navigation Marks
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DCDB Parcels

Waterbodies
Type
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Department of Environment and Natural Resources

Appendix 2 Basic cell statistics

Coast cell	Shoreline length (km)	Cell area (ha)	Remnant vegetation		Salt marsh/ mangrove		Sand dunes		Vegetation sand dunes		Unvegetated sand dunes	
			Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP1	26.3	1,121.1	1,080.20	96.4	352.7	31.5	8.9	0.8	8.9	0.8		
EP2	30.2	1,231.5	1,128.90	91.7	323.1	26.2	102.9	8.4	100.2	8.1	2.8	0.2
EP3	23.1	2,518.9	1,307.00	51.9	1125.7	44.7	259.0	10.3	259.0	10.3		
EP4	18.9	674.6	59	8.7	51.9	7.7	1.7	0.2	1.7	0.2		
EP5	51.4	2,709.8	2,405.00	88.8	2310.2	85.3						
EP6	30.9	1,837.1	1,809.70	98.5	1557.9	84.8						
EP7	18.1	974.8	946.9	97.1	118.6	12.2	192.2	19.7	192.2	19.7		
EP8	47.2	3,289.5	3,253.50	98.9	2218.7	67.4	94.1	2.9	94.1	2.9		
EP9	25.2	1,789.0	1,658.30	92.7	107.7	6.0	442.0	24.7	442.0	24.7		
EP10	118.0	5,012.1	4,618.60	92.1	3552.5	70.9	576.7	11.5	575.1	11.5	1.7	
EP11	8.3	429.3	111.7	26			16.7	3.9	16.7	3.9		
EP12	7.7	675.8	469.6	69.5			217.0	32.1	117.6	17.4	99.4	14.7
EP13	10.9	543.6	291.4	53.6			48.6	8.9	44.8	8.2	3.8	0.7
EP14	8.2	888.2	734.8	82.7	353.3	39.8	67.1	7.6	66.6	7.5	0.4	
EP15	15.1	1,207.6	687.8	57			89.0	7.4	89.0	7.4		
EP16	12.0	634.0	75.7	11.9			28.0	4.4	28.0	4.4		
EP17	7.2	332.4	117.4	35.3	22.3	6.7	3.0	9.0	28.1	8.4	1.9	0.6
EP18	24.8	984.2	250.5	25.5			108.4	11.0	89.0	9.0	19.5	2.0
EP19	11.1	604.9	393.7	65.1			107.2	17.7	83.4	13.8	23.9	3.9
EP20	12.5	721.1	515.5	71.5	11.1	1.5	235.3	32.6	226.5	31.4	8.7	1.2
EP21	38.6	1,453.2	1,014.80	69.8	753.0	51.8	189.1	13.0	189.1	13.0		
EP22	11.6	523.2	84.1	16.1			82.1	15.7	80.8	15.4	1.3	0.2
EP23	25.7	1,275.3	611.1	47.9			200.2	15.7	196.7	15.4	3.5	0.3
EP24	10.6	934.9	487.5	52.1			118.4	12.7	112.5	12.0	5.9	0.6
EP25	10.5	613.9	292.2	47.6	7.0	1.1	250.2	40.8	249.8	40.7	0.5	0.1
EP26	16.8	924.5	781.2	84.5			87.4	9.5	85.3	9.2	2.2	0.2
EP27	14.3	702.4	51.2	7.3								
EP28	35.8	1,190.8	837.8	70.4	52.2	4.4	2.5	0.2	2.5	0.2		
EP29	14.7	802.1	771.2	96.1			13.6	1.7	13.6	1.7		

Coast cell	Shoreline length (km)	Cell area (ha)	Remnant vegetation		Salt marsh/ mangrove		Sand dunes		Vegetation sand dunes		Unvegetated sand dunes	
			Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP30	24.6	926.8	827.8	89.3			58.7	6.3	58.7	6.3		
EP31	43.9	1,801.8	1,723.9	95.7			45.6	2.5	45.6	2.5		
EP32	55.9	8,389.2	6,978.0	83.2			3,543.4	42.2	2,974.1	35.5	569.3	6.8
EP33	14.5	604.1	469.7	77.8			25.2	4.2	24.8	4.1	0.3	0.1
EP34	27.6	1,783.8	1,684.5	94.4			489.5	27.4	468.9	26.3	20.6	1.2
EP35	18.9	848.3	746.2	88.0			167.3	19.7	158.1	18.6	9.2	1.1
EP36	39.3	16,656.4	12,184.1	73.1	43.0	0.3	13,847.1	83.1	9,542.8	57.3	4,304.3	25.8
EP37	38.1	2,779.0	2,132.3	76.7	120.3	4.3	1,688.4	60.8	1,117.0	40.2	571.5	20.6
EP38	43.1	5,990.2	4,838.8	80.8	378.6	6.3	4,716.6	78.7	3,933.8	65.7	782.8	13.1
EP39	52.6	7,688.6	6,629.6	86.2			721.6	9.4	601.7	7.8	12	1.6
EP40	45.4	1,680.8	1,162.1	69.1	61.5	3.7	6.7	0.4	6.4	0.4	0.3	
EP41	64.9	2,057.3	1,813.4	88.1	488.4	23.7	303.1	14.7	303.1	14.7		
EP42	20.1	1,084.7	681.7	62.8			56.9	5.2	52.6	4.8	4.4	0.4
EP43	13.7	885.0	668.3	75.5			81.6	9.2	74.0	8.4	7.6	0.9
EP44	13.9	1,911.7	1,081.9	56.6			1,391.0	72.8	897.2	46.9	493.8	25.8
EP45	14.1	486.2	154.2	31.7			44.8	9.2	36.0	7.4	8.8	1.8
EP46	13.0	892.8	679.6	76.1			84.4	9.4	76.2	8.5	8.1	0.9
EP47	20.3	1,183.4	1,102.5	93.2			18.4	1.6	16.7	1.4	1.7	0.1
EP48	17.0	2,254.4	1,384.2	61.4			1,565.3	69.4	865.1	38.4	700.2	31.1
EP49	15.8	909.5	720.5	79.2			7.6	0.8	7.6	0.8		
EP50	30.6	1,529.2	1,18	77.2			358.6	23.5	329.9	21.6	28.7	1.9
EP51	7.1	431.1	219.0	50.8			256.7	59.5	156.4	36.3	100.2	23.2
EP52	26.1	9,103.8	5,092.5	55.9			4,309.4	47.3	2,740.6	30.1	1,568.8	17.2
EP53	21.1	2,126.5	1,831.0	86.1	19.1	0.9	711.9	33.5	573.1	27.0	138.7	6.5
EP54	45.8	1,778.4	1,089.8	61.3	162.3	9.1	33.5	1.9	33.5	1.9		
EP55	71.3	2,141.2	1,926.5	9	310.2	14.5	237.1	11.1	217.8	10.2	19.3	0.9
EP56	26.6	1,222.2	1,038.8	85.0			322.0	26.3	304.5	24.9	17.4	1.4
EP57	41.2	1,652.5	78	47.2	167.9	10.2	73.9	4.5	72.2	4.4	1.8	0.1
EP58	35.9	4,850.6	2,107.4	43.4	248.6	5.1	88.5	1.8	88.5	1.8		

Coast cell	Shoreline length (km)	Cell area (ha)	Remnant vegetation		Salt marsh/ mangrove		Sand dunes		Vegetation sand dunes		Unvegetated sand dunes	
			Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP59	21.0	1,310.0	1,183.7	90.4	11.2	0.9	564.4	43.1	518.7	39.6	45.7	3.5
EP60	7.0	1,071.8	804.9	75.1	0.0	0.0	957.4	89.3	702.5	65.5	254.9	23.8
EP61	19.4	1,568.4	716.0	45.7	0.0	0.0	220.6	14.1	215.8	13.8	4.8	0.3
EP62	14.5	2,342.9	1,581.2	67.5	0.0	0.0	1,484.4	63.4	789.7	33.7	694.7	29.7
EP63	30.4	1,736.9	1,523.8	87.7	0.0	0.0	353.4	20.3	326.8	18.8	26.7	1.5
EP64	20.1	2,261.8	2,156.6	95.3	0.0	0.0	1,486.5	65.7	1,436.3	63.5	50.2	2.2
EP65	45.0	1,360.4	791.0	58.1	667.4	49.1	288.3	21.2	288.3	21.2	0.0	0.0
EP66	15.3	753.5	92.8	12.3	19.4	2.6	42.0	5.6	38.6	5.1	3.4	0.5
EP67	28.9	1,074.9	545.2	50.7	0.0	0.0	342.7	31.9	278.0	25.9	64.7	6.0
EP68	25.4	1,738.5	1,269.7	73.0	0.0	0.0	661.1	38.0	605.6	34.8	55.5	3.2
EP69	74.3	3,487.5	3,341.3	95.8	2,604.0	74.7	700.5	20.1	680.0	19.5	20.6	0.6
EP70	36.3	2,281.6	2,071.9	90.8	0.0	0.0	1,174.6	51.5	1,017.0	44.6	157.7	6.9
EP71	76.7	2,660.1	2,041.4	76.7	1,378.5	51.8	685.1	25.8	445.0	16.7	240.1	9.0
EP72	19.5	980.2	467.1	47.7	0.0	0.0	365.4	37.3	351.1	35.8	14.3	1.5
EP73	36.5	1,640.3	1,390.2	84.8	281.7	17.2	174.4	10.6	173.8	10.6	0.7	0.0
EP74	21.2	842.8	343.5	40.8	14.3	1.7	61.0	7.2	60.9	7.2	0.2	0.0
EP75	17.3	745.6	624.5	83.8	94.6	12.7	140.2	18.8	139.7	18.7	0.5	0.1
EP76	17.7	796.5	690.9	86.7	7.7	1.0	58.1	7.3	58.1	7.3	0.0	0.0
EP77	157.2	5,082.5	4,105.2	80.8	3,034.8	59.7	471.9	9.3	246.6	4.9	225.4	4.4
EP78	24.1	1,413.9	924.0	65.3	0.0	0.0	746.0	52.8	350.7	24.8	395.4	28.0
EP79	23.4	1,774.6	951.2	53.6	0.0	0.0	1,203.1	67.8	464.7	26.2	738.4	41.6
EP80	29.0	16,235.5	5,811.0	35.8	0.0	0.0	4,486.6	27.6	2,099.8	12.9	2,386.9	14.7
EP81	25.9	2,992.8	2,358.2	78.8	828.9	27.7	2,094.0	70.0	1,685.1	56.3	408.8	13.7
EP82	16.5	626.4	555.7	88.7	186.8	29.8	417.3	66.6	403.1	64.4	14.1	2.3
EP83	20.0	8,144.7	7,632.0	93.7	0.0	0.0	1,272.7	15.6	818.3	10.0	454.4	5.6
EP84	30.2	4,130.1	3,124.9	75.7	0.0	0.0	1,389.4	33.6	681.6	16.5	707.8	17.1
EP85	34.4	2,448.1	2,228.7	91.0	0.0	0.0	977.1	39.9	824.6	33.7	152.4	6.2
Total	**2475.1**	**193,751.7**	**139,101.1**	**71.8**	**24,047.0**	**12.4**	**61,641.8**	**31.8**	**44,870.2**	**23.2**	**16,771.7**	**8.7**

Appendix 3 Protected area cell statistics

Coast cell	National Park		Conservation Park		Conservation Reserve		Wilderness Protected Area		Heritage Agreement		Aquatic Reserve		NOT Protected	
	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP1											117.8	10.5	1003.3	89.5
EP2													1231.5	100
EP3													2518.9	100
EP4													674.6	100
EP5											422.4	15.6	2287.4	84.4
EP6													1837.1	100
EP7			535.4	54.9	25.1	2.6							414.3	42.5
EP8					1122.7	34.1			421.5	12.8			1745.2	53.1
EP9													1789.0	100
EP10			1310.5	26.1					12.2	0.2			3689.3	73.6
EP11													429.3	100
EP12													675.8	100
EP13									34.5	6.3			509.1	93.7
EP14									119.5	13.5			768.7	86.5
EP15													1207.6	100
EP16													634.0	100
EP17													332.4	100
EP18			1.5	0.2									982.7	99.8
EP19													604.9	100
EP20													721.1	100
EP21			29.1	2.0									1424.1	98.0
EP22													523.2	100
EP23									242.2	19.0			1033.1	81.0
EP24													934.9	100
EP25													613.9	100
EP26									54.4	5.9			870.2	94.1
EP27													702.4	100
EP28													1190.8	100

Coast cell	National Park		Conservation Park		Conservation Reserve		Wilderness Protected Area		Heritage Agreement		Aquatic Reserve		NOT Protected	
	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP29	802.1	100											0.1	
EP30	926.8	100												
EP31	917.8	50.9					878.1	48.7					5.8	0.3
EP32	5139.9	61.3	589.0	7.0			2532.2	30.2					128.1	1.5
EP33									202.0	33.4			402.1	66.6
EP34									1660.8	93.1			123.0	6.9
EP35									463.9	54.7			384.4	45.3
EP36	13069.6	78.5							711.2	4.3			2875.6	17.3
EP37	2776.9	99.9											2.1	0.1
EP38	5985.0	99.9	5.2	0.1										
EP39	7686.9	100											1.7	
EP40	0.5		366.5	21.8									1313.8	78.2
EP41			5.0	0.2					902.3	43.9			115	55.9
EP42													1084.7	100
EP43									1.2	0.1			883.8	99.9
EP44									956.9	50.1			954.8	49.9
EP45													486.2	100
EP46													892.8	100
EP47													1183.4	100
EP48													2254.4	100
EP49													909.5	100
EP50													1529.2	100
EP51					89.6	20.8							341.5	79.2
EP52			8403.1	92.3									700.7	7.7
EP53									363.2	17.1			1763.3	82.9
EP54			643.1	36.2					16.9	1.0			1118.4	62.9
EP55			2125.1	99.2									16.1	0.8
EP56			305.1	25.0									917.1	75.0
EP57			5.5	0.3					1.9	0.1			1645.2	99.6

Coast cell	National Park		Conservation Park		Conservation Reserve		Wilderness Protected Area		Heritage Agreement		Aquatic Reserve		NOT Protected	
	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell	Area (ha)	% of cell
EP58			36.4	0.7					0.2				4814.0	99.2
EP59									1014.5	77.4			295.6	22.6
EP60									2.0	0.2			1069.8	99.8
EP61													1568.4	100
EP62			515.3	22.0									1827.6	78.0
EP63													1736.9	100
EP64													2261.8	100
EP65													1360.4	100
EP66													753.5	100
EP67			98.0	9.1									976.9	90.9
EP68			0.5						367.0	21.1			1371.0	78.9
EP69			2909.6	83.4									577.9	16.6
EP70													2281.6	100
EP71													2660.1	100
EP72													980.2	100
EP73			295.4	18.0	8.0	0.5							1337.0	81.5
EP74													842.8	100
EP75													745.6	100
EP76													796.5	100
EP77													5082.5	100
EP78									167.2	11.8			1246.7	88.2
EP79			433.5	24.4					485.5	27.4			855.6	48.2
EP80			0.2		1290.2	7.9							14945.1	92.1
EP81					1903.2	63.6			0.3				1089.3	36.4
EP82									100.3	16.0			526.1	84.0
EP83			2311.5	28.4					3855.5	47.3			1977.8	24.3
EP84			3213.0	77.8					0.9				916.2	22.2
EP85									947.9	38.7			1500.2	61.3
Total	**37305.5**	**19.3**	**24137.2**	**12.5**	**4438.9**	**2.3**	**3410.3**	**1.8**	**13106.0**	**6.8**	**540.2**	**0.3**	**110813.7**	**57.2**

Appendix 4 Conservation summary results

Cell	1A CDCS threatened status rating mean	1B CDCS rarity e.g. < 20 records in state mean	1C Threatened status of flora mean	1D Threatened status of fauna mean	1E Total no. of threatened species mean	2A CDCS endemic e.g. >50% of state records mean	2B Salt marsh endemicity e.g. > 50% of state records mean	2C Florisitc vegetation endemic e.g. > 50% of state records mean	2D Species richness mean	3A Habitat for threatened bird species mean	3B Habitat for all bird species mean
EP1	0.00	2.19	0.00	4.59	3.25	3.26	0.68	0.00	4.07	5.15	1.08
EP2	0.00	4.16	3.50	4.41	3.28	6.18	0.78	0.00	4.50	4.79	3.02
EP3	0.00	8.00	0.00	3.75	3.57	5.79	0.60	1.71	3.49	5.41	3.17
EP4	0.00	0.00	0.00	6.14	3.08	0.00	0.00	0.00	3.08	0.59	3.07
EP5	0.00	0.00	0.00	2.70	3.50	0.00	0.00	0.24	3.92	5.51	3.15
EP6	0.00	0.00	0.01	2.55	3.18	0.00	0.00	2.19	3.15	4.94	1.39
EP7	0.00	3.61	0.12	3.07	2.89	5.98	0.00	2.82	4.25	4.61	2.55
EP8	0.00	3.38	0.00	4.20	3.48	5.88	0.00	1.93	3.56	5.20	1.45
EP9	0.00	3.25	0.00	3.17	3.18	7.00	0.00	2.78	3.22	4.78	0.90
EP10	0.00	6.54	2.50	3.48	7.31	6.05	0.32	1.53	6.53	8.39	8.60
EP11	0.00	3.75	2.50	5.60	3.27	6.00	0.00	0.54	3.20	5.24	2.01
EP12	0.00	3.50	0.00	4.88	3.47	2.83	0.00	0.47	3.07	4.53	1.01
EP13	0.00	0.03	6.50	2.00	2.11	0.06	0.00	0.86	3.44	2.98	1.42
EP14	0.00	3.62	6.91	4.39	5.71	6.99	0.00	1.17	4.72	6.80	4.45
EP15	0.00	7.61	0.00	4.81	4.37	6.95	0.00	1.85	3.06	4.84	1.51
EP16	0.00	4.25	0.00	6.49	3.32	2.50	0.00	0.70	3.05	1.34	1.12
EP17	0.00	7.93	2.50	5.16	3.52	6.30	0.00	1.37	5.07	5.37	5.34
EP18	0.00	8.27	0.00	4.69	3.18	7.66	0.00	0.54	5.24	5.25	6.04
EP19	0.00	7.56	0.00	3.47	2.58	3.07	0.00	1.59	3.12	4.23	1.01
EP20	0.00	3.82	6.67	4.78	4.34	6.03	0.00	2.16	4.93	5.36	6.15
EP21	0.00	0.00	2.50	3.61	6.19	3.20	0.00	0.75	3.85	7.46	4.39
EP22	0.00	0.01	2.50	6.14	3.36	0.01	0.00	0.44	3.08	4.21	1.15
EP23	2.50	7.84	2.50	3.24	3.97	7.37	0.00	0.36	3.69	5.12	1.05
EP24	2.50	7.89	7.25	4.56	4.19	7.09	0.00	1.32	4.01	5.24	3.23
EP25	0.01	0.02	0.01	4.99	3.76	0.01	0.00	1.34	4.01	5.27	4.20
EP26	5.99	8.40	2.87	4.71	4.44	3.57	0.00	0.47	4.05	5.47	3.39
EP27	0.00	0.00	2.72	5.31	4.21	0.00	0.00	0.24	6.02	5.12	5.00
EP28	5.00	7.84	2.66	4.56	5.38	3.04	0.02	2.01	6.82	6.13	6.34
EP29	2.50	3.55	2.71	4.16	5.64	2.90	0.00	3.44	5.44	6.76	4.51
EP30	2.50	7.60	2.52	4.17	5.81	5.70	0.00	5.26	5.62	6.70	5.87
EP31	0.09	6.79	2.59	4.04	5.87	4.70	0.00	3.53	5.89	6.90	5.22
EP32	2.66	7.33	6.82	4.03	5.85	6.03	0.00	4.78	6.51	6.29	6.02
EP33	0.00	3.82	2.49	4.80	4.70	3.10	0.00	3.24	4.51	5.71	2.65
EP34	0.00	3.44	0.00	3.98	4.83	2.88	0.00	7.07	5.67	6.48	4.60
EP35	1.13	0.92	2.50	3.52	3.80	0.77	0.00	5.66	3.57	5.39	1.00
EP36	0.00	6.78	6.12	4.29	6.04	6.00	0.00	4.31	7.19	6.50	8.01
EP37	0.00	7.82	2.51	3.68	6.34	4.87	0.01	3.63	5.83	6.73	7.29
EP38	0.00	7.07	6.15	4.61	6.29	6.62	0.00	5.38	5.82	6.61	6.16
EP39	4.49	7.42	2.50	4.64	5.78	7.29	0.00	4.45	6.35	6.42	6.34
EP40	0.00	7.60	6.35	3.76	5.01	7.21	0.05	2.36	6.31	6.51	7.54
EP41	0.00	7.20	2.50	4.00	5.96	7.27	0.02	3.77	6.02	6.85	6.34

Cell	1A CDCS threatened status rating mean	1B CDCS rarity e.g. < 20 records in state mean	1C Threatened status of flora mean	1D Threatened status of fauna mean	1E Total no. of threatened species mean	2A CDCS endemic e.g. >50% of state records mean	2B Salt marsh endemicity e.g. > 50% of state records mean	2C Florisitc vegetation endemic e.g. > 50% of state records mean	2D Species richness mean	3A Habitat for threatened bird species mean	3B Habitat for all bird species mean
EP42	4.53	7.32	2.50	4.58	3.69	7.83	0.00	4.10	3.89	5.49	3.80
EP43	0.00	6.71	2.88	3.44	3.63	4.43	0.00	5.08	3.63	5.44	2.35
EP44	0.00	6.50	0.00	4.34	3.98	5.44	0.00	4.42	3.33	5.33	1.02
EP45	0.00	6.70	0.00	5.12	3.33	4.25	0.00	1.71	3.09	4.54	0.86
EP46	0.00	7.08	0.00	5.52	3.33	6.17	0.00	3.73	3.61	5.33	1.00
EP47	0.00	5.48	0.00	4.49	3.09	4.16	0.00	8.27	4.69	6.05	3.00
EP48	0.00	6.17	0.00	4.73	4.14	4.00	0.00	5.44	4.91	5.85	4.01
EP49	0.00	3.25	2.50	2.40	3.14	2.50	0.00	6.91	5.22	5.14	3.13
EP50	0.00	6.99	2.50	4.73	4.00	5.19	0.00	6.27	7.56	5.73	5.05
EP51	0.00	6.00	0.00	4.99	3.89	3.00	0.00	3.97	3.95	5.17	3.09
EP52	5.00	3.77	2.50	4.24	3.98	6.55	0.00	3.15	5.66	5.60	6.44
EP53	0.00	6.78	6.99	5.10	3.66	3.60	0.00	7.31	4.12	5.31	2.04
EP54	0.00	0.00	6.62	3.71	4.37	0.00	0.00	1.98	6.09	6.03	6.47
EP55	6.70	4.02	6.83	4.00	5.75	2.97	0.00	4.15	5.77	6.74	6.26
EP56	1.60	3.58	6.71	4.48	4.47	4.97	0.00	5.84	5.27	5.97	3.43
EP57	6.76	7.89	7.32	5.09	4.98	7.26	0.00	1.37	5.40	6.06	5.44
EP58	0.12	0.31	6.76	4.97	4.61	0.50	0.05	1.48	4.06	6.46	2.41
EP59	0.55	7.50	0.91	4.45	4.45	6.94	0.00	4.84	4.48	6.37	2.42
EP60	1.50	4.00	2.50	4.28	4.02	6.37	0.00	6.40	4.46	5.79	1.77
EP61	0.31	0.86	6.79	5.55	3.60	6.09	0.00	3.59	4.25	5.42	2.03
EP62	0.00	7.50	6.73	4.47	5.03	6.18	0.00	5.33	5.28	5.45	4.41
EP63	2.68	7.45	2.78	5.41	3.71	6.09	0.00	6.59	4.19	5.49	4.01
EP64	0.02	3.50	2.50	2.99	3.45	5.09	0.00	6.82	3.67	5.31	1.08
EP65	0.00	0.00	6.57	4.14	6.50	0.07	0.00	1.89	5.27	7.57	7.41
EP66	0.00	0.00	0.00	4.81	4.28	0.00	0.00	0.80	4.15	6.20	6.31
EP67	0.00	0.00	2.50	4.57	3.51	0.00	0.00	3.73	4.78	5.51	3.57
EP68	0.00	0.00	4.50	3.30	2.79	0.00	0.00	5.96	3.73	4.30	2.54
EP69	0.00	3.50	7.07	3.15	5.65	6.51	0.15	7.52	5.03	6.87	5.24
EP70	3.50	7.75	2.50	5.13	3.54	6.77	0.00	6.56	4.07	5.14	3.02
EP71	0.00	0.00	7.00	4.25	6.07	0.00	0.15	3.54	3.75	7.24	3.44
EP72	0.00	0.01	0.01	5.47	3.61	7.33	0.00	2.48	4.48	5.62	5.47
EP73	0.00	3.49	2.50	4.23	4.38	7.34	0.00	4.93	4.40	5.53	4.05
EP74	0.00	0.00	2.75	5.14	4.41	0.00	0.00	2.18	5.83	5.44	4.02
EP75	0.00	0.00	0.00	4.95	3.40	0.01	0.00	2.59	3.10	5.13	1.01
EP76	0.00	3.18	2.50	4.94	4.23	7.17	0.00	4.22	4.41	5.96	3.39
EP77	0.00	3.00	6.38	3.23	5.83	5.38	0.00	0.97	3.65	7.12	3.04
EP78	0.00	7.03	0.04	3.25	3.00	7.02	0.00	3.63	3.38	4.86	1.09
EP79	0.00	4.51	2.50	3.90	3.40	7.18	0.00	4.05	3.50	5.08	1.57
EP80	0.00	8.01	6.14	4.99	4.29	7.40	0.00	1.15	4.98	3.17	3.04
EP81	0.00	0.01	0.01	2.87	4.01	6.37	1.11	3.68	3.69	5.32	1.48
EP82	0.00	0.00	0.01	4.09	3.81	5.76	0.00	5.66	3.46	5.36	1.01
EP83	0.00	3.00	6.99	4.69	4.82	6.82	0.00	7.07	6.05	5.82	2.02
EP84	3.91	7.91	6.33	4.58	5.14	6.01	0.00	2.48	4.88	5.78	3.48
EP85	3.50	6.77	3.60	4.62	4.54	6.85	0.00	3.87	4.03	5.62	1.35

Cell	4A Habitat for threatened reptile & amphibian species mean	4B Habitat for all reptile & amphibian species mean	5A Habitat for threatened mammal species mean	5B Habitat for all mammal species mean	6 Habitat for all butterfly species mean	7A Distribution of Aust. Sea-lion colonies (focal species) mean	7B Habitat for Aust. Pied Oystercatcher (focal species) mean	7C Distribution of Eastern Osprey nests & territories (focal species) mean	7D Distribution of White-bellied Sea-Eagle nests & territories (focal species) mean	7E Habitat for Beach Slider (focal species) mean	7F Habitat for Bight Coast Skink (focal species) mean
EP1	1.53	1.67	5.08	2.60	8.55	0.00	1.94	0.00	0.00	0.16	0.07
EP2	1.50	2.07	5.23	3.81	8.13	0.00	1.06	0.00	0.00	0.78	0.76
EP3	4.55	1.54	5.04	1.71	4.36	0.00	0.98	0.00	0.00	0.94	0.93
EP4	1.75	1.01	5.00	1.09	0.68	0.00	0.69	0.00	0.00	0.03	0.02
EP5	4.53	1.41	0.00	1.57	7.97	0.00	5.76	0.00	0.00	0.00	0.00
EP6	4.35	1.67	0.00	1.40	8.87	0.00	4.17	0.00	0.00	0.00	0.00
EP7	2.99	4.00	1.49	3.90	8.74	0.00	0.23	0.00	0.00	1.76	1.76
EP8	4.16	2.73	5.00	3.00	8.84	0.00	1.00	0.00	0.00	0.25	0.25
EP9	4.36	3.30	1.54	2.72	8.31	0.00	0.36	0.00	0.00	2.24	2.24
EP10	4.01	2.68	5.04	4.07	6.31	0.00	7.10	0.00	2.23	1.11	1.04
EP11	1.21	1.90	5.00	1.68	1.48	0.00	0.09	0.00	0.00	0.34	0.32
EP12	3.69	2.04	5.37	2.35	5.57	0.06	0.12	0.00	0.00	2.87	2.87
EP13	0.77	2.60	2.04	2.23	4.18	0.00	0.14	0.00	0.00	0.90	0.79
EP14	5.90	2.19	5.00	2.05	6.88	0.00	4.83	0.00	0.00	0.65	0.64
EP15	2.79	1.79	5.00	1.76	3.43	0.00	2.38	0.00	0.00	0.62	0.61
EP16	0.54	1.23	5.01	1.24	0.59	0.00	0.56	0.00	0.00	0.42	0.41
EP17	1.76	3.09	5.05	1.94	2.17	0.00	0.31	0.00	0.00	0.82	0.80
EP18	0.73	1.47	5.01	2.31	1.33	0.00	0.06	0.00	0.00	1.01	0.98
EP19	1.45	2.49	2.20	1.97	3.48	0.00	0.07	0.38	0.00	1.65	1.61
EP20	6.07	2.44	5.75	2.98	4.06	0.00	0.30	5.00	0.00	2.91	2.91
EP21	5.78	1.89	0.89	1.89	4.51	0.00	5.97	5.13	0.00	1.19	1.17
EP22	5.47	1.70	5.04	1.42	0.91	0.00	0.14	3.65	0.23	1.50	1.40
EP23	5.90	2.97	5.02	2.34	3.47	0.00	0.11	0.29	3.00	1.40	1.40
EP24	5.90	1.89	5.25	2.84	3.13	0.00	0.03	0.00	5.00	1.10	1.10
EP25	6.20	1.91	5.06	2.56	2.44	0.00	0.32	0.00	5.00	3.62	3.62
EP26	5.59	3.30	6.24	4.26	4.95	0.00	0.05	0.00	5.00	0.85	0.84
EP27	5.04	1.29	6.03	2.48	0.36	0.00	0.01	3.16	5.00	0.01	0.00
EP28	5.70	4.21	6.00	4.28	5.67	0.00	0.40	5.97	4.10	0.02	0.02
EP29	6.95	5.67	6.01	4.86	8.57	0.00	0.00	4.09	4.15	0.16	0.16
EP30	6.85	5.54	6.02	6.35	7.76	0.00	0.15	4.91	5.41	0.61	0.58
EP31	6.84	6.55	6.01	5.77	8.54	0.00	0.02	1.42	5.99	0.21	0.20
EP32	7.25	4.83	6.52	5.50	7.27	0.00	0.02	3.67	5.60	3.82	3.81
EP33	5.70	4.60	6.01	4.12	6.37	0.00	0.05	5.45	0.50	0.43	0.38
EP34	6.10	5.22	5.29	4.67	8.37	0.00	0.00	5.55	0.63	2.49	2.49
EP35	5.87	4.12	2.20	2.42	7.27	0.00	0.00	1.67	0.00	1.77	1.77
EP36	7.99	6.26	6.18	5.97	6.28	0.00	0.06	3.64	1.86	7.49	7.49
EP37	6.56	5.51	7.91	6.91	6.38	0.00	0.40	5.86	5.44	5.51	5.48
EP38	6.75	5.44	8.12	7.95	6.80	0.00	0.41	4.14	4.76	7.10	7.09
EP39	6.57	4.73	6.07	5.67	7.25	0.00	0.04	6.10	5.26	0.87	0.84
EP40	5.40	4.01	5.33	5.36	5.12	0.00	0.41	5.82	0.00	0.04	0.04
EP41	6.71	4.37	6.20	5.92	6.51	0.00	1.56	1.92	1.53	1.40	1.34
EP42	5.47	3.88	5.01	3.29	4.32	0.00	0.07	0.00	0.00	0.55	0.48

Cell	4A Habitat for threatened reptile & amphibian species mean	4B Habitat for all reptile & amphibian species mean	5A Habitat for threatened mammal species mean	5B Habitat for all mammal species mean	6 Habitat for all butterfly species mean	7A Distribution of Aust. Sea-lion colonies (focal species) mean	7B Habitat for Aust. Pied Oystercatcher (focal species) mean	7C Distribution of Eastern Osprey nests & territories (focal species) mean	7D Distribution of White-bellied Sea-Eagle nests & territories (focal species) mean	7E Habitat for Beach Slider (focal species) mean	7F Habitat for Bight Coast Skink (focal species) mean
EP43	5.45	3.90	5.00	3.75	5.02	0.00	0.18	1.62	0.00	1.00	0.83
EP44	6.64	4.24	5.00	2.14	3.68	0.00	0.13	0.00	0.00	6.66	6.59
EP45	0.69	2.59	6.00	2.12	1.96	0.00	0.00	0.00	0.00	0.85	0.85
EP46	1.22	3.52	2.48	2.16	5.30	0.00	0.01	4.83	4.97	0.87	0.86
EP47	0.10	4.12	0.55	3.88	6.53	0.00	0.00	5.64	5.86	0.14	0.14
EP48	4.55	4.90	5.00	2.17	4.19	0.00	0.09	5.59	2.04	6.35	6.27
EP49	0.09	4.19	0.09	2.59	6.18	0.00	0.03	0.05	0.92	0.10	0.07
EP50	1.73	3.99	5.00	3.39	5.41	0.00	0.05	3.28	2.45	2.17	2.12
EP51	4.12	3.91	6.00	3.05	4.09	0.00	0.41	5.50	0.00	5.75	5.44
EP52	5.08	3.44	5.58	2.56	4.65	0.00	0.07	0.20	0.00	4.32	4.27
EP53	2.12	4.06	5.43	3.80	7.01	0.00	0.16	1.19	2.79	3.08	3.03
EP54	1.89	5.32	5.00	3.42	4.80	0.00	0.99	3.20	5.24	0.17	0.17
EP55	2.98	6.52	6.23	6.38	5.63	0.00	1.21	7.12	6.61	1.01	1.00
EP56	2.36	6.53	6.00	5.13	6.15	0.01	0.13	6.27	5.19	2.44	2.40
EP57	1.57	3.22	6.01	3.69	2.98	0.00	1.48	5.15	4.59	0.44	0.40
EP58	1.09	2.85	5.18	2.84	3.11	0.00	1.02	5.03	6.07	0.16	0.16
EP59	3.84	5.32	2.68	2.73	7.68	0.00	0.13	6.48	5.00	3.92	3.89
EP60	5.44	4.57	4.53	2.36	6.71	0.00	0.06	7.80	5.36	8.12	8.07
EP61	0.89	2.84	5.25	2.14	3.90	0.01	0.00	6.90	8.87	1.27	1.27
EP62	4.17	4.47	7.69	5.59	5.72	0.00	0.17	4.04	5.00	5.76	5.72
EP63	1.42	3.05	5.25	2.59	7.14	0.00	0.06	6.51	3.70	1.88	1.84
EP64	4.01	3.63	3.38	1.91	7.64	0.00	0.09	5.54	0.27	6.03	5.94
EP65	2.57	2.74	5.24	1.77	3.54	0.00	4.65	5.95	4.52	2.10	1.92
EP66	0.57	2.27	5.06	1.37	0.61	0.00	0.44	5.00	5.00	0.56	0.51
EP67	2.35	3.58	1.95	2.36	3.03	0.00	0.12	2.12	7.84	2.92	2.92
EP68	2.46	3.68	2.64	2.21	4.97	0.00	0.18	0.00	2.69	3.46	3.45
EP69	4.64	3.59	5.02	2.56	6.75	0.00	3.17	0.00	1.89	1.82	1.81
EP70	3.45	4.19	5.05	3.84	6.54	0.00	0.10	1.02	5.59	4.69	4.65
EP71	3.84	2.99	5.00	1.75	5.04	0.00	6.51	0.00	6.56	2.37	2.35
EP72	2.83	3.90	2.19	2.09	3.04	0.00	0.16	0.00	5.00	3.40	3.38
EP73	3.14	4.44	7.02	4.03	5.67	0.00	0.70	0.00	6.82	1.00	0.96
EP74	5.21	3.08	5.14	3.33	2.70	0.00	0.19	2.40	2.39	0.70	0.66
EP75	2.44	3.40	5.42	2.63	5.93	0.00	0.97	5.00	0.00	1.71	1.70
EP76	2.54	4.93	5.00	3.11	5.98	0.00	0.12	6.39	2.24	0.65	0.63
EP77	3.92	3.05	0.86	1.50	5.59	0.00	6.34	1.95	1.01	0.91	0.84
EP78	3.39	4.38	4.07	2.35	4.84	0.00	0.08	0.00	0.16	4.86	4.78
EP79	4.57	4.26	5.84	3.90	3.77	0.00	0.09	0.00	0.69	6.14	6.12
EP80	3.76	2.15	6.01	1.60	2.43	0.00	0.03	2.97	0.00	2.52	2.49
EP81	6.62	4.42	5.77	3.69	5.69	0.00	0.18	2.12	0.00	6.41	6.31
EP82	6.35	4.37	5.70	2.85	6.27	0.00	0.06	6.76	2.22	6.11	6.06
EP83	5.36	4.67	6.90	4.80	7.32	0.00	0.03	0.85	4.28	1.43	1.41
EP84	6.15	4.55	6.36	3.74	5.79	0.00	0.03	4.95	5.35	3.07	3.05
EP85	3.88	4.64	6.44	3.33	6.82	0.00	0.04	6.26	1.60	3.62	3.61

Cell	8A Viewshed analysis mean	8B Viewscape analysis mean	9A Vegetation patch size mean	9B Vegetation patch connectivity mean	9C Vegetation patch < 1ha presence mean	9D Vegetation patch shape ETIR mean	10A Indigenous heritage (DAARD site presence)	10B Non-indigenous heritage sites mean	10C Significant geological feature mean	11 Wetland significance mean	Sum of conservation summary means
EP1	7.77	6.00	8.63	8.67	0.01	8.64	9.00	0.00	1.43	1.43	**97.44**
EP2	8.14	5.91	8.23	8.25	0.00	8.24	9.00	0.08	0.77	0.86	**107.44**
EP3	8.46	5.61	4.38	4.65	0.01	4.51	0.00	0.00	0.00	5.82	**88.98**
EP4	8.46	1.51	0.68	0.75	0.01	0.68	9.00	0.02	0.00	0.62	**47.97**
EP5	7.26	5.63	7.94	7.96	0.01	7.95	0.00	0.00	0.00	4.91	**81.91**
EP6	7.71	5.68	8.86	8.86	0.00	8.86	0.00	0.00	0.00	4.03	**81.89**
EP7	8.81	5.83	8.78	8.80	0.00	8.80	0.00	0.00	0.00	1.67	**97.49**
EP8	8.67	5.86	8.89	8.91	0.00	8.90	0.00	0.00	0.00	3.72	**99.26**
EP9	8.91	5.87	8.34	8.37	0.00	8.35	8.96	0.00	0.00	1.53	**103.67**
EP10	5.64	5.99	8.28	8.30	0.00	8.29	8.81	0.00	0.00	6.04	**136.20**
EP11	7.60	6.01	1.66	2.28	0.00	2.15	9.00	0.00	0.00	0.00	**72.83**
EP12	7.44	6.03	6.33	6.33	0.00	6.33	9.00	0.00	0.00	1.46	**91.63**
EP13	8.20	6.10	4.66	4.81	0.00	4.76	0.00	0.00	0.18	0.00	**61.75**
EP14	8.10	5.91	7.48	7.51	0.02	7.50	0.00	0.00	0.00	3.17	**112.58**
EP15	8.32	5.96	4.55	5.17	0.00	5.10	0.00	0.00	0.00	1.22	**83.72**
EP16	8.81	6.15	0.77	1.06	0.00	0.91	0.00	0.00	0.00	0.17	**50.67**
EP17	7.97	6.12	2.38	3.18	0.00	2.80	0.00	0.02	0.00	0.48	**81.44**
EP18	8.73	6.19	1.48	2.29	0.00	2.04	0.00	0.07	0.00	0.01	**74.57**
EP19	8.98	6.15	4.91	6.03	0.00	6.00	0.00	0.31	0.00	0.11	**74.40**
EP20	8.91	5.48	5.77	6.49	0.00	6.49	0.00	0.01	0.00	1.19	**110.97**
EP21	6.49	5.49	5.52	6.22	0.00	6.27	0.00	0.00	0.00	4.56	**94.92**
EP22	7.83	6.13	0.95	1.38	0.00	1.19	0.01	0.00	0.00	0.07	**59.92**
EP23	5.79	5.97	3.70	4.33	0.00	3.81	9.00	0.00	0.00	1.55	**97.69**
EP24	7.33	5.87	4.13	4.74	0.00	4.71	9.00	0.00	0.00	0.55	**109.84**
EP25	8.51	6.10	3.50	4.36	0.01	4.28	0.01	0.00	0.00	1.29	**82.39**
EP26	6.17	6.16	6.85	7.70	0.00	7.70	0.00	0.01	0.00	1.99	**111.01**
EP27	7.54	4.56	0.37	0.64	0.00	0.57	9.00	1.38	0.12	0.00	**76.20**
EP28	7.26	3.13	5.38	6.29	0.01	6.31	8.63	0.15	0.01	0.33	**123.67**
EP29	8.28	6.21	8.77	8.77	0.00	8.77	0.00	0.00	0.00	0.24	**123.27**
EP30	8.68	6.23	8.09	8.11	0.00	8.12	8.89	2.19	1.25	0.11	**147.61**
EP31	8.29	6.39	8.69	8.69	0.00	8.69	0.00	1.21	0.87	0.14	**130.16**
EP32	5.35	5.76	7.48	7.50	0.00	7.49	8.99	0.00	0.01	0.79	**147.98**
EP33	8.88	7.24	6.66	7.07	0.00	6.95	0.00	0.42	0.36	0.00	**106.22**
EP34	6.13	6.60	8.56	8.56	0.00	8.56	0.00	0.00	0.39	0.00	**118.58**
EP35	7.82	7.21	7.96	7.96	0.00	7.96	0.01	1.60	0.00	0.00	**95.90**
EP36	3.72	5.59	6.53	6.58	0.00	6.56	9.00	0.04	0.00	0.03	**146.54**
EP37	5.42	5.94	6.88	6.93	0.00	6.91	8.86	0.00	0.00	0.34	**145.95**
EP38	5.46	5.71	7.27	7.29	0.01	7.28	8.99	0.00	0.00	0.50	**155.79**
EP39	5.17	5.72	7.77	7.79	0.00	7.78	9.00	0.13	0.00	0.90	**143.32**
EP40	3.15	6.09	5.70	6.22	0.00	6.14	8.98	0.01	0.00	0.78	**121.30**
EP41	6.48	6.22	6.93	8.00	0.01	7.99	8.97	0.01	0.00	1.41	**133.42**
EP42	8.76	6.35	5.00	5.68	0.00	5.66	0.00	0.00	0.00	0.00	**102.24**
EP43	8.83	6.27	6.07	6.83	0.00	6.83	8.99	0.00	0.00	0.00	**108.17**

Cell	8A Viewshed analysis mean	8B Viewscape analysis mean	9A Vegetation patch size mean	9B Vegetation patch connectivity mean	9C Vegetation patch < 1ha presence mean	9D Vegetation patch shape ETIR mean	10A Indigenous heritage (DAARD site presence)	10B Non-indigenous heritage sites mean	10C Significant geological feature mean	11 Wetland significance mean	Sum of conservation summary means
EP44	6.60	5.90	4.47	5.07	0.01	4.57	0.00	0.00	0.00	0.37	**96.44**
EP45	7.73	6.32	2.08	2.95	0.00	2.65	8.99	0.00	0.29	0.00	**75.70**
EP46	4.41	6.15	6.81	6.83	0.00	6.82	0.00	0.86	0.00	0.01	**93.87**
EP47	7.46	6.18	8.40	8.40	0.00	8.40	0.00	0.00	0.00	0.00	**105.05**
EP48	4.40	5.71	5.51	5.52	0.00	5.52	0.00	0.24	0.00	0.43	**107.72**
EP49	6.98	6.21	7.03	7.13	0.00	7.10	0.01	0.00	0.00	0.00	**82.97**
EP50	5.46	6.22	6.86	6.97	0.00	6.94	9.00	0.00	0.00	0.25	**119.30**
EP51	7.92	6.24	4.58	4.61	0.00	4.60	9.00	0.00	0.00	0.11	**109.39**
EP52	1.45	5.27	4.99	5.02	0.00	5.00	9.00	0.00	0.00	3.79	**111.57**
EP53	5.07	5.86	7.72	7.74	0.00	7.73	9.00	0.00	0.15	0.08	**120.93**
EP54	7.19	5.85	5.11	5.49	0.00	5.43	8.98	0.00	0.00	0.54	**104.04**
EP55	7.16	6.02	7.12	7.18	0.00	8.11	8.05	0.00	0.00	0.88	**142.41**
EP56	7.90	6.25	7.37	7.69	0.00	7.67	0.00	0.00	0.00	0.05	**125.87**
EP57	7.00	5.89	3.58	4.21	0.01	4.14	0.00	0.00	0.00	1.73	**113.70**
EP58	7.62	5.70	3.64	3.87	0.00	3.87	8.99	0.00	0.00	0.92	**93.86**
EP59	7.54	6.17	8.12	8.15	0.00	8.14	0.00	0.00	0.00	0.15	**122.86**
EP60	4.92	5.78	6.78	6.78	0.00	6.78	0.00	0.00	0.00	0.04	**125.19**
EP61	6.48	5.88	4.10	4.12	0.00	4.11	0.00	0.00	0.00	0.00	**96.53**
EP62	3.56	5.65	6.05	6.05	0.00	6.05	9.00	0.00	0.00	0.38	**135.49**
EP63	6.81	6.25	7.91	7.93	0.00	7.93	9.00	0.00	0.02	0.11	**127.82**
EP64	6.44	5.98	8.60	8.60	0.00	8.60	9.00	0.00	0.00	0.00	**120.08**
EP65	7.58	6.26	4.60	5.18	0.00	5.14	8.98	0.00	0.00	3.01	**115.16**
EP66	8.52	6.22	0.60	0.95	0.00	0.94	8.99	0.34	0.00	0.17	**74.70**
EP67	6.53	6.21	3.88	3.54	0.00	4.47	8.18	0.00	0.00	0.19	**90.35**
EP68	6.85	6.20	6.55	6.57	0.00	6.56	0.00	0.00	0.00	0.00	**85.60**
EP69	6.13	5.86	8.56	8.63	0.00	8.60	8.81	0.00	0.00	6.21	**134.73**
EP70	7.88	6.26	8.26	8.26	0.00	8.26	9.00	2.04	0.21	0.17	**137.43**
EP71	4.45	5.88	6.55	6.89	0.00	6.73	8.81	0.00	0.00	2.91	**114.06**
EP72	7.23	6.29	4.15	4.31	0.00	4.26	0.01	0.00	0.00	0.01	**86.69**
EP73	6.58	6.16	7.71	7.71	0.00	7.71	9.00	0.00	0.00	0.77	**120.29**
EP74	8.34	5.52	3.49	3.67	0.00	3.55	9.00	0.00	0.00	0.11	**89.23**
EP75	8.85	6.10	7.55	7.56	0.00	7.56	8.97	0.00	0.00	0.85	**96.83**
EP76	8.89	6.00	7.66	7.85	0.00	7.84	8.98	0.00	0.00	0.04	**118.85**
EP77	4.85	5.92	7.15	7.23	0.00	7.21	8.98	0.00	0.00	4.92	**110.87**
EP78	6.47	5.99	5.89	5.91	0.00	5.90	9.00	0.00	0.00	0.00	**101.37**
EP79	4.72	5.70	4.84	4.84	0.00	4.84	9.00	0.00	0.00	0.28	**105.29**
EP80	1.00	5.13	3.10	3.18	0.00	3.20	9.00	0.01	0.00	0.29	**92.03**
EP81	5.40	5.73	7.09	7.10	0.00	7.10	9.00	0.00	0.00	1.45	**112.61**
EP82	6.79	6.26	8.11	8.11	0.00	8.11	8.96	0.00	0.04	0.01	**122.28**
EP83	4.15	5.52	8.45	8.45	0.00	8.45	9.00	0.00	0.00	0.15	**128.50**
EP84	3.84	5.57	6.79	6.81	0.00	6.81	8.99	0.02	0.00	1.64	**133.99**
EP85	7.69	6.17	8.24	8.25	0.00	8.25	0.00	0.00	0.00	0.03	**123.64**

Appendix 5 Threatening processes summary results

Cell	1A Campsites & day use area	1B ORV tracks	2A Development zoning	2B Land ownership	2C Viewshed analysis (sea views)	2D Viewscape analysis (visual amenity)	2E Existing development	3A Land use	3B Mining activities	3C Wastewater treatment plants/ rubbish dumps
EP1	0.03	3.80	3.35	6.82	7.77	6.00	1.52	5.56	0.51	0.00
EP2	0.03	4.65	3.29	6.61	8.14	5.91	2.83	6.06	0.00	0.00
EP3	0.00	1.81	6.05	8.22	8.46	5.61	0.53	8.79	7.52	1.21
EP4	0.04	0.90	7.01	7.40	8.46	1.51	5.06	8.61	0.15	3.51
EP5	0.01	3.03	2.34	4.14	7.26	5.63	0.49	1.49	5.12	0.03
EP6	0.01	1.57	1.94	5.09	7.71	5.68	0.38	4.93	5.48	0.00
EP7	0.01	2.25	1.20	3.05	8.81	5.83	0.54	2.81	2.15	0.00
EP8	0.00	1.56	1.15	3.02	8.67	5.86	0.15	4.48	5.17	0.00
EP9	0.00	2.66	1.03	7.68	8.91	5.87	0.92	8.11	3.81	0.00
EP10	0.03	2.50	1.39	5.89	5.64	5.99	0.72	4.74	0.99	0.00
EP11	0.09	3.43	1.00	7.89	7.60	6.01	3.23	7.87	0.00	0.00
EP12	0.03	3.33	1.00	7.62	7.44	6.03	0.00	7.59	2.18	0.00
EP13	0.04	3.35	1.18	7.83	8.20	6.10	0.00	7.40	0.02	0.00
EP14	0.02	2.77	2.95	7.16	8.10	5.91	2.27	5.24	3.06	0.00
EP15	0.01	2.82	1.38	8.18	8.32	5.96	0.16	7.86	0.57	0.00
EP16	0.00	2.03	2.25	7.60	8.81	6.15	0.38	7.54	0.13	0.00
EP17	0.05	3.45	2.90	7.05	7.97	6.12	4.05	6.38	0.27	0.00
EP18	0.05	3.61	2.09	8.10	8.73	6.19	2.26	7.69	0.00	0.00
EP19	0.02	2.98	2.18	7.41	8.98	6.15	0.77	6.70	0.01	0.00
EP20	0.03	2.94	3.39	7.43	8.91	5.48	2.49	7.65	0.07	0.04
EP21	0.01	2.81	3.18	7.82	6.49	5.49	1.62	6.90	0.01	0.00
EP22	0.04	2.91	5.15	8.49	7.83	6.13	3.05	8.07	0.00	0.00
EP23	0.01	2.90	3.08	6.90	5.79	5.97	0.70	6.82	0.03	0.00
EP24	0.01	3.20	5.39	8.71	7.33	5.87	1.53	8.67	0.33	0.00
EP25	0.02	4.01	2.75	7.98	8.51	6.10	2.90	7.33	1.75	0.01
EP26	0.01	4.02	7.46	8.02	6.17	6.16	2.38	6.30	0.28	0.00
EP27	0.07	2.83	8.47	7.77	7.54	4.56	8.63	7.48	0.00	0.00
EP28	0.04	3.52	6.35	6.90	7.26	3.13	6.26	6.51	0.01	0.00
EP29	0.01	2.62	1.00	0.00	8.28	6.21	0.42	0.00	0.00	0.00
EP30	0.07	4.01	1.07	0.00	8.68	6.23	0.85	0.00	0.01	0.00
EP31	0.03	1.28	1.00	0.03	8.29	6.39	0.73	0.03	0.00	0.00
EP32	0.00	1.50	1.02	0.11	5.35	5.76	0.22	0.11	0.07	0.00
EP33	0.03	3.07	1.32	5.86	8.88	7.24	1.61	3.77	1.00	0.00
EP34	0.02	2.08	1.02	1.28	6.13	6.60	0.00	0.00	1.98	0.00
EP35	0.08	1.91	1.00	2.37	7.82	7.21	0.00	0.02	0.00	0.00
EP36	0.00	1.42	1.00	0.87	3.72	5.59	0.09	0.20	0.92	0.00
EP37	0.00	0.57	1.10	0.00	5.42	5.94	0.10	0.00	0.00	0.00
EP38	0.00	0.56	1.01	0.00	5.46	5.71	0.05	0.00	0.00	0.00
EP39	0.01	0.95	1.00	0.00	5.17	5.72	0.21	0.00	0.00	0.00
EP40	0.03	3.39	2.08	6.10	3.15	6.09	3.70	4.86	0.00	0.00
EP41	0.02	1.91	1.12	4.56	6.48	6.22	2.33	2.86	0.00	0.00

Cell	1A Campsites & day use area	1B ORV tracks	2A Development zoning	2B Land ownership	2C Viewshed analysis (sea views)	2D Viewscape analysis (visual amenity)	2E Existing development	3A Land use	3B Mining activities	3C Wastewater treatment plants/ rubbish dumps
EP42	0.09	3.29	6.30	7.30	8.76	6.35	0.34	6.18	0.39	0.00
EP43	0.07	2.96	4.09	6.17	8.83	6.27	0.00	4.18	0.56	0.00
EP44	0.01	1.46	1.66	3.00	6.60	5.90	0.01	3.13	1.89	0.00
EP45	0.04	2.98	5.58	6.75	7.73	6.32	0.33	5.29	0.00	0.00
EP46	0.02	1.78	2.61	6.06	4.41	6.15	0.49	3.86	1.18	0.00
EP47	0.01	0.86	1.65	5.23	7.46	6.18	0.00	7.58	0.69	0.00
EP48	0.02	1.08	1.01	7.51	4.40	5.71	0.00	8.50	3.14	0.00
EP49	0.00	0.48	3.14	6.68	6.98	6.21	0.00	8.19	0.00	0.00
EP50	0.01	1.50	3.23	5.49	5.46	6.22	2.09	7.32	2.47	0.00
EP51	0.07	1.71	5.68	5.66	7.92	6.24	0.15	4.80	5.01	0.00
EP52	0.00	0.49	1.05	0.59	1.45	5.27	0.02	0.55	0.52	0.00
EP53	0.02	2.03	1.34	5.41	5.07	5.86	0.33	3.23	5.05	0.00
EP54	0.02	3.35	3.09	3.96	7.19	5.85	2.88	2.32	3.33	0.00
EP55	0.01	1.25	1.66	0.06	7.16	6.02	0.03	0.00	0.00	0.00
EP56	0.01	1.74	1.88	5.49	7.90	6.25	0.00	4.95	3.91	0.00
EP57	0.01	2.51	2.91	7.50	7.00	5.89	0.97	6.01	0.73	0.00
EP58	0.00	2.03	6.70	8.27	7.62	5.70	0.24	7.78	0.00	0.00
EP59	0.02	2.89	1.00	1.99	7.54	6.17	0.00	0.43	0.00	0.00
EP60	0.02	3.21	1.11	8.62	4.92	5.78	0.30	5.17	1.39	0.00
EP61	0.02	2.08	4.79	8.14	6.48	5.88	1.45	7.92	2.41	0.00
EP62	0.01	1.52	1.35	3.85	3.56	5.65	0.26	1.80	2.94	0.00
EP63	0.05	3.98	3.33	5.87	6.81	6.25	1.58	5.23	0.01	0.00
EP64	0.01	1.65	2.08	7.01	6.44	5.98	0.30	5.86	0.03	0.00
EP65	0.02	2.35	4.01	6.49	7.58	6.26	0.03	6.77	0.00	0.00
EP66	0.07	3.15	5.46	7.47	8.52	6.22	5.53	7.01	0.02	0.01
EP67	0.05	2.94	3.08	7.37	6.53	6.21	3.12	6.40	0.01	0.00
EP68	0.04	4.13	1.74	4.48	6.85	6.20	1.31	5.66	0.00	0.00
EP69	0.03	1.89	1.06	1.00	6.13	5.86	0.25	1.41	0.00	0.00
EP70	0.03	3.53	1.00	4.00	7.88	6.26	0.00	8.53	0.00	0.00
EP71	0.01	2.59	1.31	4.37	4.45	5.88	0.36	7.13	0.00	0.00
EP72	0.01	3.60	2.11	6.38	7.23	6.29	0.90	8.39	0.00	0.00
EP73	0.03	4.75	1.83	4.18	6.58	6.16	0.34	6.75	0.01	0.00
EP74	0.06	4.03	5.73	7.33	8.34	5.52	6.16	7.55	0.03	0.00
EP75	0.02	6.23	3.07	8.37	8.85	6.10	3.95	7.19	0.04	0.00
EP76	0.06	4.18	2.08	8.43	8.89	6.00	2.03	7.74	0.00	0.00
EP77	0.04	1.80	1.43	5.84	4.85	5.92	0.04	6.42	0.10	0.00
EP78	0.12	4.70	1.03	3.64	6.47	5.99	0.00	4.91	0.00	0.00
EP79	0.03	1.82	1.07	2.21	4.72	5.70	0.16	3.77	0.00	0.00
EP80	0.00	4.41	4.57	4.28	1.00	5.13	0.23	7.60	5.41	0.19
EP81	0.00	1.48	1.02	1.50	5.40	5.73	0.00	2.42	0.00	0.00
EP82	0.07	3.74	1.24	3.82	6.79	6.26	0.54	5.89	0.00	0.00
EP83	0.00	1.68	5.59	1.70	4.15	5.52	0.08	1.50	0.52	0.00
EP84	0.05	4.39	1.62	1.93	3.84	5.57	0.19	1.96	0.00	0.00
EP85	0.01	2.65	2.90	3.10	7.69	6.17	0.00	3.32	0.00	0.00

Cell	4A Vegetation isolation	4B Vegetation degradation	4C Vegetation shape	4D Vegetation patch size	4E Weed distribution	4FFeral species: rabbits	5A Dune stability	5B Cliff stability	5C Acid sulphate soils	Sum of threat summary means
EP1	0.96	2.64	2.92	1.00	1.76	0.03	0.13	0.00	1.00	**45.782**
EP2	0.92	4.74	2.76	0.94	2.36	0.06	0.46	0.04	0.40	**50.191**
EP3	0.52	5.04	1.68	0.88	0.13	0.00	0.53	0.00	1.87	**58.867**
EP4	0.10	8.29	0.33	0.20	2.00	0.00	0.02	0.00	0.53	**54.144**
EP5	0.88	1.14	2.66	0.90	0.08	0.00	0.00	0.00	3.94	**39.161**
EP6	0.98	0.17	2.95	0.98	0.13	0.00	0.00	0.00	3.43	**41.432**
EP7	0.98	0.03	2.94	1.00	0.06	0.00	0.98	0.00	0.40	**33.040**
EP8	0.99	2.17	2.98	1.02	4.04	0.00	0.14	0.00	2.32	**43.735**
EP9	0.93	1.39	2.80	0.96	5.07	0.29	1.25	0.00	0.20	**51.877**
EP10	0.92	2.51	2.78	0.95	2.27	0.00	0.65	0.00	2.79	**40.762**
EP11	0.31	8.04	0.95	1.10	4.64	0.00	0.20	0.04	0.00	**52.403**
EP12	0.70	8.30	2.11	0.71	7.94	3.14	2.18	0.00	0.00	**60.308**
EP13	0.53	6.37	1.65	0.74	6.91	2.97	0.58	0.06	0.00	**53.919**
EP14	0.85	5.18	2.53	0.88	5.95	0.79	0.36	0.01	1.99	**55.993**
EP15	0.58	5.23	1.79	1.22	7.57	0.16	0.35	0.03	0.00	**52.197**
EP16	0.13	8.15	0.52	0.51	2.99	0.14	0.24	0.22	0.00	**47.781**
EP17	0.37	4.23	1.45	1.24	2.45	3.49	0.49	0.03	0.24	**52.203**
EP18	0.29	7.34	1.05	1.39	4.34	4.74	0.65	0.08	0.00	**58.636**
EP19	0.67	5.83	2.04	1.83	2.66	5.01	1.10	0.07	0.00	**54.405**
EP20	0.72	5.91	2.16	1.44	4.06	0.78	1.67	0.00	0.06	**55.243**
EP21	0.75	4.58	2.10	1.50	4.17	0.65	0.67	0.14	2.01	**50.895**
EP22	0.26	8.31	0.77	0.91	7.79	2.52	0.89	0.09	0.00	**63.195**
EP23	0.50	6.04	1.99	1.22	7.36	1.26	0.79	0.07	0.00	**51.439**
EP24	0.54	6.17	1.63	1.20	3.39	0.41	0.64	0.01	0.00	**55.030**
EP25	0.49	6.68	1.54	1.38	6.50	1.00	2.01	0.01	0.13	**61.070**
EP26	0.86	3.61	2.57	1.71	6.69	3.72	0.48	0.08	0.00	**60.498**
EP27	0.11	8.39	0.33	0.51	5.12	0.00	0.01	0.01	0.00	**61.841**
EP28	0.83	6.01	2.24	1.90	5.43	0.00	0.01	0.04	0.21	**56.641**
EP29	0.97	2.76	2.92	0.97	2.98	0.00	0.09	0.20	0.00	**29.460**
EP30	0.93	4.09	2.73	0.96	3.90	0.90	0.36	0.09	0.00	**34.891**
EP31	0.97	1.49	2.90	0.97	2.88	0.16	0.12	0.16	0.00	**27.425**
EP32	0.83	5.49	2.51	0.86	2.85	0.00	2.40	0.27	0.00	**29.333**
EP33	0.79	3.98	2.48	1.36	7.84	0.00	0.26	0.49	0.00	**49.986**
EP34	0.95	3.42	2.85	0.95	4.90	0.00	1.43	0.53	0.00	**34.157**
EP35	0.88	1.30	2.65	0.88	0.35	0.00	1.03	1.23	0.00	**28.757**
EP36	0.73	3.40	2.21	0.79	3.42	0.00	5.20	0.04	0.01	**29.635**
EP37	0.77	4.49	2.33	0.84	1.24	0.00	3.90	0.09	0.13	**26.929**
EP38	0.81	4.05	2.44	0.83	1.14	0.00	4.48	0.10	0.09	**26.729**
EP39	0.87	2.97	2.61	0.89	1.94	0.86	0.56	0.17	0.00	**23.927**
EP40	0.70	6.64	2.16	1.33	4.13	0.47	0.03	0.13	0.17	**45.171**
EP41	0.89	4.29	2.68	1.96	4.33	0.00	0.81	0.02	0.66	**41.134**
EP42	0.65	4.70	1.93	1.36	4.41	0.24	0.35	0.31	0.00	**52.945**
EP43	0.76	3.21	2.28	1.52	0.88	1.47	0.67	0.58	0.00	**44.474**

Cell	4A Vegetation isolation	4B Vegetation degradation	4C Vegetation shape	4D Vegetation patch size	4E Weed distribution	4FFeral species: rabbits	5A Dune stability	5B Cliff stability	5C Acid sulphate soils	Sum of threat summary means
EP44	0.57	7.03	2.20	1.19	4.40	0.00	4.77	0.05	0.00	**43.879**
EP45	0.33	2.52	1.28	1.51	1.52	0.90	0.55	1.18	0.00	**44.810**
EP46	0.76	5.01	2.29	0.78	2.36	0.34	0.53	0.91	0.00	**39.555**
EP47	0.93	7.19	2.80	0.93	2.66	0.00	0.09	0.64	0.00	**44.896**
EP48	0.61	8.04	1.84	0.62	1.68	0.00	4.81	0.16	0.00	**49.129**
EP49	0.79	8.36	2.41	0.93	3.68	0.00	0.07	0.95	0.00	**48.859**
EP50	0.77	4.15	2.35	0.94	4.19	0.00	1.30	0.68	0.00	**48.170**
EP51	0.51	7.69	1.55	0.56	4.15	0.03	4.28	0.02	0.00	**56.037**
EP52	0.56	4.02	1.68	0.59	6.06	0.01	3.11	0.00	0.00	**25.989**
EP53	0.86	7.18	2.59	0.88	5.59	0.03	1.99	0.40	0.06	**47.923**
EP54	0.63	5.81	1.91	1.14	4.61	1.17	0.10	0.03	0.31	**47.707**
EP55	1.84	2.15	2.72	1.91	2.73	0.68	0.61	0.37	0.54	**29.718**
EP56	0.85	2.87	2.59	1.19	3.73	2.40	1.43	0.50	0.00	**47.682**
EP57	0.51	6.49	1.51	1.26	4.47	1.18	0.27	0.00	0.31	**49.539**
EP58	0.44	5.92	1.31	0.72	3.47	0.43	0.09	0.15	0.17	**51.042**
EP59	0.91	3.74	2.74	0.96	1.87	0.16	2.33	0.17	0.03	**32.940**
EP60	0.75	6.42	2.26	0.75	3.06	0.13	5.50	0.08	0.00	**49.466**
EP61	0.46	6.81	1.38	0.48	4.82	0.00	0.72	0.55	0.00	**54.382**
EP62	0.67	5.38	2.02	0.67	1.69	0.74	4.41	0.00	0.00	**36.524**
EP63	0.89	3.98	2.65	0.91	1.56	1.39	1.12	0.61	0.00	**46.223**
EP64	0.96	6.07	2.87	0.96	3.05	2.14	3.48	0.14	0.00	**48.998**
EP65	0.58	6.96	1.77	1.20	4.91	0.67	1.25	0.09	1.96	**52.899**
EP66	0.29	7.91	0.54	0.86	3.00	2.77	0.35	0.01	0.09	**59.265**
EP67	1.53	7.38	1.62	1.30	4.17	1.01	1.87	0.68	0.00	**55.260**
EP68	0.73	2.42	2.21	0.77	4.67	0.39	2.05	0.05	0.00	**43.685**
EP69	0.96	5.25	2.90	1.06	1.87	0.00	1.04	0.00	3.31	**34.021**
EP70	0.92	3.42	2.75	0.92	4.28	0.17	2.90	0.26	0.00	**46.861**
EP71	0.77	1.86	2.45	1.13	0.64	0.00	1.70	0.02	2.77	**37.408**
EP72	0.49	5.82	1.50	0.72	3.66	0.11	1.96	0.04	0.00	**49.208**
EP73	0.86	2.42	2.57	0.86	0.37	0.33	0.58	0.18	0.62	**39.422**
EP74	0.42	5.19	1.36	0.67	4.86	1.53	0.41	0.19	0.10	**59.452**
EP75	0.84	1.56	2.52	0.84	0.75	0.00	0.95	0.03	0.57	**51.900**
EP76	0.87	2.52	2.62	1.12	4.75	0.54	0.37	0.07	0.05	**52.321**
EP77	0.80	2.34	2.43	0.91	0.17	0.00	0.72	0.04	3.55	**37.397**
EP78	0.66	4.02	1.98	0.68	1.92	0.00	3.86	0.46	0.00	**40.434**
EP79	0.54	6.35	1.61	0.54	7.17	0.00	5.10	0.22	0.00	**41.003**
EP80	0.39	6.43	1.09	0.50	4.94	0.03	2.00	0.01	0.00	**48.211**
EP81	0.79	3.71	2.37	0.81	7.08	0.00	4.15	0.04	1.38	**37.899**
EP82	0.90	5.28	2.70	0.90	3.47	0.00	3.51	0.53	0.33	**45.976**
EP83	0.94	1.56	2.82	0.94	5.44	0.00	1.03	0.00	0.00	**33.468**
EP84	0.76	4.75	2.28	0.79	4.59	0.00	2.41	0.11	0.00	**35.231**
EP85	0.92	3.16	2.75	0.92	2.47	0.00	2.27	0.28	0.00	**38.597**

Appendix 6 Number of biological survey sites per cell

Cell	Flora						Fauna			
	Survey sites	Opportune sites	Herbarium record sites	Threatened plant population record sites	Reserve database record sites	Total flora sites	Survey sites	Opportune survey sites	Reserve database record sites	Total fauna sites
EP1	0	0	1	0	0	1	0	3	0	3
EP2	7	1	3	0	0	11	0	10	0	10
EP3	5	0	1	0	0	6	0	4	0	4
EP4	0	0	6	0	0	6	0	7	0	7
EP5	0	0	8	0	0	8	0	9	0	9
EP6	0	0	6	0	0	6	0	1	0	1
EP7	6	0	0	0	0	6	2	14	0	16
EP8	2	0	4	0	0	6	0	1	0	1
EP9	1	0	2	0	0	3	0	1	0	1
EP10	15	1	23	0	0	39	1	41	0	42
EP11	3	0	3	0	0	6	0	5	0	5
EP12	2	0	0	0	0	2	0	0	0	0
EP13	0	0	3	0	0	3	0	2	0	2
EP14	6	8	6	2	0	22	0	6	0	6
EP15	5	0	2	0	0	7	0	0	0	0
EP16	1	0	2	0	0	3	0	1	0	1
EP17	2	0	6	0	0	8	0	15	0	15
EP18	8	8	3	1	0	20	4	9	1	14
EP19	1	0	1	0	0	2	0	0	0	0
EP20	2	0	6	0	0	8	0	15	0	15
EP21	36	0	10	1	0	47	1	4	1	6
EP22	0	0	2	0	0	2	0	3	0	3
EP23	8	0	10	1	0	19	0	1	1	2
EP24	2	0	6	0	0	8	0	3	0	3
EP25	0	0	4	0	0	4	0	11	0	11
EP26	1	0	4	0	0	5	0	6	0	6
EP27	0	0	13	0	0	13	0	30	0	30
EP28	13	4	35	0	0	52	1	40	0	41
EP29	3	0	48	0	0	51	0	23	0	23
EP30	14	0	34	0	0	48	2	25	0	27
EP31	11	0	46	0	0	57	1	42	0	43
EP32	26	0	103	1	0	130	5	63	1	69
EP33	9	1	8	0	0	18	1	15	0	16
EP34	7	0	10	0	0	17	2	42	0	44
EP35	0	0	1	0	0	1	0	40	0	40
EP36	11	0	62	1	0	74	1	49	0	50
EP37	8	0	46	0	0	54	3	38	1	42
EP38	7	0	38	0	0	45	4	29	0	33
EP39	10	1	88	0	0	99	2	43	0	45
EP40	7	0	18	1	1	27	2	39	1	42
EP41	14	0	14	1	0	29	3	11	0	14
EP42	3	0	6	0	0	9	0	13	0	13

Appendix 6 – Number of biological survey sites per cell

Cell	Flora						Fauna			
	Survey sites	Opportune sites	Herbarium record sites	Threatened plant population record sites	Reserve database record sites	Total flora sites	Survey sites	Opportune survey sites	Reserve database record sites	Total fauna sites
EP43	7	0	3	0	0	10	1	9	0	10
EP44	7	0	3	0	0	10	0	2	0	2
EP45	2	0	3	0	0	5	0	3	0	3
EP46	5	0	1	0	0	6	0	0	0	0
EP47	2	0	3	0	0	5	1	13	0	14
EP48	7	0	2	0	0	9	0	8	0	8
EP49	3	0	2	0	0	5	2	6	0	8
EP50	5	0	8	0	0	13	0	21	0	21
EP51	3	0	0	0	0	3	0	5	0	5
EP52	11	0	11	1	0	23	5	22	0	27
EP53	7	0	3	1	0	11	0	8	0	8
EP54	7	3	10	0	0	20	0	34	0	34
EP55	29	0	11	0	1	41	13	70	0	83
EP56	19	1	3	0	0	23	3	11	0	14
EP57	8	1	5	0	0	14	1	12	0	13
EP58	9	5	7	2	1	24	0	8	2	10
EP59	6	0	2	0	0	8	0	7	0	7
EP60	3	0	5	0	0	8	0	3	0	3
EP61	4	0	8	0	0	12	0	7	0	7
EP62	9	5	8	1	0	23	0	23	0	23
EP63	11	1	4	0	0	16	0	11	0	11
EP64	4	1	6	0	0	11	0	5	0	5
EP65	4	0	4	0	0	8	0	14	0	14
EP66	0	1	3	0	0	4	0	15	0	15
EP67	17	0	5	0	0	22	2	11	1	14
EP68	0	0	4	1	0	5	0	2	0	2
EP69	13	6	5	1	1	26	2	16	1	19
EP70	19	0	5	0	0	24	1	6	0	7
EP71	4	0	1	0	0	5	0	4	0	4
EP72	3	0	1	0	0	4	0	10	0	10
EP73	10	0	15	2	0	27	0	21	2	23
EP74	0	0	7	0	0	7	0	17	0	17
EP75	1	0	1	0	0	2	0	3	0	3
EP76	5	0	2	0	0	7	0	6	0	6
EP77	8	1	6	0	0	15	0	7	0	7
EP78	12	1	1	0	0	14	0	1	0	1
EP79	6	0	1	0	0	7	1	13	0	14
EP80	7	1	15	0	0	23	0	23	0	23
EP81	7	0	5	0	0	12	2	3	0	5
EP82	2	0	1	0	0	3	0	4	0	4
EP83	12	2	18	2	0	34	1	9	1	11
EP84	11	1	13	0	0	25	0	34	0	34
EP85	12	2	3	0	0	17	0	4	0	4
Total	**577**	**56**	**916**	**20**	**4**	**1573**	**70**	**1225**	**13**	**1308**

Appendix 7 South Australian vegetation structural formations*

	Projective foliage cover of tallest stratum			
Life form/ height class	Dense 70–100%	Mid-dense 30–70%	Sparse 10–30%	Very sparse 1–10%
Trees > 30 m	tall closed forest	tall open forest	tall woodland	tall open woodland
Trees 10–30 m	closed forest	open forest	woodland	open woodland
Trees 5–10 m	low closed forest	low open forest	low woodland	low open woodland
Trees < 5 m	very low closed forest	very low open forest	very low woodland	very low open woodland
Mallee (> 3 m)	closed mallee	mallee	open mallee	very open mallee
Low mallee (< 3 m)	closed low mallee	low mallee	open low mallee	very open low mallee
Shrubs > 2 m	tall closed shrubland	tall shrubland	tall open shrubland	tall very open shrubland
Shrubs 1–2 m	closed shrubland	shrubland	open shrubland	very open shrubland
Shrubs < 1 m	low closed shrubland	low shrubland	low open shrubland	low very open shrubland
Mat plants	closed mat plants	mat plants	open mat plants	very open mat plants
Hummock grass	closed hummock grassland	hummock grassland	open hummock grassland	very open hummock grassland
Tussock Grasses	closed tussock grassland	tussock grassland	open tussock grassland	very open tussock grassland
Herbs	closed herbland			
Sedges	closed sedgeland	sedgeland	open sedgeland	very open sedgeland
Ferns	closed fernland	fernland	open fernland	very open fernland

***Adapted from Specht 1972; Muir 1977**

Conservation categories

E	Endangered: in danger disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate
V	Vulnerable: rare and at risk from potential threats or long-term threats which could cause the species to become endangered in the future
R	Rare: has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area); not currently exposed to significant threats but warrants monitoring and protective measures to prevent reduction of population size

Appendix 8 Non-indigenous heritage

Non-Indigenous heritage sites within the Eyre Peninsula coastal boundary

There are different levels of heritage protection as well as various types of heritage lists relevant to South Australia. Some lists provide protection for places, while others acknowledge significance but provide no statutory protection. Table 1 lists the built heritage sites present within the study area that are protected under existing legislation or have been identified for further protection. A description of the levels of heritage listing follows.

Table 1 Non-Indigenous built heritage sites contained within the Eyre Peninsula coastal boundary.

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
Point Lowly	Point Lowly Lighthouse Complex (including Lighthouse, Reserve Land of 2.14 Hectares, Power House, Two Keepers' Cottages, Oil Store, & Signal Flag Mast)		Associated with the maritime history of South Australia and the development of Port Pirie, Whyalla and BHP's mining operations in the area.	REG, RNE	C	EP2
Whyalla	Whyalla Institute	Gay Street		IDE	T	EP4
Whyalla	Plant, BHP Complex	Off McBryde Terrace		IDE	C, T	EP4
Whyalla	Ada Ryan Gardens	Cudmore Terrace		IDE	T	EP4
Whyalla	Whyalla Town Primary School	Walls Street	A prominent group of school buildings, which have played an integral part in the lives and education of much of the local community.	IDE	T	EP4
Whyalla	Mornington Apartments	Broadbent Terrace, cnr Walker Street	An unusual multiple residential building built during World War 2, for long the tallest building in Whyalla. It is of distinctive Moderne style.	IDE	T	EP4
Whyalla	School Canteen - former Dairy	Broadbent Terrace	The building(s) are representative of the provision of service facilities by BHP for its employees, critical for the growth of the Whyalla Township.	IDE	T	EP4
Whyalla	Annexe Classrooms (Technical School)	Broadbent Terrace	A technical classroom building that is a significant element in the development of the Whyalla Technical School	IDE	T	EP4

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
Whyalla	Dwelling	Darling Terrrace, cnr Cudmore Terrace	A larger representative of the corrugated iron clad dwellings built to cater for the influx of new citizens after Whyalla was proclaimed a town in 1914.	IDE	T	EP4
Whyalla	World War Two Gun Emplacements, Hummock Hill	Gay Street	Representative of the desire to defend the town's significant industry (the BHP steel works and shipyards) during the Second World War.	REG	C	EP4
Whyalla	Whyalla High School (former Whyalla Technical High School)	Broadbent Terrace	One of only three technical high schools to be built in SA this school represents a stage in the development of education which provided for technical and vocational rather than purely academic education.	REG	T	EP4
Whyalla	Four Cottages	Delprat Terrace	Typically small cottages of the kind built to cater for the influx of new citizens after Whyalla was proclaimed a town in 1914.	IDE	T	EP4
Whyalla	Dwelling, former RAOB Lodge	Dick Street	Representative of the importance of community and social clubs in the development of the town in the boom period at the beginning of WW2.	IDE	T	EP4
Cowleds Landing	Monument (Pioneers)			IDE		EP5, EP6
Murninnie Shacks	Chinamen's Graves			IDE		EP7
Cowell	Dalgety Agency, Cowell Meat Store	Main Street	Built during a boom time and represents the commercial development of the town.	IDE	T	EP10
Cowell	Cowell Bakery	Main Street	Representing the commercial development of the town.	IDE	T	EP10
Cowell	Gospel Hall, Former Baptist Church	First Street	Built for the Baptists and later used by Lutherans.	IDE	T	EP10
Cowell	House, Rectory	First Street	Served as a rectory from 1966 to 1958.	IDE	T	EP10
Cowell	House, School (Third)	Main Street		IDE	T	EP10
Cowell	Franklin Harbour Institute	Main Street		IDE	T	EP10
Cowell	Police Station & Lock Up	Third Street	Represents the development of law and order in the district.	IDE	T	EP10
Cowell	House, Shop	Main Street	First used as a grocer shop, then a garage, representing the commercial development of the town.	IDE	T	EP10
Cowell	Two Storey Building (Flats);	Main Street	Was possibly operated as a boarding house in the 1880s.	IDE	T	EP10

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
	Hotel, Boarding House?					
Cowell	Post Office	Main Street	Built as the second post office in the town, representing development of communication in the district.	IDE	T	EP10
Cowell	War Memorial	Main Street		IDE	T	EP10
Cowell	Franklin Harbor Hotel	Main Street	The Franklin Harbour Hotel is the earliest hotel to be built in this part of the Eyre Peninsula and the most intact 19th century hotel remaining on the Eyre Peninsula.	REG	T	EP10
Cowell	Cowell Methodist Church	Second Street		IDE	T	EP10
Cowell	National Trust Museum (Post Office/Residence)	Main Street	Built as the first post office in the town, representing development of communication in the district.	IDE	T	EP10
Cowell	DC of Franklin Harbour (National Bank)	Main Street	Originally built for the National Bank in 1912.	IDE	T	EP10
Cowell	Four Attached Shops	Main Street	Formerly a set of offices including three wheat buyers.	IDE	T	EP10
Cowell	Old Cowell Cemetery	Beach Road	Site of the original Cowell cemetery. Graves were transferred to the new cemetery c. 1896	IDE		EP10
Cowell	ANZ Bank, Residence	Main Street	Originally built as the Bank of Adelaide.	IDE	T	EP10
Cowell	Attached Shops, Cornelius Store	Main Street	Originally built as a greengrocers shop.	IDE	T	EP10
Cowell	Two Attached Shops	Main Street	Represents the commercial development of the town.	IDE	T	EP10
Cowell	Cowell Jetty		Built at a period when, after closer settlement, a jetty was seen as vital for the area's economic progress.	IDE	C, T	EP10
Cowell	Commercial Hotel	Main Street		IDE	T	EP10
Cowell	Residence, First Hospital	Esplanade	Funded by a local Doctor and built as a small cottage hospital, later used as nurses quarters.	IDE	T	EP10
Cowell	Methodist Manse	Second Street		IDE	T	EP10
Port Gibbon	Railway Sleepers & Cutting		Constructed to provide a rail link between the jetty and the higher shoreline behind.	IDE		EP11
Arno Bay	Arno Bay Hotel	Creek Road		IDE		EP14
Arno Bay	Former Superphosphate Shed		Built to store superphosphate this is associated with the nearby jetty and shipping trade in the district	IDE	C	EP14
Arno Bay	Former Wheat		A rare example of a once	IDE	C	EP14

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
	Buyer's Office		common function of seaside towns, associated with the maritime and agricultural industries of the district.			
Arno Bay	Cast Iron Lead Light & Jetty		Built in 1882 these items are associated with of the main ports of the district.	IDE	C	EP14
Port Neill	Lady Kinnaird Anchor	Port Neill Foreshore	Carrying over 8000 bags of wheat, the Lady Kinnaird was wrecked off Cape Burr in 1880.	LOC	C	EP17
Port Neill	Uniting Church	Wallis Street		LOC	T	EP17
Port Neill	Port Neill Jetty	Port Neill Foreshore	Associated with the maritime history of the district.	LOC	C	EP17
Port Neill	House, Location of First Carrow School	Wallis Street	Site of the first school which commenced in 1910.	IDE	T	EP17
Port Neill	Port Neill Hotel	Peake Terrace		LOC	T	EP17
Port Neill	House, Methodist Manse	Wallis Street		IDE	T	EP17
Lipson Cove	Lipson Cove Jetty (Ruin)		Built in 1882 and demolished in 1949 it was reported to have been 330 feet long.	IDE	C	EP18
Lipson Cove	Wallaby Sam Monument	Foreshore Lipson Cove		LOC		EP18, EP19
Tumby Bay	Tumby Bay Bakery	Spencer Street	Represents the commercial development of the town.	IDE	T	EP20
Tumby Bay	Tumby Bay Oval Grandstand	West Terrace		IDE	T	EP20
Tumby Bay	House	West Terrace		IDE	T	EP20
Tumby Bay	Tumby Bay Hotel	North Terrace		REG, LOC	T	EP20
Tumby Bay	Rotunda/Art Gallery	Tumby Terrace	Originally built as a band rotunda and later used by the croquet club.	IDE	T	EP20
Tumby Bay	St Margaret's Church of Scotland	Lipson Road	Second Anglican church to be built in the district.	IDE	T	EP20
Tumby Bay	Two Houses (paired & single)	North Terrace		IDE	T	EP20
Tumby Bay	Residence	North Terrace		IDE	T	EP20
Tumby Bay	Residence (Tank Maker's, Betting Shop)	North Terrace		IDE	T	EP20
Tumby Bay	Four Attached Shops (Hopping Bros)	Lipson Road	Represents the commercial development of the town.	IDE	T	EP20
Tumby Bay	Pioneer Memorial Clock	Tumby Bay Foreshore		LOC		EP20
Tumby Bay	Pair of Shops	North	Originally a barber shop and	IDE	T	EP20

Appendix 8 – Non-indigenous heritage

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
		Terrace	tailor's shop, represent the commercial development of the town.			
Tumby Bay	Supper Room	Mortlock Street		LOC	T	EP20
Tumby Bay	Church of Christ	Tumby Terrace		LOC	T	EP20
Tumby Bay	House, former Post Office	Tumby Terrace		IDE	T	EP20
Tumby Bay	Dwelling	Spencer Street		LOC		EP20
Tumby Bay	Bratten Memorial	Tumby Bay Foreshore		LOC		EP20
Tumby Bay	Excell Museum	Barraud Street		LOC	T	EP20
Tumby Bay	House (several buildings); Hospital	Esplanade	Built as a cottage hospital in 1908 and declared a public hospital in 1912. Served as the town's hospital for over 30 years.	IDE	T	EP20
Tumby Bay	Commercial Premises	Lipson Road		LOC	T	EP20
Tumby Bay	Uniting Church	Spencer Street		LOC	T	EP20
Tumby Bay	Commercial Premises	Lipson Road		LOC	T	EP20
Tumby Bay	New Jetty	Tumby Bay Foreshore	Associated with the maritime history of the district.	LOC	C	EP20
Tumby Bay	Serv-Well Store, former Mill	Mortlock & Spencer Streets	The shop was originally part of a flour mill constructed in 1908.	IDE	T	EP20
Tumby Bay	Police Station	Tumby Terrace		IDE	T	EP20
Tumby Bay	Seabreeze Hotel	Tumby Terrace	Reflects the commercial development of the town.	IDE	T	EP20
Tumby Bay	War Memorial	Tumby Bay Foreshore		LOC		EP20
North Shields	North Shields Hall	Dorward Street		LOC		EP26
North Shields	Wheatsheaf Hotel	Dorward Street		LOC		EP26
North Shields	North Shields Jetty	Easton Road	Associated with the maritime history of the district.	LOC	C	EP26
Boston	House, 'Taitucka'	Lincoln Highway	Associated with one of the earliest leaseholders in the district, J F Haigh.	IDE		EP27
Boston	Two Stone Cottages, 6.2km Sth of North Shields, western side of road	Lincoln Highway		LOC		EP27

Appendix 8 – Non-indigenous heritage

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
Port Lincoln	House, 'Weeroona Cottage'	Lincoln Highway		IDE	T	EP27
Port Lincoln	Baptist Church	Hallett Place		IDE	T	EP27
Port Lincoln	Former Windmill Base (sometime Pioneer Mill Museum)	Dorset Place	The mill is Port Lincoln's oldest remaining building.	REG	T	EP27
Port Lincoln	Ortmann & Whitford (Commercial Bank)	Lewis Street		IDE	T	EP27
Port Lincoln	'Mill Cottage' (National Trust Museum)	Flinders Highway	Built for one of the early settlers of the area.	IDE	T	EP27
Port Lincoln	Hawson's Grave, Hawson Square	Hawson Place	The event of the 10 year old Hawson's death became an important element in folk history.	REG	T	EP27
Port Lincoln	Port Lincoln Jetty	Tasman Terrace	Believed to be the first jetty to be built in Port Lincoln and the third government built jetty to be erected in South Australia.	IDE	C, T	EP27
Port Lincoln	Moreton Bay Fig Trees	Tasman Terrace (end of Light Street)	An early example of beautification of Port Lincoln's streets.	IDE	C, T	EP27
Port Lincoln	Dorwood Edzell Buildings	Tasman Terrace	Represent the commercial development of Port Lincoln.	IDE	T	EP27
Port Lincoln	First Landing Site – 1839	Shaen Street, Lincoln Highway	Presumed site of the first landing of settlers to the district.	IDE	C, T	EP27
Port Lincoln	Kirton Point Jetty	Gawler Terrace	Built as the terminal for the Port Lincoln - Yeelana railway, and was an integral part of the Eyre Peninsula railway system, linking the network to a sea port.	IDE	C, T	EP27
Port Lincoln	Former CW Schuermann's Mission Site (Lutheran)	Lincoln Highway	Significant in reflecting an early Lutheran mission established by C W Schuermann.	REG		EP27
Port Lincoln	Monument, Pioneer Memorial Park	Brockworth Street		IDE	T	EP27
Port Lincoln	Former Church	Cnr London & Stevenson		IDE	T	EP27
Port Lincoln	Port Lincoln Police Station & Courthouse	Washington Street	Representative of the early establishment of law and order in Port Lincoln.	REG, RNE	T	EP27
Port Lincoln	St Thomas Anglican Church	Washington Street	Built in 1849, believed to be the oldest church on the Eyre Peninsula. Contains some fine stained glass windows.	IDE	T	EP27
Port	DC of Lincoln,	Washington	Erected as Council offices in the	IDE	T	EP27

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
Lincoln	Branch Office	Street	time before the Council moved to Cummins.			
Port Lincoln	Cottage	Mortlock Street, cnr Lincoln Street		IDE	T	EP27
Port Lincoln	Port Lincoln Railway Station	Railway Terrace	Reflects something of the great significance that the railway played in the economic life of the communities on Eyre Peninsula.	REG	T	EP27
Port Lincoln	Dwelling ('Boston House')	Lincoln Highway	Size, design and quality of construction reflects the lifestyle of SA's upper class. Good example of High Victorian Colonial style dwelling.	REG		EP27
Port Lincoln	Methodist Church	Liverpool Street, cnr Mortlock Street	Built as the second Methodist church in the town.	IDE	T	EP27
Port Lincoln	Shop, Kay's Photoflower	Lewis Street	Has been used as a saddlers and blacksmiths, represents the commercial development of the town.	IDE	T	EP27
Port Lincoln	Masonic Lodge	Bligh Street		IDE	T	EP27
Port Lincoln	Bartlett Memorial Hall (AMP Agency)	Adelaide Place		IDE	T	EP27
Port Lincoln	'Arrandale' (Dwelling, Cottage and Stables)	Proper Bay Road	The property is significant for its association with Sinclair, an early pioneer of the district and is a good example of a early substantial house and outbuildings.	REG		EP28
Tulka	Flinders Cairn (Water Supply)	Sleaford Bay Road		LOC		EP28 , EP29
Lincoln National Park	Stone Tank and Ruin, Surfleet Cove	Hundred Flinders		LOC		EP30
Lincoln National Park	Cottage - Near Cape Colbert	Hundred Flinders		LOC		EP30 , EP31
Port Lincoln	Memory Cove Tablet Site, Memory Cove Wilderness Protection Area		The Memory Cove Tablet marks an historic site related to Matthew Flinders' expedition of 1801-03 and the loss of several members of his crew. It is one of the few sites in South Australia where Flinders came ashore.	REG, RNE	C	EP31
Sleaford Bay	Former Fishery Bay Whaling Station	Near	Example of the earliest European industry in South	REG	C	EP33

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
			Australia and its importance before and immediately after settlement. Most extensive relics and remains of whaling in South Australia.			
Uley	Ruins of John McDouall Stuart's Hut	Hundred Uley		LOC		EP35
Coffin Bay	Former Coffin Bay Whaling Site (designated place of archaeological significance) Coffin Bay National Park		This site provides evidence of one of the Colony's first export industries, of which little is known or documented.	REG	C	EP39
Coffin Bay	Site of Oyster Town - including well	Kellidie Conservation Park		LOC	C	EP40
Coffin Bay	Coffin Bay Main Jetty	Kellidie Bay Waters	Associated with the maritime history of the district.	LOC	C	EP40
Coffin Bay	House & Chimney	Main Street		IDE	T	EP40
Coffin Bay	Monument - Corner Giles Road	Giles Road		LOC		EP40
Mount Dutton Bay	Mount Dutton Bay Jetty	Woolshed Drive	Associated with the nearby woolshed, this jetty represents the development of the wool industry on Eyre Peninsula and the importance of shipping as a means of transport.	REG	C	EP41
Mount Dutton Bay	Mount Dutton Bay Woolshed	Woolshed Drive	Associated with the important Eyre Peninsula pastoral pioneer, Price Maurice and the development of the wool industry on the Peninsula.	REG	C	EP41
Mount Dutton Bay	House- South to turn off to Dutton Bay - Previous Church	Hundred Lake Wangary		LOC		EP41
Mount Dutton Bay	Shearer's Quarters - Mount Dutton Bay		Associated with the nearby shearing shed and jetty where the wool clip was loaded onto vessels.	LOC	C	EP41
Coffin Bay	Frenchman Bluff Whaling Site		Rare archaeological evidence of early bay whaling, date unknown.	IDE	C	EP42
Mount Hope	Outbuilding - 'Kiana'	Flinders Highway		LOC		EP46
Mount Hope	Homestead - 'Kiana'	Flinders Highway		LOC		EP46
Mount Hope	Sheepyard - 'Kiana'	Flinders Highway		LOC		EP46
Elliston	Old Council Chambers	Beach Terrace		IDE	T	EP50

Appendix 8 – Non-indigenous heritage

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
Elliston	Elliston Post Office	Little Bay Road		IDE	T	EP50
Elliston	House (Police Station)	Beach Road		IDE	T	EP50
Elliston	Stone Building, Elliston School	Flinders Highway		IDE	T	EP50
Elliston	Elliston Jetty	Flinders Highway	Associated with the maritime history of the district.	REG	C	EP50
Elliston	Cast Iron Lead Light	Flinders Highway	Installed to guide boats through the reef, providing a vital navigation aid.	REG	C	EP50
Talia	Monument near Talia Caves		Memorial to a drowning in the vicinity.	IDE	C	EP53
Port Kenny	Port Kenny Jetty		Associated with the maritime history of the district.	IDE	C	EP54
Venus Bay	Venus Bay Jetty		Associated with the maritime history of the district.	IDE	C	EP54
Yanerbie	Sceale Bay Whaling Station		Rare archaeological evidence of early bay whaling.	IDE	C	EP63
Streaky Bay	General Shops (Criterion Hotel)	Bay Road		IDE	T	EP66
Streaky Bay	Pug & Pine Cottage, National Trust Museum	Montgomerie Terrace		IDE	T	EP66
Streaky Bay	Streaky Bay Jetty	Bay Road	Associated with the maritime history of the district.	IDE	C, T	EP66
Streaky Bay	Masonic Temple	Bay Road		IDE	T	EP66
Streaky Bay	Streaky Bay Uniting Church	Wells Street		IDE	T	EP66
Streaky Bay	House (Bank of New South Wales)	Bay Road, cnr Wells Street		IDE	T	EP66
Streaky Bay	Streaky Bay District Institute & Council	Alfred Terrace		IDE	T	EP66
Streaky Bay	Streaky Bay Community Hotel/Motel	Alfred Terrace		IDE	T	EP66
Streaky Bay	House	Wells Street		IDE	T	EP66
Streaky Bay	Former District Council Chambers	Alfred Terrace		IDE	T	EP66
Streaky Bay	Police Station	Linklater Street		IDE	T	EP66
Streaky Bay	House, 'Balfour House'	Wells Street		IDE	T	EP66
Streaky Bay	St Augustine of Hippo Anglican Church	Wells Street		IDE	T	EP66
Streaky Bay	Cottage	Wells Street		IDE	T	EP66
Streaky Bay	St Canutes Roman Catholic Church	Bockelberg Street		IDE	T	EP66
Streaky Bay	National Trust	Montgomerie		IDE	T	EP66

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
	Museum	Terrace				
Streaky Bay	Streaky Bay Hospital – Nurses' Quarters	Hospital Drive		IDE	T	EP66
Streaky Bay	House (Kitchen to Shearing Shed)	Hospital Drive		IDE	T	EP66
Streaky Bay	Tourist Centre & Warehouse/Store	Wells Street		IDE	T	EP66
Haslam	Port Haslam Warehouse/Goods Shed		Associated with the maritime history of the district, built to store goods to be loaded or off-loaded from ships.	IDE	C, T	EP68
Haslam	Port Haslam Jetty		Associated with the maritime history of the district.	IDE	C, T	EP68
Haslam	Haslam Rural School			IDE	T	EP68
Smoky Bay	Point Collinson Whaling Station Site		Rare archaeological evidence of early bay whaling, date unknown.	REG	C	EP70
Smoky Bay	Smoky Bay Jetty		Built in 1911, associated with the maritime history of the district.	IDE	C	EP72
Smoky Bay	House, 'Koppi-Tucka'	Flinders Highway		IDE		EP72
Ceduna	Our Lady of the Sea Catholic Church	Thevenard Road, cnr May Crescent		IDE	T	EP74
Ceduna	Cottage	Decres Bay Road		IDE	T	EP74
Ceduna	National Trust Museum (School)	Park Terrace	Associated with development of education in the district.	IDE	T	EP74
Ceduna	Ceduna Jetty		Associated with the maritime history of the district.	IDE	C, T	EP74
Ceduna	Workshop & House (Boarding House)	Poynton Street		IDE	T	EP74
Ceduna	Ceduna Uniting Church	Poynton Street		IDE	T	EP74
Thevenard	Railway Ganger's House	Railway Terrace		IDE	T	EP74
Thevenard	Railway Station Master's House			IDE	T	EP74
Thevenard	Thevenard Railway Station	Railway Terrace		IDE	T	EP74
Thevenard	Two Cottages (Cornelius Bakery)	Railway Terrace		IDE	T	EP74
Thevenard	Thevenard Jetty	Thevenard Road	Associated with the maritime history of the district, built to load grain, salt and gypsum.	IDE	C, T	EP74
Cape Beaufort	Cape Beaufort Whaling Site		Rare archaeological evidence of early bay whaling, date	IDE	C	EP76

Town/ Locality	Description	Street	Significance	Heritage Status *	The me	Cell
			unknown.			
Denial Bay	House (Post Office)	Main Street		IDE	T	EP76
Denial Bay	Denial Bay Jetty		Associated with the maritime history of the district.	IDE	C	EP76
Point Peter	Point Peter Whaling Site		Rare archaeological evidence of early bay whaling, date unknown.	IDE	C	EP77
Fowlers Bay	Whale Bone Area and the Point Fowler Structure, Fowlers Bay Conservation Reserve (designated places of archaeological significance)		Indicative of the whaling industry - one of the first successful export industries to be established in South Australia.	REG	C	EP84
Fowlers Bay	Fowlers Bay Jetty	Esplanade	Associated with the maritime history of the district.	IDE	C, T	EP84
Fowlers Bay	Cemetery, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	Remains of Homestead/Laundry, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	Stables, Blacksmith's Shop & Store, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	Tank & Slaughterhouse Ruin, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	Shearing Shed, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	Shearers' Quarters, 'Yalata'	Nundroo-Fowlers Bay Rd		IDE		EP84
Fowlers Bay	House (Fowlers Bay Post Office, Telegraph Station)	Esplanade		IDE	T	EP84
Fowlers Bay	Monument to Matthew Flinders	Esplanade	Matthew Flinders anchored in and named Fowlers Bay in January 1802.	IDE	C,T	EP84
Fowlers Bay	House (Fowlers Bay Police Station) (now part of Fowlers Bay Holiday Accommodation)	Esplanade		IDE	T	EP84
Fowlers Bay	Fowlers Bay Hall/Institute	West Terrace		IDE	T	EP84

C = Coastal theme, T = Township theme

Table 2 Status table for built heritage sites listed in Table 1 above.

Status	Description / legislation	Notes	
World Heritage Place	*Environment Protection and Biodiversity Conservation Act 1999*	There are no World Heritage Places within the defined coastal regions of the project	WHP
National Heritage Place	*Environment Protection and Biodiversity Conservation Act 1999*	There are no National Heritage Places within the defined coastal regions of the project	NHP
Commonwealth Heritage Place	*Environment Protection and Biodiversity Conservation Act 1999*	Owned or controlled by the Australian government. There are no Commonwealth Heritage Places within the project area	CHP
State Heritage Area	*Heritage Act 1993* and *Development Act 1993*	For the purposes of the Development Act all places within State Heritage Areas are regarded as State Heritage Places.	SHA
State Heritage Place (Registered)	*Heritage Places Act 1993*	Entered in the South Australian Heritage Register as a State Heritage Place.	REG
State Heritage Place (Provisional)	*Heritage Places Act 1993*	Provisional entry implies the same status of protection as a Registered place.	PRO
State Heritage Place (Nominated)	*Heritage Places Act 1993*	Have no legal status as nominated – considered to be identified until such time as are formally listed.	NOM
Local Heritage Place (Authorised)	*Development Act 1993*	Included in local Councils' Development Plans. This is currently 'voluntary' and not every Council has undertaken the process to include local heritage places within their Development Plan.	LOC
Local Heritage Place (Interim)	*Development Act 1993*	Considered to have the same status as a local heritage place. Indicative of the stage of the process for inclusion in a Development Plan as a local heritage place.	LIO
Contributory Item	*Development Act 1993*	Contributory items are located within Historic (Conservation) Zones or Historic (Conservation) Policy Areas in Development Plans and relate to the 'character' of that area. Contributory Items are soon to be phased out. They have no legislative status.	CON
Identified Place: – State recommended in heritage surveys – Locals recommended in heritage surveys – National Trust – RNE (not C'wealth)		Have no legal status. In case of RNE, due regard of these places must be taken by the Federal Minister.	IDE, RNE

Levels of Listing

The following levels of heritage protection apply in South Australia and are described in further detail below:

- World Heritage Places (currently only one place in South Australia)
- National Heritage Places (currently five places in South Australia)
- Commonwealth Heritage Places (owned by the Commonwealth, seven places in South Australia)
- Register of the National Estate (over 1,200 'historic' places and over 500 'natural' and 'indigenous' places, but only Commonwealth-owned or managed places are protected)
- State Heritage Places and State Heritage Areas (approximately 2,200 places and 17 areas)
- Local Heritage Places and Historic (Conservation) Zones and Policy Areas (over 6,500 places and areas)

Heritage assessment, nomination and recording processes exist for all three tiers of government: Commonwealth, State and Local. Following the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), heritage has become more complex at the Commonwealth level. Although World heritage processes are well established, National and Commonwealth heritage processes are relatively newly developed and their lists are in early stages of construction.

World Heritage

This is a list of places that are important to all the peoples of the world. The places on this list have special universal values above and beyond the values they hold for a particular nation. Only the Australian Government can nominate Australian places for entry on this list. The World Heritage Committee assesses nominated places against set criteria and decides which places will be included on the World Heritage List. World Heritage sites in Australia are fully protected under Australian Government law.

National Heritage Places and Commonwealth Heritage Places

National Heritage Places

The National Heritage List was established on 1 January 2004 and is Australia's list of places with outstanding heritage value to the nation. The Australian Heritage Council assesses the values of nominated places and makes recommendations to the Minister for Sustainability, Environment, Water, Population, and Communities about listing. The final decision on listing is made by the Minister.

Listed places are protected by Australian Government laws and special agreements with state and territory governments and with Indigenous and private owners. Places on the list are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which requires that approval be obtained before any action takes place that could have a significant impact on the national heritage values of a listed place.

Commonwealth Heritage Places

The Commonwealth Heritage List was established on 1 January 2004 and comprises natural, indigenous and historic heritage places on Commonwealth lands and waters or under Australian Government control which are identified by the Federal Heritage Minister as having Commonwealth heritage values. This list can be considered to be the Commonwealth equivalent of a State Heritage Register.

Places that are included in the Commonwealth Heritage List are protected under the provisions of the EPBC Act. To protect the heritage values of Commonwealth Heritage Places they own or lease, Australian Government agencies are required to develop heritage strategies, a heritage register, and management plans for places on the Commonwealth Heritage List in accordance with the Commonwealth Heritage management principles.

The National and Commonwealth Heritage criteria against which the heritage values of a place are assessed can be found at: http://www.environment.gov.au/epbc/protect/heritage.html

Under the heritage system, the Commonwealth Heritage List and the National Heritage List have similar criteria. The key difference is the level or 'threshold' of significance required to be reached to meet the criteria. Heritage experts are able to 'test' a place for heritage value against these criteria.

Register of the National Estate (RNE)

The Register of the National Estate was established in 1975 and will continue as a statutory register until February 2012. During this period the Minister for Sustainability, Environment, Water, Population, and Communities is required to continue considering the register when making some decisions under the EPBC Act. This transition period also allows states, territories, local and the Australian Government to complete the task of transferring places to appropriate heritage registers where necessary and to amend legislation that refers to the RNE as a statutory list.

From February 2012 all references to the register will be removed from the EPBC Act and the Australian Heritage Council Act (AHC Act). The RNE will be maintained after this time on a non-statutory basis as a publicly available archive.

Although fewer resources are now devoted by the Commonwealth to the register, the list remains significant, since under the EPBC Act the Commonwealth Minister for Sustainability, Environment, Water, Population, and Communities must have regard to the register when he makes a relevant decision.

Many places in the register are already included in other statutory lists, such as the state heritage lists, or local government heritage registers. As a result, those places receive protection under the relevant federal, state or territory legislation, or under council bylaws.

In the case of places of National or Commonwealth significance that are in the register, some of these places are already included in the National Heritage List or the Commonwealth Heritage List, and therefore receive protection under the EPBC Act. The Australian Government will, over the coming years, assess whether there are further places in the register that should be included in the Commonwealth Heritage List.

The criteria for the RNE can be found at
http://www.environment.gov.au/epbc/protect/heritage.html

State Heritage Places and Areas

State Heritage Places

State Heritage Places are places and sites of significance to the state. In the main they comprise non-Indigenous heritage sites and some natural sites, and include built structures, geological and archaeological sites and sites of significant events. State Heritage Places are created and protected under the provisions of the *Heritage Places Act 1993*, with the *Development Act 1993* providing legislative control for development of such places. The *Heritage Places Act 1993* also allows for specific protection of archaeological, palaeontological, speleological and geological sites. Places which are 'designated' to have special significance in one or more of these areas require a permit issued by the South Australian Heritage Council for collection of specimens or artefacts or for any work that will affect the significance of these sites.

The *Development Act 1993* requires all development applications affecting State Heritage Places and State Heritage Areas to be referred to the Minister responsible for the *Heritage Places Act 1993*. The *Development Act 1993* defines a range of acts or activities as 'development' as described within section 4(1) of the *Development Act 1993*, and includes the demolition, removal, conversion, alteration, or painting of, or addition to, the place, or any other work that could materially affect the heritage value of the place.

An application is required for any development that materially affects the fabric of State Heritage Places and places within State Heritage Areas. This includes adjoining development or works that could affect the setting of the heritage place.

<u>*State Heritage Areas*</u>

Under the provisions of the repealed *South Australian Heritage Act 1978,* State Heritage Areas were designated by the Minister to whom the Act was committed and their creation was gazetted. Under the *Heritage Act 1993*, the State Heritage Authority recommended the creation of State Heritage Areas but they were created through the process of preparing Plan Amendment Reports under the provisions of the *Development Act 1993*. Since the Act was amended in 2005 to become the *Heritage Places Act 1993*, some terminology has changed but the process remains the same. The SA Heritage Council recommends the creation of a State Heritage Area to the Heritage Minister, who can then request the Planning Minister to initiate a Development Plan Amendment (DPA) to give effect to the request.

To be entered in the register a State Heritage Place must satisfy one or more of the criteria listed in Section 16(1) of the *Heritage Places Act 1993*.

Local Heritage Places and Areas

A local heritage place is described within the *Development Act 1993* as a place that is designated as a place of local heritage value by a Development Plan. Amendments to the Development Plan must be supported by appropriate investigations, generally containing the findings of a heritage survey, and places must meet at least one of the criteria in section 23(4) of the *Development Act 1993*. This Act also allows for the establishment of Historic (Conservation) Zones or Historic (Conservation) Policy Areas within Development Plans.

The protection of local heritage is dealt with through the *Development Act 1993*, and local councils are responsible for initiating the statutory process by which a Development Plan is amended to include lists of significant individual local heritage places or create heritage areas.

<u>*Contributory Items*</u>

Contributory Items are identified through policy formulation and amendment, and are deemed to have historic value by contributing to the heritage values of a Historic (Conservation) Zone or Policy Area. They are not equivalent to a Local Heritage Place, but are surviving examples of development in a particular area and its character. Policies applying to Contributory Items should be directed at conserving the historic elements identified through investigations as contributing to the character of an area.

For Local Heritage Places, the Development Act defines development as the demolition, removal, conversion, alteration of, or addition to, the place, or any other work (not including painting but including, in the case of a tree, any tree-damaging activity) that could materially affect the heritage value of the place.

The legislation for designating a Historic (Conservation) Zone or Policy Area provides for demolition control. This means the approval of council is required to demolish a building located within a Historic (Conservation) Zone or Policy Area whether or not it is listed as a local heritage place.

Shipwrecks

Over 800 shipwrecks are recorded along South Australia's coast and inland waters reflecting the state's significant maritime history. The remains of these vessels are important educational, recreational and tourism assets.

In 1976 the Commonwealth Government acknowledged the need to protect significant shipwreck sites and relics with the introduction of the *Historic Shipwrecks Act 1976*. Complementary South Australian legislation followed a few years later, with the *Historic Shipwrecks Act 1981*.

Under these Acts significant shipwrecks or relics are protected as declared Historic Shipwrecks, with people encouraged to visit them on a 'look but don't interfere' basis. Any shipwreck that is more than 75 years old (from date of wreck) is automatically declared as historic and protected. Other shipwrecks (either found or not yet located) can be individually declared Historic, once their significance has been determined.

Relics associated with an historic wreck, either *in situ* or removed from the wreck, are also protected. The transfer, possession and custody of material such as relics, including coins, from historic shipwrecks, are also regulated. Historic shipwrecks and their associated relics are protected even if a person came into possession of this material long before the Historic Shipwrecks Acts existed.

The Heritage Branch (DENR) is the South Australian Government agency responsible for administering the Historic Shipwrecks Act. To date, over 350 South Australian shipwrecks have been declared Historic and are protected.

Much of South Australia's coastline is defined as Commonwealth waters for the purposes of the Historic Shipwreck Acts. State waters include the two gulfs (Spencer and St Vincent), four historic bays (Anxious, Encounter, Lacepede and Rivoli) and all inland waters.

An agreed set of assessment criteria is applied to determine the significance of a shipwreck or relic that has been recommended for declaration as Historic. Both the nature (historic, technical, social, archaeological, scientific) and the degree (rare or representative) of significance are considered. Many Historic Shipwrecks display features which are a combination of these criteria.

Table 3 Summary of statutory heritage listing in South Australia

	World Heritage	National Heritage	Commonwealth Heritage	Register of the National Estate	State Heritage (Places & Areas)	Local Heritage
Administration of legislation	Minister for Sustainability, Environment, Water, Population and Communities	Minister for Sustainability, Environment, Water, Population and Communities	Minister for Sustainability, Environment, Water, Population and Communities	Australian Heritage Council	Minister for Environment & Conservation	Minister for Urban Development & Planning
Nomination	Australian Government	Any person including the Minister and the Australian Heritage Council	Any person including the Minister and the Australian Heritage Council	Any person	Any person, including the SAHC	Any person
Values	Outstanding universal value	Outstanding heritage value to our nation	Commonwealth heritage value	National Estate value	Heritage value to the state	Significance to the local community
Types of value	Natural and cultural	Natural, indigenous, historic	Natural, indigenous, historic	Natural, indigenous, historic	Cultural and natural	Cultural and natural
Criteria	World Heritage Committee	EPBC Act	EPBC Act	AHC Act	Heritage Places Act 1993	Development Act 1993
Assessment	World Heritage Bureau	Australian Heritage Council	Australian Heritage Council	Australian Heritage Council	Heritage Branch, Department of Environment & Natural Resources	Local government
Decision on listing	World Heritage Committee	Minister for Sustainability, Environment, Water, Population and Communities	Minister for Sustainability, Environment, Water, Population and Communities	Australian Heritage Council	South Australian Heritage Council	Minister for Urban Development & Planning
Tenure	Any tenure may be listed but status of tenure unaffected	Any tenure may be listed but status of tenure unaffected	Only Commonwealth areas may be listed but status of tenure unaffected	Any tenure may be listed but status of tenure unaffected	Any tenure may be listed but status of tenure unaffected	Any tenure may be listed but status of tenure unaffected

	World Heritage	National Heritage	Commonwealth Heritage	Register of the National Estate	State Heritage (Places & Areas)	Local Heritage
Obligations	A person must not take an action that has, will have, or is likely to have, a significant impact on the world heritage values of a declared World Heritage property, without approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities.	A person must not take an action that has, will have, or is likely to have, a significant impact on the national heritage values of a national heritage place, without approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities.	A person must not take an action that has, will have, or is likely to have a significant impact on the environment (including heritage values) in a Commonwealth heritage place, without approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities.	Minister for Sustainability, Environment, Water, Population and Communities	A person must not intentionally or recklessly damage a State Heritage Place nor undertake any action that damages a State Heritage place or destroys or reduces the heritage significance of a State Heritage Place.	

Appendix 9 List of information available on DVD

Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume 1

Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume 2

Digital Mapping Content

- Instructions
- Digital Map Symbology
- GIS Datasets Used
- Raw GIS Data
- Metadata on datasets used
- Interactive Digital Map (for use with ArcReader)

Additional Documentation

- Complete flora list
- Complete amphibian and reptile list
- Complete bird list
- Complete butterfly list
- Complete mammal list
- Conservation Analysis Summary Table
- Threat Analysis Summary Table
- Coastal Cell Area Statistics

Additional Maps

- Floristic vegetation maps

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