

Appendix D.35. Waikiki Beach, Rockingham

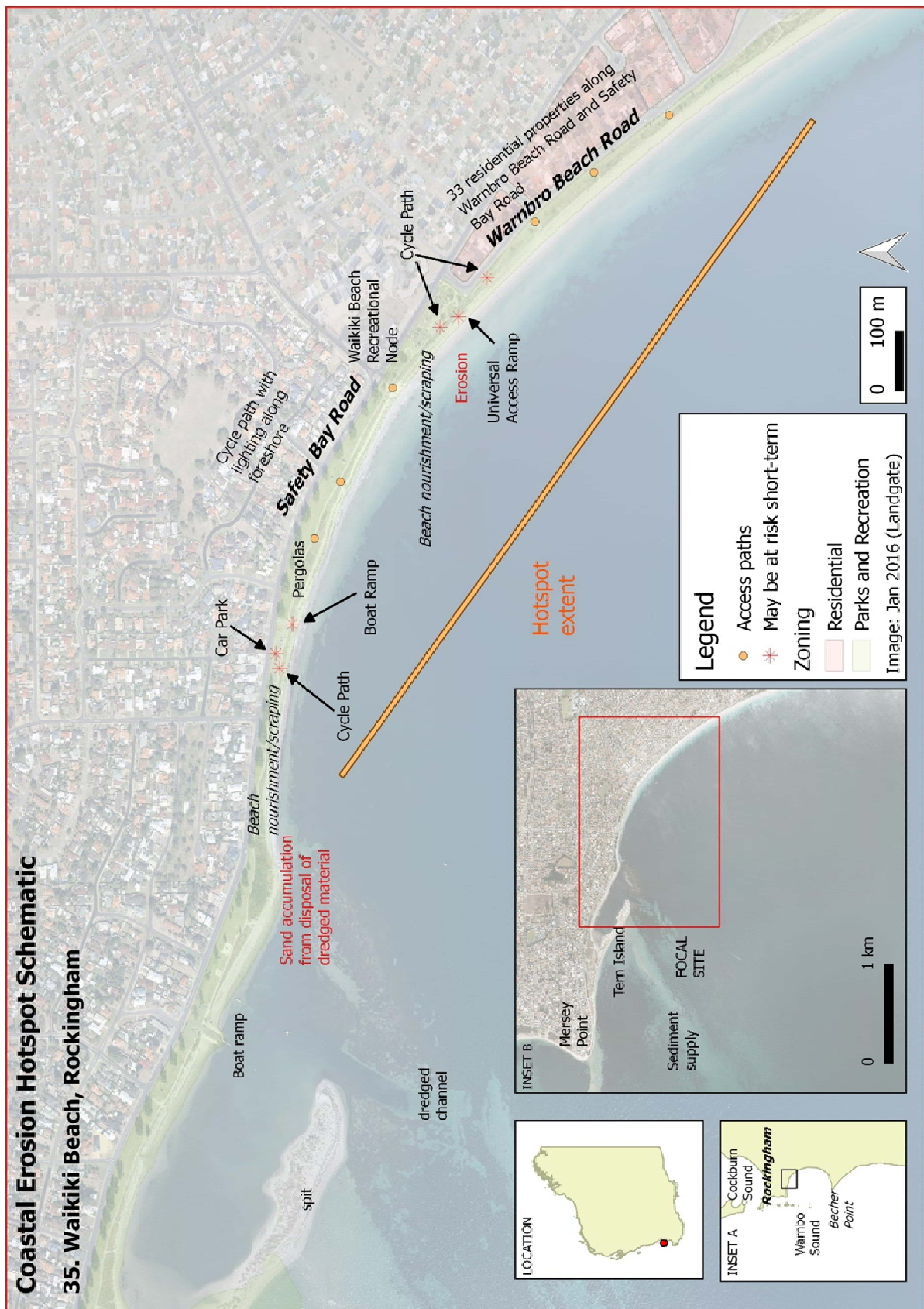


Figure D-35: Waikiki Beach, Rockingham schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-35: Waikiki Beach, Rockingham summary information

Hotspot No.	35
Hotspot Name	Waikiki Beach, Rockingham
Local Coastal Manager	City of Rockingham
Hotspot issue	<p>The Waikiki foreshore position varies cyclically with long-term fluctuations due to the inconsistent supply of sediment onshore at Safety Bay (to the west). At present, sediment is accumulating in a sand spit and foreland, restricting the natural supply of sediment to Waikiki. In future the spit is likely to join to the foreshore and provide additional sediment to the coast. Erosion is occurring along the foreshore, with local downdrift erosion near the boat ramps and cyclic sediment loss during high storm surges. The foreshore position has been managed using beach renourishment, with sources including dredge material from the channel, as well as sediment sourced from the Point Peron sand trap. Most recently renourishment has been undertaken using sediment dredged from the channel in 2014, with material scraped from the lower part of the beach onto the foredune (beach scraping); beach scraping is ongoing in the area. Conflicting demands on the use of the area around the main boat ramp include the need for dredging to keep the boat ramp and channel clear of sediment, and the problem this causes by interfering with the sediment transport pathways.</p> <p>More than 25 publicly owned assets may be at risk of erosion damage in the area (see attached figure), five of which are at risk of damage in the short-term, including the Donald Drive car park, Donald Drive boat ramp, cycle path, the toe of beach access paths and the universal access ramp. Much of the infrastructure is focused at the Waikiki Beach recreational node. In the longer term, Warnbro Beach Road, a section of Safety Beach Road and some private properties along Warnbro Beach Road are high-value assets at risk. Recreational use is mainly swimming, walking, fishing and boat launching with the remainder of activities focused behind the beach. There are alternate options for similar activities on adjacent foreshores.</p>
Extent of erosion problem and hotspot characteristics	<p>Northern Warnbro Sound along Safety Bay Road between June Road and Viking Road</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Regional hazard assessment contained within Damara (2012)</p> <p>Management & Adaptation Options: The City is planning on extending the existing seawall to provide full protection the car parking and recreational area. Design has been completed.</p> <p>Additional Comments: Site is partly protected by an existing seawall.</p> <p>Reports:</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Sandbar dynamics and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	5 public assets susceptible to erosion hazard. Cycle path ((1) seaward of Donald Drive car park, (2) 20m cycle path E of universal access ramp, (3) 100m cycle path W of universal access ramp), universal access ramp, Donald Drive boat ramp, Donald Drive car park, toe of access paths
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	>10 public assets susceptible to erosion hazard. Possibly 25m of Warnbro Beach Rd (at the corner), cycle path and lights, Donald Drive boat ramp, Donald Drive car park, pergolas at Donald Drive ramp, nodal focus at Waikiki Beach recreation area [stairs to beach, pergola, play equipment, courts, outdoor gym equipment, car park, universal access ramp, covered area, seats, BBQs, fencing], 4 stairs access ways along Warnbro Beach Rd, numerous informal access ways along Safety Beach Rd, toe of access paths

Assets susceptible to erosion hazard in Projected timeframe (25+ years)	>12 public assets susceptible to erosion hazard. Warnbro beach road, possibly 25m of Warnbro Beach Rd (at the corner), sections of Safety Beach Rd, cycle path and lights, Donald Drive boat ramp, Donald Drive car park, pergolas at Donald Drive ramp, nodal focus at Waikiki Beach recreation area [stairs to beach, pergola, play equipment, courts, outdoor gym equipment, car park, universal access ramp, covered area, seats, BBQs, fencing], 4 stairs access ways along Warnbro Beach Rd, numerous informal access ways along Safety Beach Rd, toe of beach paths Private property: 32 on Warnbro Beach Rd and 1 on Safety Bay Rd
Existing management	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Minor renourishment using beach & boating channel sources)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion will continue to result in loss of renourishment and scarping Avoid (N), Retreat (N), Accommodate (N) Protect (Y -Increase renourishment rates using external sources. Emergency renourishment if assets at risk May-August) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - M Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Exposure of assets to acute erosion hazard for >3 months / year (within May-September) Monitoring: Photographic monitoring. Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Progressive retreat along the length of the shore Avoid (N), Retreat (Y - Relocate dual use path. Progressively reduce presence of fixed infrastructure. Assumed progressive retreat with retreat required more than once), Accommodate (N), Protect (Y - Increase renourishment rates using external sources (contributing to high cost). Artificial dune built along extended area (annually), 'back-up' seawall for restricted facilities) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - M Protect - H Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Exposure of assets to acute erosion hazard for >3 months / year (within May-September) Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Progressive retreat along the length of the shore Avoid (N), Retreat (Y - Truncate Warnbro Road to Short Street), Accommodate (N), Protect (Y - 'back-up' seawall for limited facilities. Substantial ongoing renourishment using external source)



Works to avoid to achieve long-term plans	<p>Coastal protection works without substantial associated renourishment; Infill development along Warnbro Beach Road.</p> <p>The existing situation has fixed infrastructure close to the majority of the shore. Any hard protection works will transfer erosion protection further alongshore. Consequently, soft works such as an artificial dune or beach renourishment are appropriate. Due to the site and length of Warnbro Sound beach, soft works will have a short life, with rapid redistribution alongshore. Viking Road park area represents the first alongshore location where erosion stress may be transferred to.</p>
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Appendix D.36. Mandurah Northern Beaches

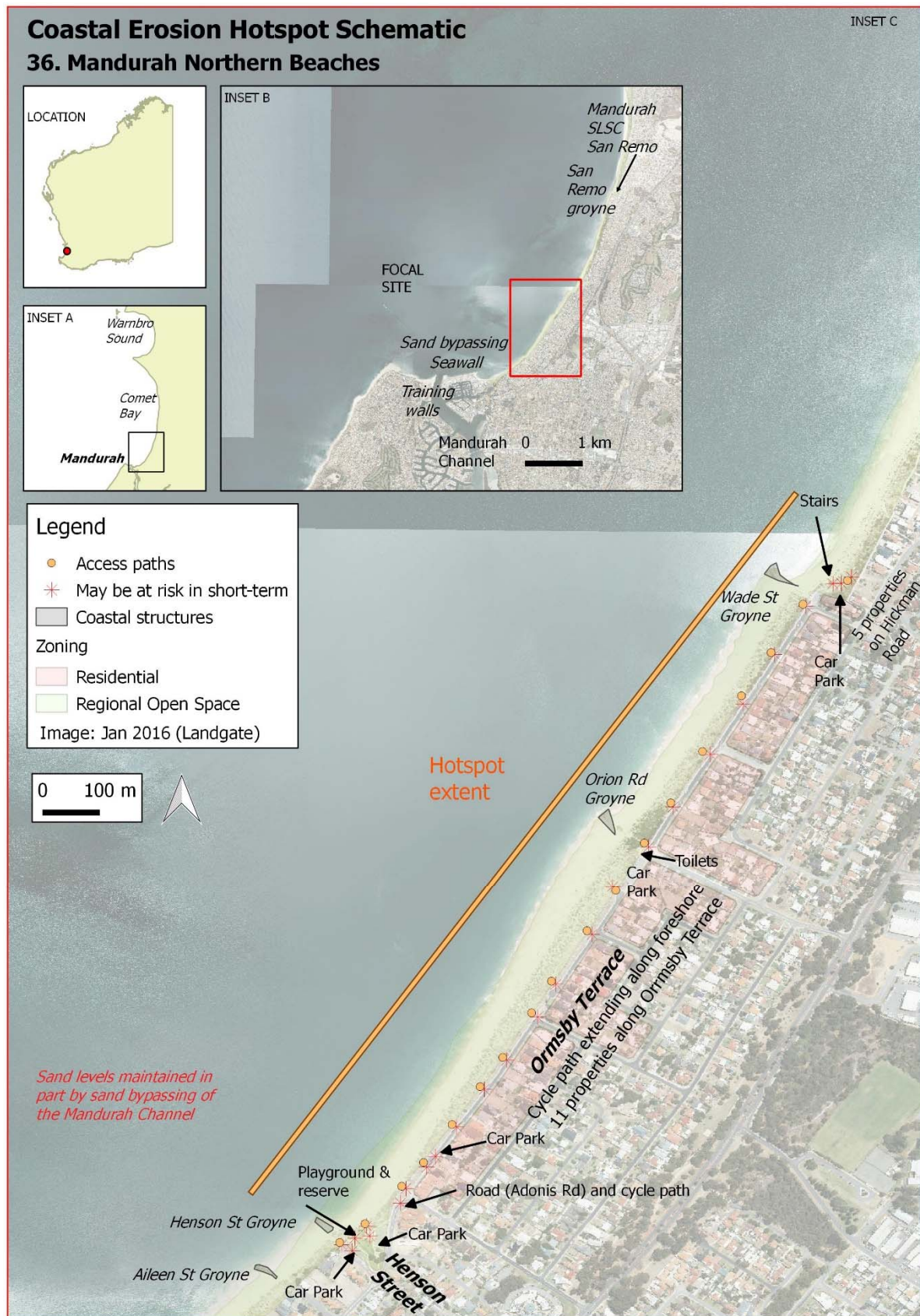


Figure D-36: Mandurah Northern Beaches schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-36: Mandurah Northern Beaches summary information

Hotspot No.	36
Hotspot Name	Mandurah Northern Beaches
Local Coastal Manager	City of Mandurah
Hotspot issue	<p>Mandurah Northern Beaches have had an ongoing erosion problem since development was undertaken on the foredune and foredune sand was used to fill swampy land behind those dunes to enable the levelling of the area and improve suitability for development. Downdrift erosion to the north has been caused by training walls at the Mandurah channel and marina seawalls limiting sediment availability. Erosion mitigation works have included sand bypassing of the Mandurah channel and construction of a series of groynes, including a recent extension of the trapping lengths. Downdrift erosion occurs on the northern side of the groynes where recreational assets are focussed. The foreshore is reliant on the sand bypassing, with the rate of bypassing not always matching the sediment demand required to stabilise the coast. The City of Mandurah is looking to implement, among other studies, a coastal data collection campaign along the Northern Beaches.</p> <p>More than 15 publicly owned assets may be at risk of erosion damage in the area (see attached figure), eight of which are at risk of damage in the short-term, including Adonis Place, three car parks (Henson Street, Ormsby Terrace and Wade Street), staircase and beach access points, the reserve and cycle path. In the longer term, Ormsby Terrace, its associated infrastructure and private properties to landward (including on Ormsby Tce and Hickman Road) are high-value assets at risk. The main recreational uses are walking, swimming, fishing and cycling. The community pressure to protect these recreational uses is anticipated to increase as damage occurs to assets near Wade Street and Henson Street.</p>
Extent of erosion problem and hotspot characteristics	<p>Between Henson Street groyne and immediately north of Wade Street groyne</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparent costs of likely forms of erosion mitigation are high. • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Pre-CHRMAP Adaptation Plan CZM (2009b)</p> <p>Hazard Assessment: MRA (2010) identifies risk from erosion:</p> <p>Seawall to Aileen Street: Immediate (existing buffer <S1)</p> <p>Henderson Street to Orion Road: Immediate (existing buffer <S1)</p> <p>Orion Road to Wade Street: 2040 to 2110</p> <p>Watersun Beach: Immediate (existing buffer <S1)</p> <p>San Remo: 2040 to 2110</p> <p>Management & Adaptation Options: CZM (2009b) - Study area Mandurah coastline, split in to coastal compartments. No timeframes specified. Recommends: Assess the condition of Ormsby Terrace road comparative to other transport routes. If seen as extreme priority based on current condition and service importance, develop management actions to increase resilience based on projection for climate change.</p> <p>Additional Comments: Management of beaches interconnected with Mandurah sand bypassing.</p> <p>Reports:</p> <p>MRA (2010) Mandurah Northern Groyne Field Coastal Vulnerability. Prepared for the City of Mandurah by MP Rogers. Report R266, Rev. 1, Jul-2010.</p> <p>CZM (2009a) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Risk Assessment. Report prepared for the City of Mandurah by Coastal Zone Management. May-2009</p> <p>CZM (2009b) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Adaptation Report prepared for the City of Mandurah by Coastal Zone Management. Jun-2009</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Sandbar dynamics and ongoing coastal movement data collection

Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	8 public assets susceptible to erosion hazard. 15m of Adonis Road, 5m of cycle path on Adonis Rd, stairs to beach from Wade St car park, Henson St carpark (N), Ormsby Terrace southern carpark (cul de sac), Wade St car park, reserve at Henson St with playground, non-rigid access locations
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	11 public assets susceptible to erosion hazard. 30m of Adonis Road, possibly up to 200m of Ormsby Terrace (S), Possibly up to 200m of Ormsby Terrace from Orion St to Wade St, cycle path along ~400m of foreshore, stairs to beach from Wade St car park, access track seaward of houses N of Wade St, Henson St carpark (N), Ormsby Terrace southern carpark (cul de sac), Wade St car park, reserve at Henson St with playground, many non-rigid access locations. Private property: 8 (5 on Ormsby St, 3 N of Wade St along Hickman Rd)
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	15 public assets susceptible to erosion hazard. 60m of Adonis Road, possibly up to 200m of Ormsby Terrace (S), Ormsby Terrace centre section with 2 cul de sacs, possibly up to 200m of Ormsby Terrace from Orion St to Wade St, Ormsby Terrace from Orion St to Wade St, cycle path along most of foreshore, stairs to beach from Wade St car park, access track seaward of houses N of Wade St, Henson St carpark (x2), Ormsby Terrace southern carpark (cul de sac), Wade St car park, Orion Street car park, reserve at Henson St with playground, toilet block at Orion St, many non-rigid access locations. Private property: 16 (11 on Ormsby St, 5 N of Wade St along Hickman Rd)
Existing management	Avoid (N), Retreat (N), Accommodate (Y - Annual bypassing undertaken at Mandurah Channel entrance), Protect (Y - Small groynes used to slow alongshore transport rates)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion will continue to threaten parts of Ormsby Terrace, particularly on the north side of the rock groynes Avoid (N), Retreat (N), Accommodate (Y - Continue annual bypassing Planning policy to encourage house access away from coast Identify easements to provide alternative access), Protect (Y - Maintain existing groynes) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Accommodate - M Protect - L Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Acute erosion causes damage to Ormsby Terrace infrastructure 3+ times in 10 years Monitoring: Photographic monitoring. Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Increased beach rotation between the groynes. Efficiency of bypassing to transfer sand north will reduce. Increased seasonal downdrift erosion north of groyne field Avoid (N), Retreat (Y - Remove short-term facilities north of groynes, Remove facilities seaward of Ormsby Terrace, Remove sections of Ormsby Terrace not required for access, Retreat car parks on N side of groynes), Accommodate (Y - Continue annual bypassing, with part placement further north, implement easements for 8 private properties), Protect (Y -Construct downdrift short 'back-up' revetments)
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - H Accommodate – H Protect - M

Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	<p>Trigger for next level management: Ormsby Terrace damage that prevents access to houses, which cannot be managed by ‘back-up’ revetments or private property retreat (i.e. cost-benefit of houses supports massive engineering works).</p> <p>Monitoring: Whole of Comet Bay coastal monitoring program, assessing acute and progressive erosion.</p> <p>Alternate option: N/A</p>
Management and adaptation options for Projected timeframe (25+ years).	<p>Anticipated behaviour: Overall net retreat will result in shorter segments of beach retained by rock groynes and larger extent of foreshore assets exposed to erosion hazard.</p> <p>Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Extend groynes (L-shaped) to hold additional beach. Extensive renourishment is required to support groyne extensions, Ongoing major renourishment program for north Comet Bay likely required)</p>
Works to avoid to achieve long-term plans	<p>No additional armoured facilities north of groynes (e.g. Mandurah SLSC north of San Remo groyne) as these effectively use the sand buffer necessary for the beach segments to withstand seasonal downdrift erosion; No infill development to the north; No additional sand retention works west of Henson Street.</p>

Appendix D.37. Doddies Beach, Roberts Point

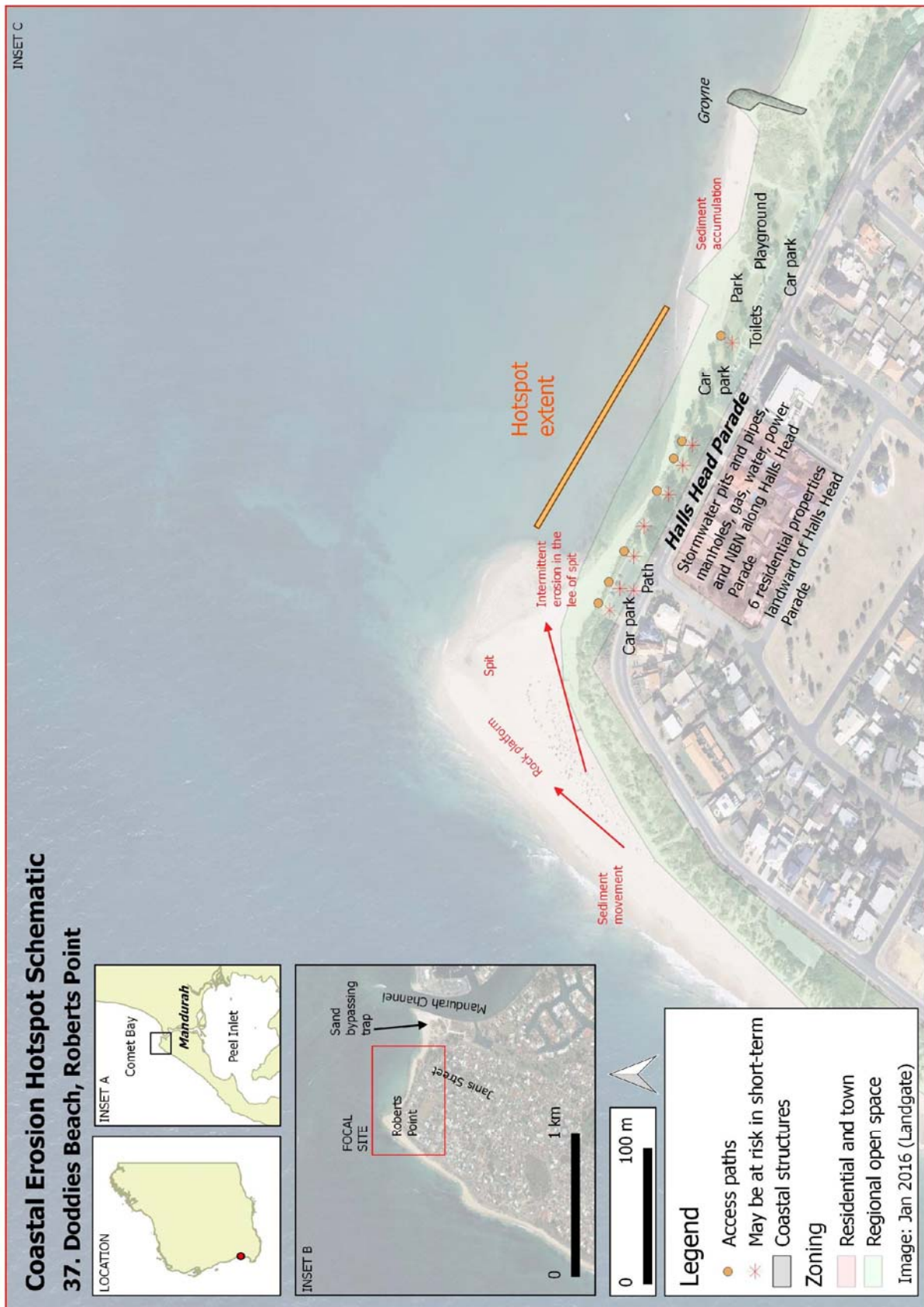


Figure D-37: Doddies Beach, Roberts Point schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-37: Doddies Beach, Roberts Point summary information

Hotspot No.	37
Hotspot Name	Doddies Beach, Roberts Point
Local Coastal Manager	City of Mandurah
Hotspot issue	<p>Doddies Beach, Mandurah, is located between an elongate rocky reef and the James Street groyne. A sand spit forms on the reef and its pulsatory movement feeds sediment south east around Halls Head and along Doddies Beach. This sediment accumulates behind the rocks at Robert Point, at Janis Street groyne, at the Mandurah entrance training wall and offshore onto the Mandurah Bar. The volume of the sediment pulses varies from year to year, in turn leading to variations in the width of Doddies Beach. Retreat of Doddies Beach can be expected if there is a reduction in the volume or efficiency of the sand bypassing at the Dawesville Cut. The beach is dependent on the bypassing of sediment around the Dawesville Channel and the Janis Street groyne installed 1988.</p> <p>Fifteen publicly owned assets may be at risk of erosion damage in the area (see attached figure), with three possibly at risk in the short-term. This includes seven sand access tracks (counted as one combined asset), 190m of footpaths and Halls Head Parade carpark west. In the longer-term, an additional 12 public assets may be at risk including a grassed park area, Halls Head Parade carpark east, 300m of footpath, a shaded playground, a toilet block, 230m of Halls Head Parade, and associated services (storm water pits, gas, water, power, NBN and six non-trafficable manholes). Six private residential properties may be vulnerable in the long term, including two vacant lots. Beach and foreshore use in the area includes swimming, walking, kite surfing, fishing and picnicking, with high value placed on the amenity provided by the beach itself (nominated by local government).</p>
Extent of erosion problem and hotspot characteristics	<p>Small section of foreshore on Halls Head Parade between rock platform and area of sediment accumulation adjacent to the groyne.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Pre-CHRMAP Adaptation Plan CZM (2009b)</p> <p>Hazard Assessment: CZM (2009a) Coastal compartment rated as extremely vulnerable to erosion.</p> <p>Management & Adaptation Options: CZM (2009b) -CZM (2009b) - Study area Mandurah coastline, split in to coastal compartments. No timeframes specified. Recommendations (Halls Head Beach to Robert Point): Review the asset management register to review where this road [Halls Head Parade] fits in the asset management register – should be seen as one of the highest priorities. Review length of Janise St groyne.</p> <p>Additional Comments: Management of beaches interconnected with Mandurah sand bypassing.</p> <p>Reports:</p> <p>CZM (2009a) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Risk Assessment. Report prepared for the City of Mandurah by Coastal Zone Management. May-2009</p> <p>CZM (2009b) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Adaptation Report prepared for the City of Mandurah by Coastal Zone Management. Jun-2009</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection, and possibly geotechnical
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	3 public assets susceptible to erosion hazard. 7 pedestrian access tracks, 190m of footpaths, Halls Head Parade carpark west.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	6 public assets susceptible to erosion hazard. 7 pedestrian access tracks, grassed park area, Halls Head Parade carpark east, 300m of footpaths, 80m of Halls Head Parade, Halls Head Parade carpark west.

Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>15 public assets susceptible to erosion hazard. 7 pedestrian access tracks, grassed park area, shaded playground, Halls Head Parade carpark east, toilet block, 310m of footpaths, 230m of Halls Head Parade, Halls Head Parade carpark west.</p> <p>Services: Storm water pits with connecting pipe to W of Halls Head Parade, 80PVC1.5MP 70kPa gas pipeline along Halls Head Parade, 100AC water main along Halls Head Parade, 6 non-trafficable manholes, LV buried cable along Halls Head Parade, LV overhead cable along Halls Head Parade, in-service NBN cable along Halls Head Parade.</p> <p>Private Property: 6 private properties on Halls Head Parade, including 2 vacant lots</p>
Existing management	<p>Avoid (N), Retreat (N), Accommodate (N), Protect (Y - groyne off Janis St installed 1988 to east of site. Bypassing of sediment around Dawesville cut may regulate sediment supply)</p>
Management options for Imminent timeframe (0–5 years)	<p>Anticipated behaviour: Storm erosion capable of affecting carpark, section of footpath and trees.</p> <p>Avoid (N), Retreat (Y - modify western car park), Accommodate (N), Protect (N)</p> <p>Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Should include geophysical assessment.</p>
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	<p>Retreat - L Prepare Plans - 50k</p>
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	<p>Trigger for next level management: Direct erosion threat to western carpark. Monitoring: Photographic monitoring Alternate option: Protect - additional short groynes (timber or sandbag) with renourishment OR interseason renourishment (beach scraping).</p>
Management and adaptation options for Expected timeframe (5–25 years)	<p>Anticipated behaviour: Moderate erosion plus storm impact will affect western & central carpark, footpath & reserve.</p> <p>Avoid (N), Retreat (Y - relocate western car park and stop landscaping to the West. Modify the remaining carpark (east)), Accommodate (N), Protect (N)</p> <p>Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.</p>
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	<p>Retreat - M Prepare plans - 50k</p>
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	<p>Trigger for next level management: Buffer width to road <10m OR sand drift on to road more than 1x per year. Monitoring: Buffer width measurement; post-storm monitoring Alternate option: Protect - armouring (revetment) along Halls Head Parade (not recommended).</p>
Management and adaptation options for Projected timeframe (25+ years).	<p>Anticipated behaviour: Sustained erosion may cause loss of foreshore reserve at western end (subject to underlying rock), affecting roadway.</p> <p>Avoid (N), Retreat (Y - plan to cul-de-sac north west corner of Halls Head Parade. Retreat 6 private properties along Halls Head Parade), Accommodate (N), Protect (N)</p>
Works to avoid to achieve long-term plans	<p>Fixed infrastructure (toilet blocks etc.) Services on northern side of road.</p>

Appendix D.38. Falcon Bay to Rakoa St

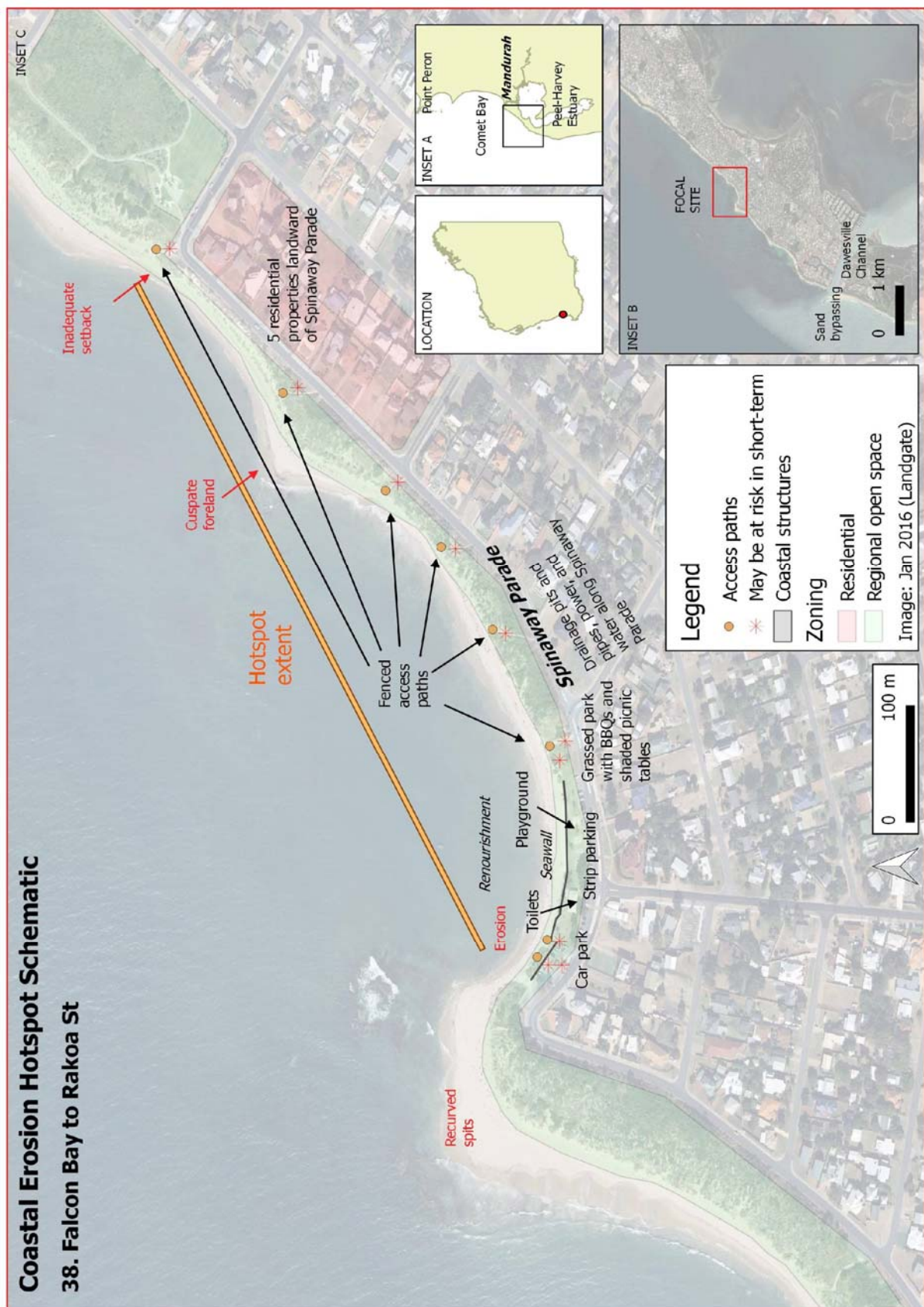


Figure D-38: Falcon Bay to Rakoa St schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-38: Falcon Bay to Rakoa St summary information

Hotspot No.	38
Hotspot Name	Falcon Bay to Rakoa St
Local Coastal Manager	City of Mandurah
Hotspot issue	<p>Falcon Bay to Rakoa Street are two small bays separated by a small cusped foreland, with Falcon Bay the larger bay in the south. The two bays are a series of interconnected bays between the Dawesville Cut and the Mandurah entrance channel. The beaches are dependent on sediment supply from the south with inter-annual variability in the amount of sediment provided. Erosion may be enhanced dependent on the bypassing regime at the Dawesville Channel and the time sand is contained within spits to the south. The beaches are backed by a narrow coastal reserve. Facilities were constructed on the upper level of the active beach to support beach boat launching in an area of known sand supply variability. Previous management actions included beach renourishment, dune planting and stabilisation, and limestone block walling in the 1960's.</p> <p>Eighteen publicly owned assets may be at risk of erosion damage in the area (see attached figure), with eight possibly at risk in the short-term. These assets include Spinaway Parade carpark, a grassed park area, and six fenced access tracks. An additional ten public assets may be at risk in the longer-term including 750m of Spinaway Parade and associated services (drainage pits and connecting pipes, overhead power and water mains), strip parking, BBQs, shaded picnic tables, a playground and a toilet block. Five private properties may be vulnerable to erosion damage along Spinaway Parade in the long-term. Recreational activities at the site include swimming, sunbathing, fishing and exercising.</p>
Extent of erosion problem and hotspot characteristics	<p>Foreshore along Spinaway Parade between the sand boat ramp at the point and Rakoa Street.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Pre-CHRMAP Adaptation Plan CZM (2009b)</p> <p>Hazard Assessment: CZM (2009a) Coastal compartment rated as highly vulnerable to erosion.</p> <p>Management & Adaptation Options: CZM (2009b) -CZM (2009b) - Study area Mandurah coastline, split in to coastal compartments. No timeframes specified. Recommendations (Gretel Drive to Falcon Point) specific focal points should be toilet block, car park. Model predicted shoreline change at Falcon Bay and determine mitigation actions required.</p> <p>Reports</p> <p>Additional Comments: Management of beaches interconnected with Dawesville sand bypassing. City of Mandurah has advertising (Jan-2017) tenders for the design and construction of a seawall.</p> <p>Reports:</p> <p>CZM (2009a) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Risk Assessment. Report prepared for the City of Mandurah by Coastal Zone Management. May-2009</p> <p>CZM (2009b) Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Plan: Phase I Strategic Adaptation Report prepared for the City of Mandurah by Coastal Zone Management. Jun-2009</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection, and possibly geotechnical
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	8 public assets susceptible to erosion hazard. Spinaway Parade carpark, grassed park area, 6 fenced access tracks.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	13 public assets susceptible to erosion hazard. Spinaway Parade carpark, grassed park area, BBQs, shaded picnic tables, toilet block, playground, 80m of Spinaway Parade, 6 fenced access tracks.

Assets susceptible to erosion hazard in Projected timeframe (25+ years)	18 public assets susceptible to erosion hazard. Spinaway Parade carpark, strip parking, grassed park area, BBQs, shaded picnic tables, toilet block, playground, 600m of Spinaway Parade, and 150m of Spinaway Parade, 6 fenced access tracks. Services: Drainage pits and connecting pipes along Spinaway Parade, LV overhead cable along Spinaway Parade, 100AC water main along Spinaway Parade Private Property: 5 on Spinaway Parade
Existing management	Existing behaviour: A sheet pile wall has been tendered for design and construct to protect toilet block. Beach boat launching ramp removed a number of years ago. Avoid (N), Retreat (N), Accommodate (Y - dune planting and stabilisation), Protect (Y - Renourishment, limestone walling possibly installed in 1960s)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion may affect dune mobility near Rakoa St & beach amenity near BBQs. Avoid (N), Retreat (N), Accommodate (Y - Manage access paths. Runoff management), Protect (Y - planned upgrade to walling with expectation of future retreat (i.e. short to medium-term), Review Dawesville bypassing arrangement) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Accommodate - L Protect - M Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Sand drift onto Rakoa St. Loss of beach. Monitoring: Photographic monitoring (post-storm in winter) Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: For moderate erosion, sand drift is likely to affect Spinaway Parade/Rakoa Street and reduce BBQ area. Without active modification to bypassing and dune management near Rakoa St, the need to retreat in the third level of management will occur sooner. Avoid (N), Retreat (Y - consider retreat of toilet block), Accommodate (Y - dune management for sand drift on to road), Protect (Y - renourishment of recreational beach. Maintain new walling and modify bypassing regime) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L Accommodate - L Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Erosion threat to Spinaway Parade and Rakoa Street corner / threat to pavilion area. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Progressive erosion will affect pinch points along Rakoa Street and recreational facilities on south of Falcon Beach. Avoid (N), Retreat (Y - Remove recreational facilities (no space for relocation), Cul-de-sac south western corner of Spinaway Parade, retreat of 5 properties along Spinaway Parade, encourage use of back of the block), Accommodate (N), Protect (N)



Works to avoid to achieve long-term plans	Do not support subdivision. Avoid permanent development seaward of current development (e.g. in greenfield foreshore reserve) - temporary/relocatable development as per SPP2.6 is acceptable.
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Appendix D.39. Binningup Seawall



Figure D-39: Binningup Seawall schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-39: Binningup Seawall summary information

Hotspot No.	39
Hotspot Name	Binningup Seawall
Local Coastal Manager	Shire of Harvey
Hotspot issue	<p>The Binningup site was developed to improve the delivery of 4WD vehicles with trailerable vessels to the beach with all season access for the surf lifesaving club. The seawall was initially constructed in 2007 and extended in 2011, replacing the foredune with recreational facilities; it should be noted that the non-typical seawall may not possess the ability to withstand wave energy. The development is located on or seaward of the vegetation line with a seawall that is not tolerable to shoreline change and is impacted by the seasonal and year to year variations in beach width and dune position which may be up to 25m in an individual storm (e.g. storm damage of wall in 2013). Beach access from the ramps is limited when the beach narrows. The damage observed at the seawall suggests the marine conditions have not been appropriately assessed and taken into account in the design. Erosion will impact on the amenity and integrity of the facility, with frequent damage and eventual retreat so the wall will have increased downdrift erosion.</p> <p>Seven publicly owned assets may be at risk of erosion damage in the area (see attached figure), with three assets at risk of damage in the short-term, including two boat launching areas and beach access points, including crushed limestone vehicle access to the south. In the moderate-term, the Binningup SLSC, which is partly protected, is a high-value asset at risk.</p>
Extent of erosion problem and hotspot characteristics	<p>Area surrounding Binningup beach seawall, surf club and car park</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Complete</p> <p>Hazard Assessment: Damara (2016) - Erosion risk identified as dependent on geotechnical investigation of seawall foundations.</p> <p>Management & Adaptation Options: Damara (2016) - Study area Shire coastline, with focus on individual townsites. Recommended adaptation strategy (Binningup Seawall): Immediate (0-5 years) monitor and redesign facility, 2021 onwards manage ramp access, 2026 onwards implement revised option.</p> <p>Additional Comments: Site currently protected by a sea wall</p> <p>Reports: Damara (2016) Shire of Harvey Coastal Hazard Risk Management and Adaptation Plan. Prepared by Damara WA and Land Insights for Shire of Harvey. Report 246-00-09, Rev. 0, Sep-2016</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Geotechnical and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	3 public assets susceptible to erosion hazard. Boat launching x 2, fixed beach access, crushed limestone vehicle access to S
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	6 public assets susceptible to erosion hazard. Boat launching x 2, fixed beach access, crushed limestone vehicle access to S, *Binningup SLSC (part protected includes toilet block), park, *playground
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	7 public assets susceptible to erosion hazard. Boat launching x 2, fixed beach access, crushed limestone vehicle access to S, car park, *Binningup SLSC (part protected includes toilet block), park, *playground

Existing management	Avoid (N), Retreat (N), Accommodate (Y - The existing facility is not marine standard, and therefore acts primarily to delineate the beach from the land. It does not control the shoreline position.), Protect (N)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (N), Accommodate (Y - Alternative beach access required following erosion events), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Accommodate - L Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Facility not providing effective beach access (or seasonally compromising access) Monitoring: Beach width Alternate option: Preferably do not construct marine grade revetment to protect the facility. This will cause reduced beach access (i.e. primary function of facility). Cost estimate will be higher if this is selected.
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - Remove facility and construct new facility to landward [redesign requires better understanding of underlying rock]), Accommodate (Y - Reduce coastal footprint of facility. Extend beach access points landward), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - H Accommodate - L Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Facility significantly compromising beach access due to downdrift erosion Monitoring: Beach width Alternate option: Preferably do not construct marine grade revetment to protect the facility. This will cause reduced beach access (i.e. primary function of facility).
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y - Remove facility and construct new facility to landward), Accommodate (Y - Reduce coastal footprint of facility. Extend beach access points landward), Protect (N)
Works to avoid to achieve long-term plans	Permanent development to the north. Ideally, avoid protecting present facility further as this will reduce beach access which is the primary function of the facility

Appendix D.40. The Cut, Bunbury

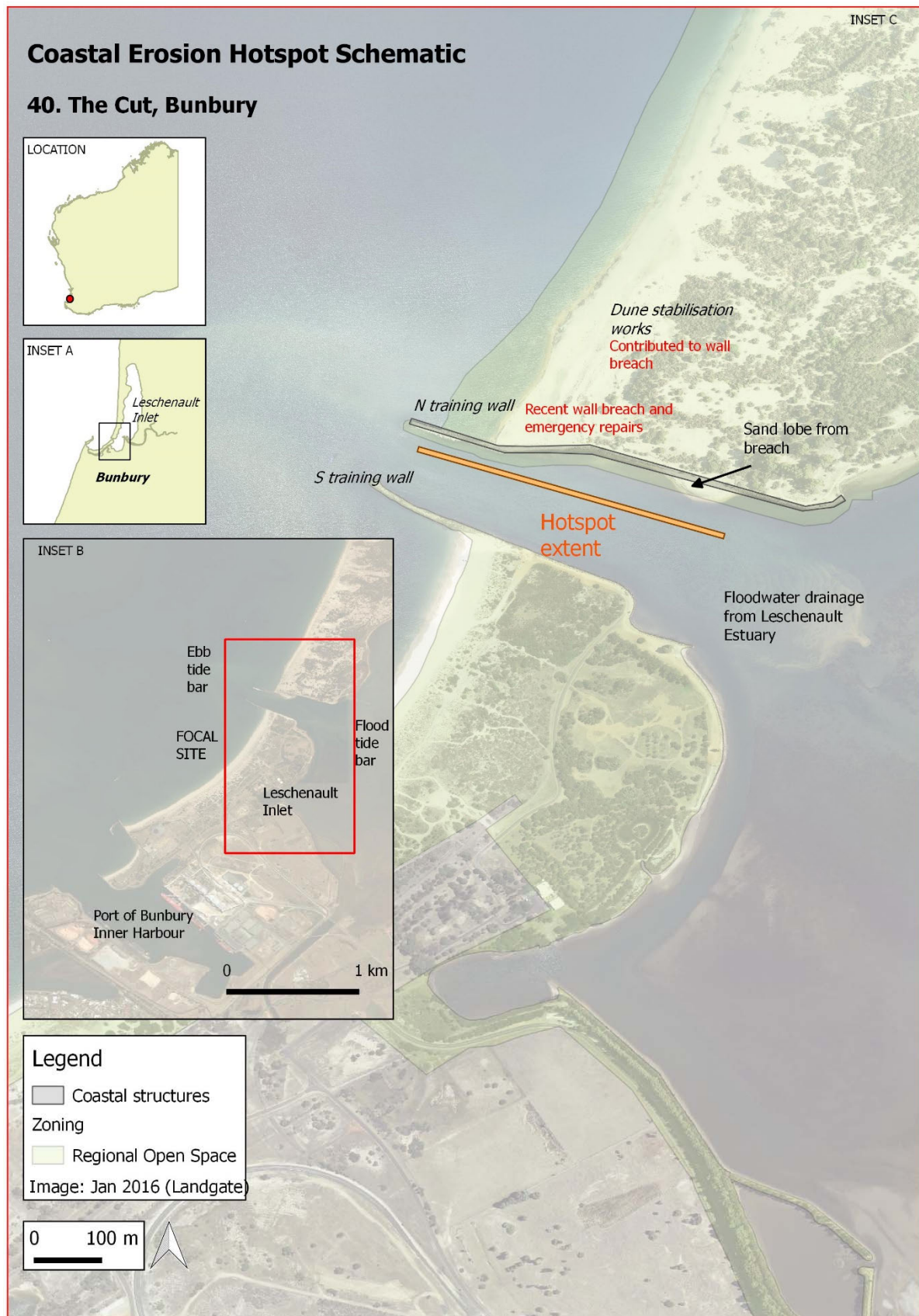


Figure D-40: The Cut, Bunbury schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-40: The Cut, Bunbury summary information

Hotspot No.	40
Hotspot Name	The Cut, Bunbury
Local Coastal Manager	Shire of Harvey, City of Bunbury and DBCA
Hotspot issue	<p>The issue at the Cut is the integrity of the training walls, and their ability to provide flood mitigation. The Cut was excavated in the 1950s to drain the Leschenault Estuary, Collie and Preston Rivers because Town and Port works blocked effective drainage. The training walls were installed in the 1950s and 1970s to assist with the unstable ocean entrance, with formation of unstable flood and ebb tide bars, and a net erosive trend. The ocean beach position fluctuates due to sediment pulses from the bar to the north, including sand from a dredge spoil ground for the Port. In winter 2012 the northern training wall was breached at a structural transition causing sand to spill into the cut and form a mound in the channel. Responsibility for the Cut is uncertain, with Department of Transport undertaking the emergency repairs in 2014, but having no management responsibility for the Cut and adjacent areas. The restricted site access via the beach to the north limits the capacity to undertake further works on the northern side of the cut.. The sediment within the channel has since migrated along the northern training wall into the Estuary. Future changes at the Cut are related to the pattern of progressive erosion and potential changes due to sea level rise; such as increased exposure of the training walls, increased scour and channel mobility, and reduced efficiency of tidal exchange.</p> <p>Although intended for floodwater drainage, concerns are also raised regarding restrictions to navigation and estuarine water quality. The channel is not maintained for navigation, since the Estuary is very shallow and only suited for very small craft. Boats which can safely operate in the open ocean have good launching and safe access options within the Port and Leschenault Inlet. Boats do use the Cut despite its navigation hazards.</p>
Extent of erosion problem and hotspot characteristics	<p>Along the northern training wall</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Apparent costs of likely forms of erosion mitigation are high. • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Complete</p> <p>Hazard Assessment: Damara (2016)</p> <p>Management & Adaptation Options: Damara (2016) - Study area Shire coastline, with focus on individual townsites. Recommend adaption strategy (training walls) design review of the training wall immediately (0-5 years) and by 2026 and onwards undertake continued modifications to training wall as shoreline retreats.</p> <p>Additional Comments: There is no clearly defined organisation with management responsibility for the training walls.</p> <p>Reports:</p> <p>Damara (2016) Shire of Harvey Coastal Hazard Risk Management and Adaptation Plan. Prepared by Damara WA and Land Insights for Shire of Harvey. Report 246-00-09, Rev. 0, Sep-2016.</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Sandbar dynamics and possibly littoral transport
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	1 public asset susceptible to erosion hazard, the maintenance of the channel for flood mitigation
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	1 public asset susceptible to erosion hazard, the maintenance of the channel for flood mitigation
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	1 public asset susceptible to erosion hazard, the maintenance of the channel for flood mitigation

Existing management	Avoid (N), Retreat (N), Accommodate (Y -Raise training wall revetment), Protect (N)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (N), Accommodate (Y -Raise training wall revetment), Protect (Y -Improved stability of central section on north training wall)
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Accommodate - H Protect - H
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Existing length of training walls does not serve a purpose for entrance stability Monitoring: Beach width observations Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Beach retreat is expected to continue Avoid (N), Retreat (N), Accommodate (Y - Reduce seaward length of training walls, widen the channel, Consider placement of Bunbury Port dredge spoil to assist), Protect (N)
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - H
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Existing length of training walls does not serve a purpose for entrance stability, and deepening is contributing to structural damage Monitoring: Beach width observations Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (N), Accommodate (Y - Progressively reduce seaward length of training walls), Protect (N)
Works to avoid to achieve long-term plans	Extension of the training walls and deepening via dredging

Appendix D.41. Koombana Beach

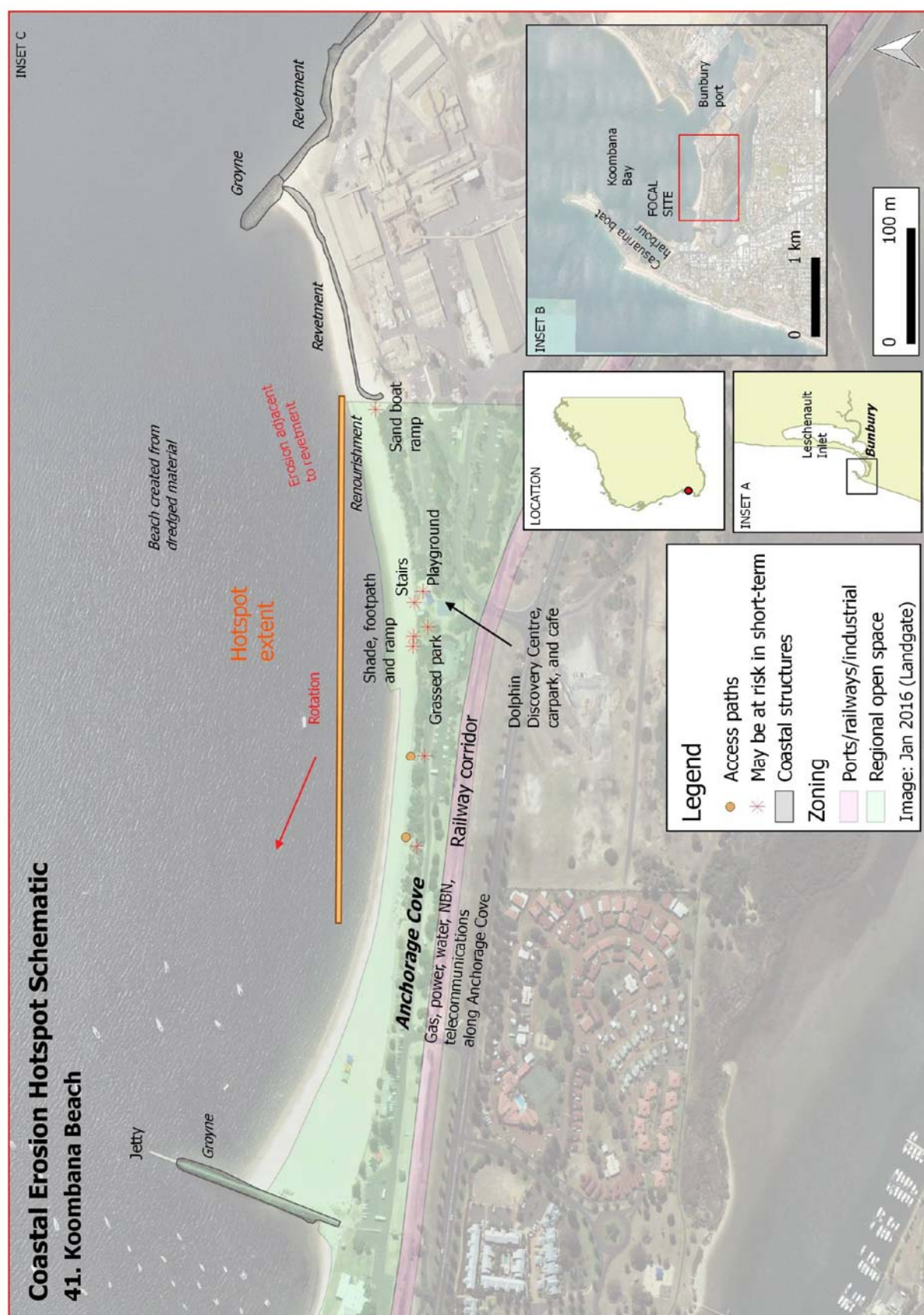


Figure D-41: Koombana Beach schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-41: Koombana Beach summary information

Hotspot No.	41
Hotspot Name	Koombana Beach
Local Coastal Manager	City of Bunbury
Hotspot issue	<p>Koombana Beach is a discrete beach within Bunbury Harbour formed in the 1970s as part of modifications to the Estuary to reduce the threat of flooding, and later works to construct Bunbury Inner Harbour. Approximately 100,000m³ of dredge material from the Inner Harbour was placed on the beach. This material has been redistributed, with erosion along the eastern foreshore since the 1970s, and accretion on the eastern side of the Koombana Yacht Club groyne. The beach has rotated in response to port works, changing wave patterns from the new channel, and in response to the placement of structures. The eastern end of the beach has a 230m rock revetment constructed in July 2015. Sand renourishment is undertaken to mitigate erosion immediately to the west of the structure. Any loss of sediment from the beach through offshore movement under storm conditions is unlikely to fully recover and sequential events would lead to long-term erosion. Major refurbishment of the Dolphin Discovery Centre (DDC) has been proposed as part of the Transforming Bunbury Waterfront project, including a proposal to construct a buried seawall in front of the DDC. Sand nourishment was most recently undertaken by Southern Ports Authority in March 2017.</p> <p>Seventeen publicly owned assets may be at risk of erosion damage in the area (see attached figure), with nine possibly at risk in the short-term. These assets include two fenced sand access tracks, a gazebo, a footpath and concrete ramp to the beach, a grassed area, a playground, a staircase, and a sand boat ramp. An additional 10 public assets may be at risk in the longer-term including the carpark and 200m of Anchorage Cove, and associated services (gas, power, water, NBN and telecommunications) and 10m of the railway corridor. The Dolphin Discovery Centre (lease term TBC with SWDC) and associated cafe (lease on a 5 year term with optional renewal) both may be at risk in the longer-term. Coastal recreational activities in the area include the use of the DDC and interacting with the dolphins, sailing, swimming, exercising, sun bathing and picnicking. Owners of the DDC and associated buildings are the main non-governmental stakeholders likely to have an interest in how this foreshore is managed.</p>
Extent of erosion problem and hotspot characteristics	<p>Section of foreshore in the middle of Koombana Beach adjacent to the revetment.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparent costs of likely forms of erosion mitigation are high. • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled. As part of the planning approvals for the DDC the city is required to prepare a CHRMAP for the DDC and also work with the port to prepare a Koombana Beach Management Plan</p> <p>Hazard Assessment: Regional hazard assessment contained within Damara (2012)</p> <p>Management & Adaptation Options: Koombana Beach is currently undergoing foreshore redevelopment project, which included design and construction of additional coastal protection structures. First stage of foreshore works construction currently (Jan-2017) being tendered.</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p> <p>Bunbury Coastal Protection Part A - Koombana Beach Coastal Erosion & Design Report Seashore Engineering 2013 - City of Bunbury Risk Management Implementation Plan Coastal Protection Koombana Foreshore Project, Bunbury Cardno 2016 - Koombana Master Plan CHRMAP MP Rogers 2015</p>

Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Renourishment source, including characterisation of sediments in harbour sand traps, and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	9 public assets susceptible to erosion hazard. 2 fenced access paths, gazebo, footpath and ramp to beach, grassed area, playground, stairs access, sand boat ramp.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	17 public assets susceptible to erosion hazard. 2 fenced access paths, , Dolphin Discovery Centre carpark, gazebo, footpath and ramp to beach, grassed area, playground, stairs access, sand boat ramp, 210m of Anchorage Cove (road), Dolphin Discovery Centre building and Dolphin Discovery Centre café. Services: 100PVCMP 70kPa gas pipeline along Anchorage Cove, LV buried cable along Anchorage Cove, 4 power poles along Anchorage Cove, 40PVC water pipe between Anchorage Cove and Koombana Drive, in-service NBN cable along Anchorage Cove, fibre optic telecommunications cable running to Dolphin Discovery Centre. Leasehold: Dolphin Discovery Centre and Dolphin Discovery Centre cafe.
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	19 public assets susceptible to erosion hazard. 2 fenced access paths, Dolphin Discovery Centre carpark, gazebo, footpath and ramp to beach, grassed area, playground, stairs access, sand boat ramp, 210m of Anchorage Cove (road), 10m of railway corridor, Dolphin Discovery Centre building and Dolphin Discovery Centre café. Services: 100PVCMP 70kPa gas pipeline along Anchorage Cove, LV buried cable along Anchorage Cove, 4 power poles along Anchorage Cove, 40PVC water pipe between Anchorage Cove and Koombana Drive, in-service NBN cable along Anchorage Cove, fibre optic telecommunications cable running to Dolphin Discovery Centre. Leasehold: Dolphin Discovery Centre and Dolphin Discovery Centre café.
Existing management	Existing behaviour: Beach created from dredge spoil from inner harbour works and widened from large dredge campaigns. Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Revetment constructed immediately to the east, Renourishment, most recently 2017)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Foreshore assets at Dolphin Discovery centre potentially affected by storm erosion. Beach continued to erode at the east with new revetment transferring erosion stress immediately west. Avoid (N), Retreat (N), Accommodate (N), Protect (Y - renourish. Buried revetment constructed in front of Dolphin Discovery Centre in 2017 with possible discussion of extended groyne) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Review lease agreements with DDC to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - M Prepare Plans - 50k Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Loss of remaining buffer (~5m). Monitoring: Buffer width measurement and beach profiles Alternate option: N/A

Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Moderate erosion will cause loss of minimal remaining dune buffer. Avoid (N), Retreat (Y - Modify eastern car park), Accommodate (N), Protect (Y - ongoing renourishment to maintain beach, consider short groynes to extend the life of the renourishment) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Buried seawall exposed for more than 6 months of the year. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Sustained erosion that exceeds the renourishment rate will cause any 'buried' revetment to become exposed, lowering the beach & losing the main beach amenity. Only consider one of the retreat or protect options. Avoid (N), Retreat (Y - retreat towards the west as there is insufficient space to retain a functional beach in front of beach-use facilities [do not protect]), Accommodate (N), Protect (Y - massive renourishment [do not retreat] with contribution by lessee)
Works to avoid to achieve long-term plans	Works that will result in a permanent loss of the beach because the sandy beach is an essential component of the Dolphin Discovery Centre

Appendix D.42. Wonnerup Beach (East)

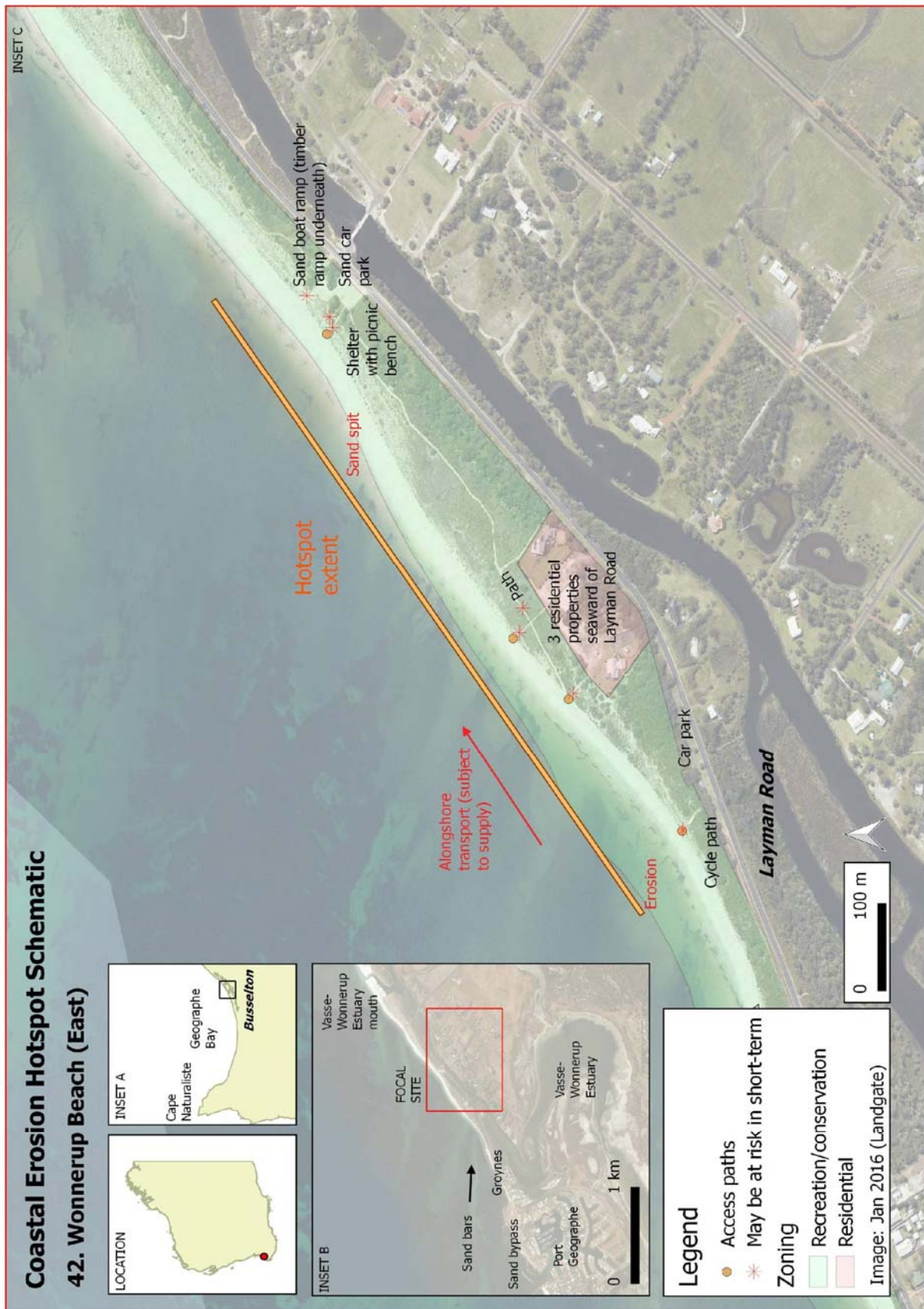


Figure D-42: Wonnerup Beach (East) schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-42: Wonnerup Beach (East) summary information

Hotspot No.	42
Hotspot Name	Wonnerup Beach (East)
Local Coastal Manager	City of Busselton
Hotspot issue	<p>Wonnerup Beach (East) is a NNW section of coast between the groynes east of Port Geographe and the mouth of the Vasse-Wonnerup estuary. The beach is backed to landward by a narrow, low-lying beach-ridge plain formed on an elongate spit at the mouth of the Vasse-Wonnerup estuary. Sand nourishment of the adjacent Wonnerup Beach has been undertaken on two occasions in recent years and is being managed by the Department of Transport, as harbour managers, through an Environmental Monitoring and Management Plan (EMMP). The Port Geographe coastal environment is complex system with a variety of features contributing to sand transport in the region. This includes the decadal changes of the Wonnerup sand bar, and its associated change to the sand exchange with the adjacent beaches. The harbour itself also has a localised influence on sand transport in the region. Whilst this influence is being managed by the EMMP, the bathymetric deepening adjacent to the site indicates the rate of bypassing of Port Geographe to Wonnerup Beach that is occurring through the EMMP may be insufficient to solely sustain this Wonnerup Beach (East) foreshore.</p> <p>Eight publicly owned assets may be at risk of erosion damage in the area (see attached figure), four of which may be at risk in the short-term. These assets include four sand access tracks (counted as one combined asset), a beach shelter over a picnic bench, one sand ramp boat underlain by a timber ramp, and a sand path along the coast. In the longer-term, four additional public assets may be at risk, including the sand car parking area in the east and a carpark, cycle path and Layman Road in the west at Baudin Reserve. Three private properties in this area may be at risk in the short-term, but become likely to be at risk by the medium-term. This region has a moderate level of recreational use, including walking, fishing and boating.</p>
Extent of erosion problem and hotspot characteristics	<p>Eastern Wonnerup foreshore along Layman Road in proximity to three private properties and extending to the boat ramp.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: City of Busselton are preparing to undertake a tender process for CHRMAP</p> <p>Hazard Assessment: Damara (2011) - Risk of erosion identified as dependent on condition of existing coastal structures.</p> <p>Management & Adaptation Options: Nil</p> <p>Additional Comments: Management of the beach is interconnected to the sand bypassing at Port Geographe.</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p> <p>Shore Coastal (2016) East Wonnerup (Baudin Reserve) Coastal Erosion - Desktop Review. Prepared for the City of Busselton by Shore Coastal. Report SCR1510, RevC. May-2016.</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	4 public assets susceptible to erosion hazard. 4 informal access tracks, one sand boat ramp (with timber ramp underneath), informal sand paths, beach shelter over picnic bench

Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	6 public assets susceptible to erosion hazard. 3 informal access tracks, one sand boat ramp (with timber ramp underneath), informal sand paths, sand parking area, beach shelter over picnic bench, cycle path (at western extent). Private Property: 3 on Layman Road.
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	8 public assets susceptible to erosion hazard. 4 informal access tracks, one sand boat ramp (with timber ramp underneath), informal sand paths, sand parking area, beach shelter over picnic bench, Baudin Reserve beach carpark, Layman Road (at the western extent), cycle path (at the western extent). Private Property: 3 on Layman Road.
Existing management	Avoid (Y - existing buffer to the three houses and boat ramp), Retreat (N), Accommodate (N - note it is partially reliant on sand bypassing across Port Geographe), Protect (N)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion threat to remaining section of path. Avoid (N), Retreat (Y - minor recreational assets), Accommodate (N), Protect (N)
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Buffer <20m to 'Marine terrace' line. Monitoring: Buffer width measurement, including estimation of onshore feed from sand bar. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: Two groynes in conjunction with the ongoing bypassing of Port Geographe (transfers erosion to the east)
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Progressive erosion will cause threat to private properties. Can be deferred by moderate renourishment. The site is partially reliant on the mechanical bypassing across Port Geographe and the sand exchange from Wonnerup sand bar. Continued imbalance of sand on the downdrift side of Port Geographe is possible. Avoid (N), Retreat (N), Accommodate (Y - dune management to reduce drift), Protect (Y - Renourishment (opportunistic management) and modify bypassing regime to increase sand supply)) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - L Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Buffer <5m to 'Marine Terrace' line. Monitoring: Buffer width measurement. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: groynes and ongoing renourishment (for road protection). Could consider allowing East Wonnerup properties to build 'back-up' seawall (private property), but not recommended as long-term (i.e. <20 years)
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: With sustained widespread erosion, the position of these isolated houses is untenable. Avoid (N), Retreat (Y - retreat of 3 private properties. Road may require closure if both sides of road are threatened by sea level rise), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Sub-division of properties and further development on the private properties. Additional investment in coastal infrastructure in area of likely hazard.

Appendix D.43. Wonnerup Beaches

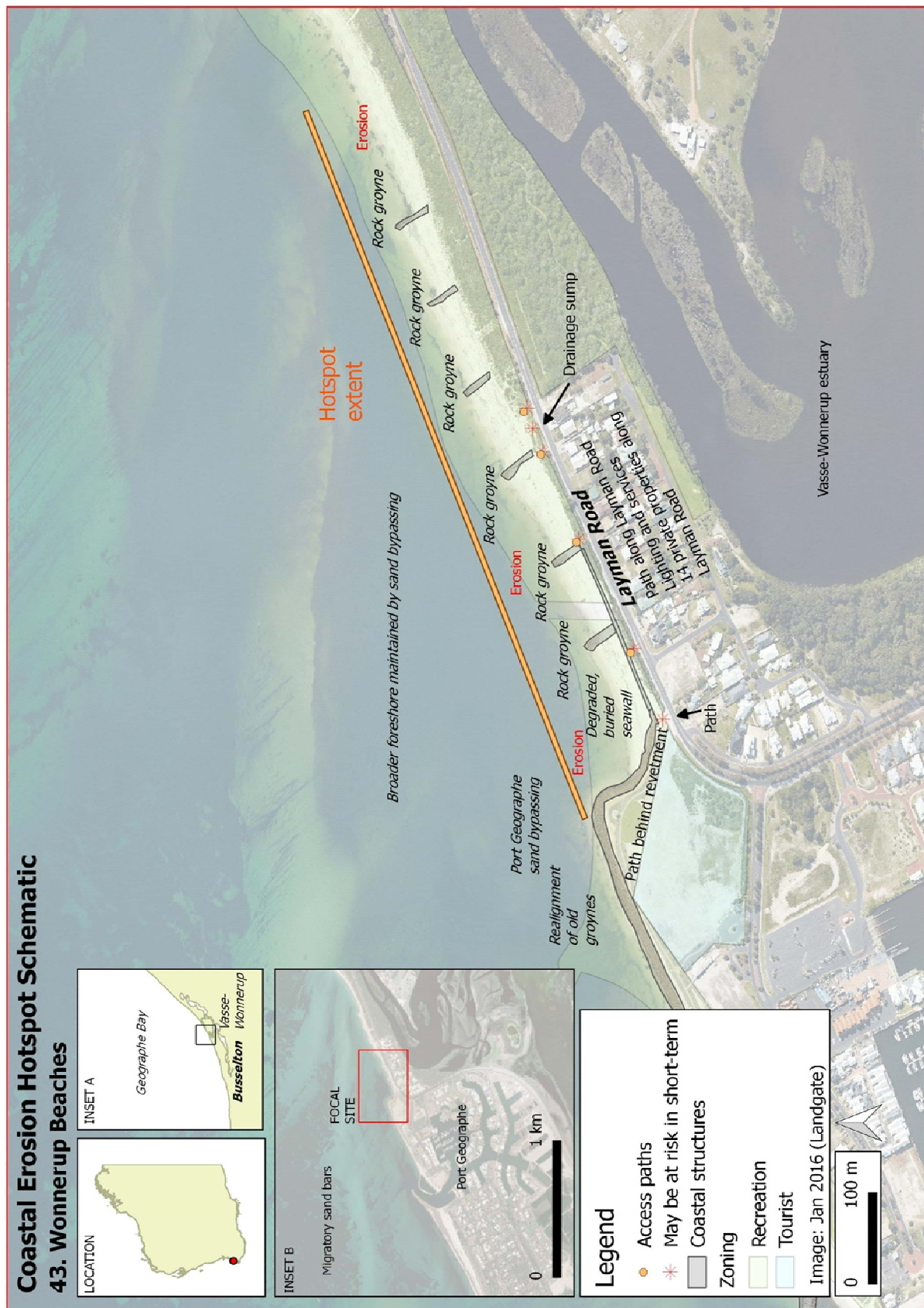


Figure D-43: Wonnerup Beaches schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-43: Wonnerup Beaches summary information

Hotspot No.	43
Hotspot Name	Wonnerup Beaches
Local Coastal Manager	City of Busselton
Hotspot issue	<p>Wonnerup is part of the broader Geographe Bay shore with rhythmic supply of sediment to the shore, with erosion exacerbated by the interruption of sediment transport by the Port Geographe Marina structures. The foreshore has had a revetment, six groynes, reconfiguration of the Port Geographe structures, bypassing and renourishment undertaken to address the erosion issues. Monitoring is undertaken at the site.</p> <p>Five publicly owned assets may be at risk of erosion damage in the area (see attached figure), with two assets at risk of damage in the short-term, including a path and beach access points. In the longer term, Layman Road and the associated lighting and services (gas, water, phone, power), and 14 private properties (including 4 vacant lots) along Layman Road are high-value assets at risk. The foreshore is used for walking, swimming, dog walking and fishing. There are community groups and residents with a vested interest in the management of Wonnerup.</p>
Extent of erosion problem and hotspot characteristics	<p>From NE end of Spinnaker Blvd revetment to 135m NE of 6th groyne in field.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Damara (2011) - Identified as at risk by 2110 under low climate change scenario.</p> <p>Management & Adaptation Options: Nil</p> <p>Additional Comments: Existing coastal protection structures in place at this site. Management of the beach is interconnected to the sand bypassing at Port Geographe.</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	2 public assets susceptible to erosion hazard. Path, access paths (4).
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>5 public assets susceptible to erosion hazard. Layman Road, *path (behind rock revetment), path, access paths (4).</p> <p>Services: Gas, water, power, telecommunications.</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>5 public assets susceptible to erosion hazard. Layman Road and services, *path (behind rock revetment), path, access paths (4).</p> <p>Services: Gas, water, power, telecommunications.</p> <p>Private property: 14 on Layman Road including 4 vacant lots.</p>
Existing management	<p>Avoid (N),</p> <p>Retreat (N),</p> <p>Accommodate (Y - Sand bypassing, harbour entrance modification),</p> <p>Protect (Y - Drown-drift groyne field, 'back-up' seawall)</p>

Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Beach use is considered susceptible to acute hazard Avoid (N), Retreat (Y - Relocate drainage sump to avoid sand movement), Accommodate (Y - Continue sand bypassing as required), Protect (Y - Maintain groyne field and back-up sea wall)
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L Accommodate - M Protect - L
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: East Wonnerup properties subject to acute erosion or active sand drift Monitoring: Beach width. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Imbalance of sand on downdrift side of Port Geographe is possible. Avoid (N), Retreat (N), Accommodate (Y - Continue sand bypassing as required and increase sand supply where possible), Protect (Y - Allow East Wonnerup properties to build 'back-up' seawall (private property), Extension of existing structures is a possible but expensive option, valid only for the short-term (10-20 years)) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - M Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Acute erosion hazard to Layman Road Monitoring: Beach width. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: Could consider increasing tolerance to erosion phases with extension of the 'back-up' seawall along Layman Road.
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: General coastal erosion plus migration of the onshore sand feed will cause progressive retreat that will threaten Layman Road. Avoid (N), Retreat (Y - In extended timescale, truncate Layman Road and relocate flow control structure), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Additional investment in coastal infrastructure Continued imbalance of sand on the downdrift side of Port Geographe is possible. This can be managed by increasing the sand supply (treated through entrance reconfiguration), extending the groyne field up to the end of Layman Road or increasing the tolerance to erosion phases (e.g. 'back-up' seawall).

Appendix D.44. King St

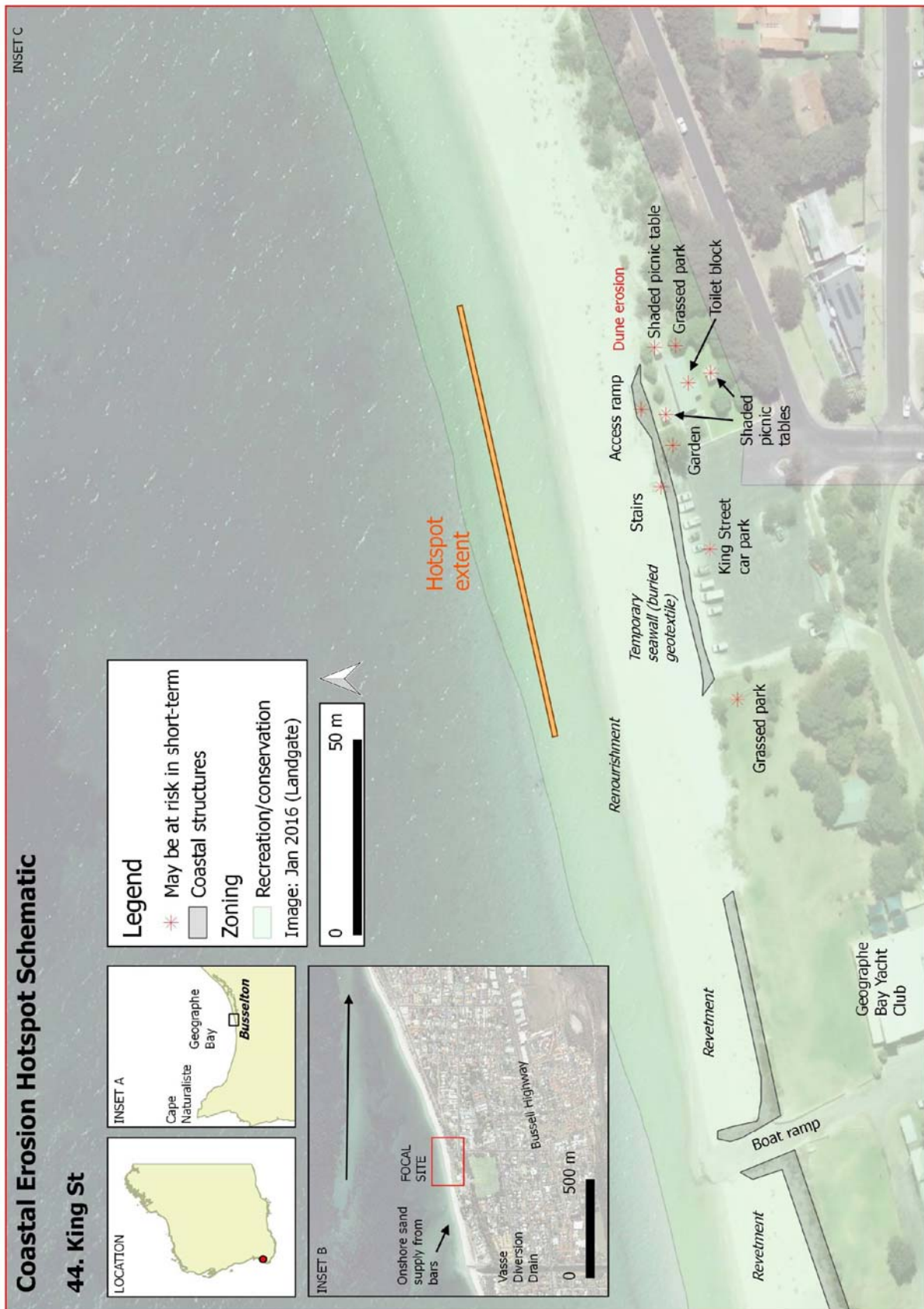


Figure D-44: King St schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-44: King St summary information

Hotspot No.	44
Hotspot Name	King St
Local Coastal Manager	City of Busselton
Hotspot issue	<p>The King Street hotspot is part of the broader Busselton coast which naturally has a rhythmic, mobile shoreline. Public recreational assets have been constructed on the foredunes of a modified beach-ridge plain, to provide direct access to the active shore. The protection afforded by a foredune, as seen in the adjoining dune areas, is not available in this region due to the location of these assets. Sand supply to this foreshore is from alongshore drift, which is supplemented by onshore feed from sand bars. Alongshore sediment transport is partially interrupted by Vasse drain and the Geographe Bay Yacht Club boat ramp to the west. The site has a temporary buried geotextile revetment which does not provide adequate protection for the service life of the assets, with a new geotextile revetment planned for the site.</p> <p>Ten publicly owned assets may be at risk of erosion damage in the area (see attached figure), with all assets at risk in the short-term. These assets include two grassed park areas, King Street car park, a garden area, a toilet block, an access ramp and set of stairs, and three shaded picnic tables. Recreational uses include walking, fishing and swimming.</p>
Extent of erosion problem and hotspot characteristics	<p>Short section of King Street foreshore in proximity to facilities.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: City of Busselton are preparing to undertake a tender process for CHRMAP</p> <p>Hazard Assessment: Damara (2011) - Identified as at risk by 2110 under low climate change scenario.</p> <p>Management & Adaptation Options: Shore Coastal (2013) - Recommended immediate adaptation option for the construction of a seawall. The City have completed the design for a seawall.</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	10 public assets susceptible to erosion hazard. 2 grassed park areas, King Street carpark, garden, toilet block, access ramp, access stairs, 3 shaded picnic tables
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	10 public assets susceptible to erosion hazard. 2 grassed park areas, King Street carpark, garden, toilet block, access ramp, access stairs, 3 shaded picnic tables
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	10 public assets susceptible to erosion hazard. 2 grassed park areas, King Street carpark, garden, toilet block, access ramp, access stairs, 3 shaded picnic tables

Existing management	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - existing buried geotextile revetment (upgraded 2017). Beach scraping over buried revetment. Rock revetment immediately to the west)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion threatens carpark, ramp and amenities block. Any proposed works at the yacht club should consider the impact on this foreshore. Avoid (N), Retreat (N), Accommodate (N), Protect (Y - small scale sand importation. Note: buried geotextile revetment was upgraded in 2017.) Preparation of planning frameworks for retreat in next level of management including prepare for emergency reduction of carpark, and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - L Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Erosion threat to toilet block. Monitoring: Photographic monitoring. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: Protect - Short alongshore control structures (timber or GSC) to redistribute sediment.
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Progressive erosion removes remaining buffer. Avoid (N), Retreat (Y - managed retreat for revetment (W); relocate toilet block; Modify carpark), Accommodate (N), Protect (Y - look for opportunities for large-scale nourishment) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - M Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Retreat with 5-10m increments. Monitoring: Buffer measurement; Photographic monitoring. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: Maintain upgraded revetment. Accommodate - Piled ramp.
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Sustained erosion reducing useable area. Avoid (N), Retreat (Y - managed retreat. Note: If this becomes an area of enhanced recreation development, protect may be an alternate option.), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	The focus should be on nodal development. Stop extending facilities to east. Any proposed works at the yacht club should consider the impact on this foreshore.

Appendix D.45. Craig St, Busselton

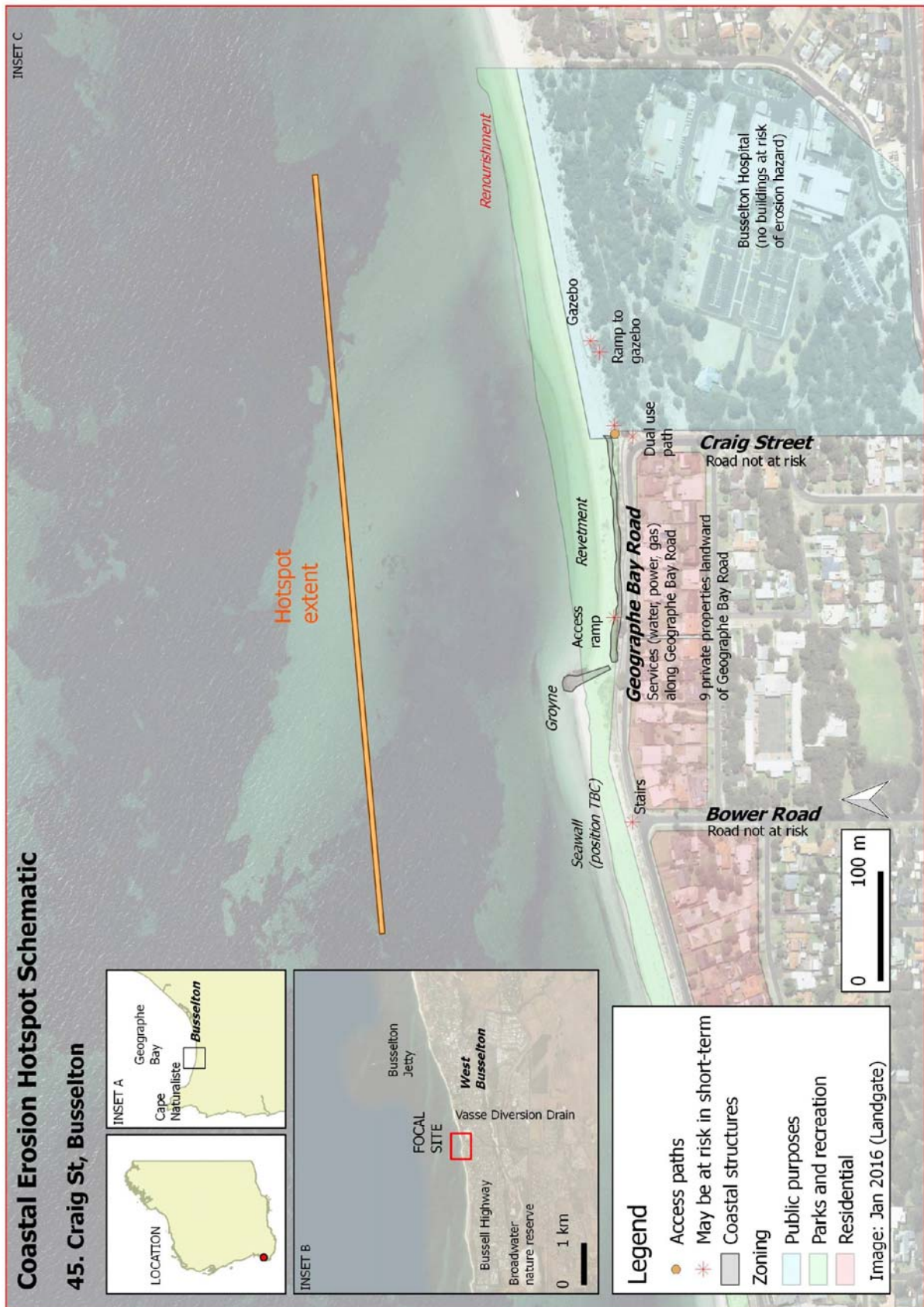


Figure D-45: Craig St, Busselton schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-45: Craig St, Busselton summary information

Hotspot No.	45
Hotspot Name	Craig St, Busselton
Local Coastal Manager	City of Busselton
Hotspot issue	<p>The shoreline of the Craig Street hotspot is part of a rhythmic coast, with alternating depositional sand bars and erosional troughs which may naturally migrate in response to a marked easterly littoral transport. Downdrift erosion has been accentuated due to shore stabilisation works on this active, recently accreted shoreline, mainly the Craig Street groyne. This is a foreshore with coastal management including monitoring, sand renourishment and structures, maintenance, upgrades and modification. The coastal developments are reliant on erosion mitigation works (seawalls, groynes and renourishment) being maintained.</p> <p>Ten publicly owned assets may be at risk of erosion damage in the area (see attached figure), with six assets at risk of damage in the short-term. These include two access ramps, including one with an associated formal path, a section of dual use path, an access track, a gazebo/lookout, and a path leading to this gazebo. In the longer term, 200m of Geographe Bay Road and its associated services (power, water, and gas) may also be at risk. Approximately nine private properties along Geographe Bay Road may be threatened by erosion hazard in the longer term. This broad area is used for walking, swimming, dog walking, fishing, boat launching, kite surfing and windsurfing.</p>
Extent of erosion problem and hotspot characteristics	<p>From 65m E of Bower Road to 180m E of Craig Street.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Damara (2011) - Risk of erosion identified as dependent on condition of existing seawall.</p> <p>Management & Adaptation Options: Shore Coastal (2013) provides general short-term (up to 2018) recommendations for sand nourishment as required and maintenance of existing coastal protection structure.</p> <p>Additional Comments: Existing buried seawall in place, but extent and condition unknown.</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	6 public assets susceptible to erosion hazard. Access ramp. A formal access path with ramp, a small section of path at eastern extent of rock revetment, an informal access track, a gazebo/lookout, and ramp/path leading to gazebo.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	6 public assets susceptible to erosion hazard. Access ramp. A formal access path with ramp, a small section of path at eastern extent of rock revetment, an informal access track, a gazebo/lookout, and ramp/path leading to gazebo.
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	10 public assets susceptible to erosion hazard. Access ramp, a formal access path with ramp, a path (some sitting behind rock revetment) an informal access track, a gazebo/lookout, and ramp/path leading to gazebo, Geographe Bay Rd (partially behind rock revetment).

	Services: Power, water, gas. Private Property: 9 on Geographe Bay Road
Existing management	Avoid (Y - Small-moderate erosion buffers to infrastructure present along the coast), Retreat (N), Accommodate (N), Protect (Y - General reliance upon alongshore control structures (groynes), Small-scale renourishment have been undertaken)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Storm erosion threatens DUP and road Avoid (N), Retreat (Y - relocation of DUP if required), Accommodate (N), Protect (Y - small scale sediment movement, maintain existing structures) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L (if required) Protect - L Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: No buffer to DUP remaining Monitoring: Buffer width measurement; Photographic monitoring. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: Protect - refurbish revetment, including downdrift transition.
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - relocation of DUP if required), Accommodate (N), Protect (Y - Construct new short groyne to east, with nourishment; large-scale nourishment and extend/relocate groyne)
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L (if required) Protect - H
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Short groyne outflanked (i.e. need longer structure) Monitoring: Photographic monitoring. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Seawalls and groynes)
Works to avoid to achieve long-term plans	Redevelopment or increased development on the hospital site further seaward

Appendix D.46. Abbey, Busselton

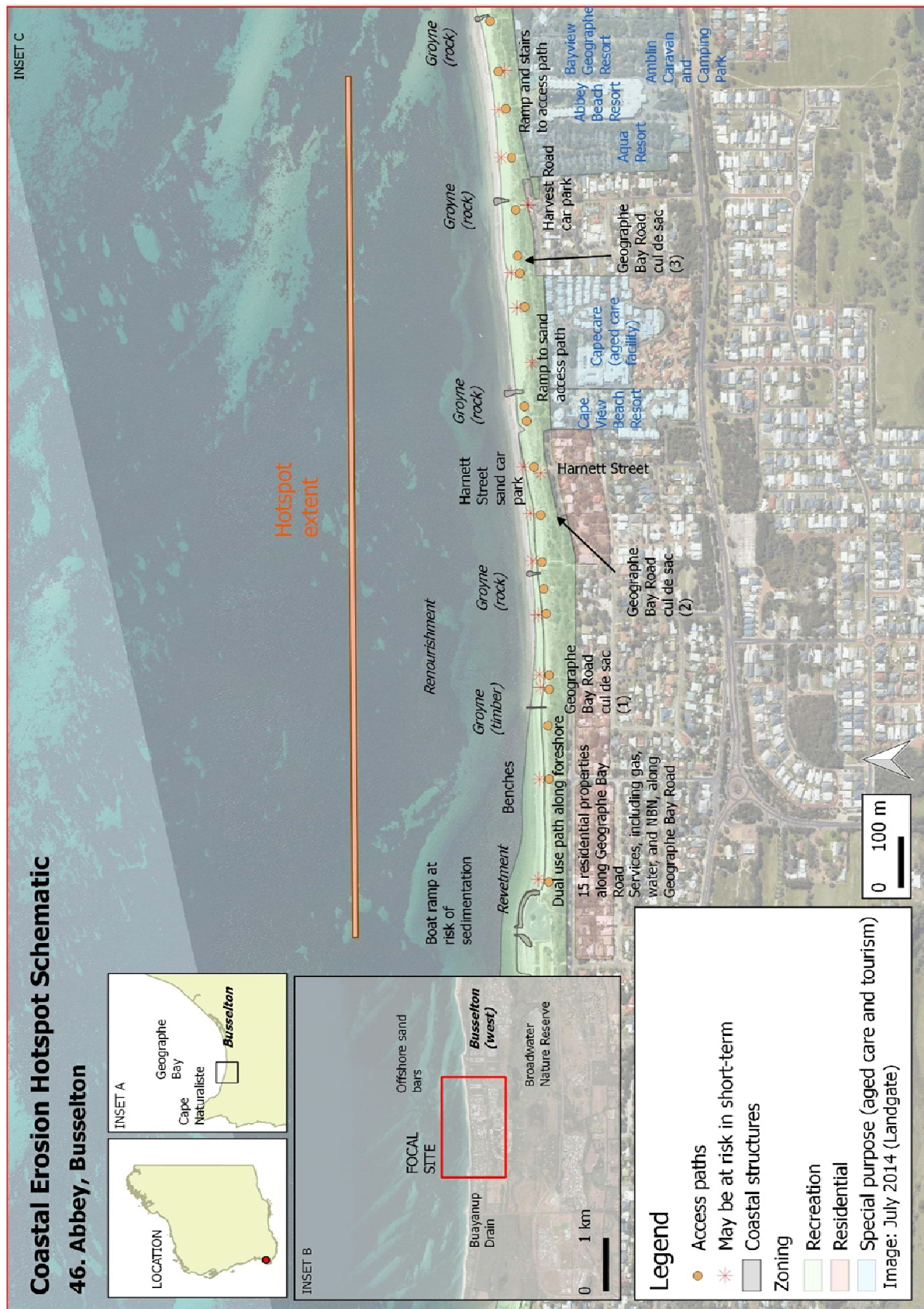


Figure D-46: Abbey, Busselton schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-46: Abbey, Busselton summary information

Hotspot No.	46
Hotspot Name	Abbey, Busselton
Local Coastal Manager	City of Busselton
Hotspot issue	<p>The Abbey hotspot has a naturally unstable shoreline due to its rhythmic nature, with alternating depositional bars and erosional troughs which may naturally migrate in response to a marked easterly littoral transport. The Abbey foreshore is maintained by a series of structures, including the revetment at the Abbey boat ramp, and the series of groynes (one timber and four rock) that sit along this section of coast. This is a foreshore with coastal management including monitoring, sand renourishment and structures, maintenance, upgrades and modification. The coastal developments are reliant on erosion mitigation works being maintained.</p> <p>Seventeen publicly owned assets may be at risk of erosion damage in the area (see attached figure), nine of which may be at risk in the short-term. These include multiple access paths (counted as one combined asset), benches, the boat ramp (at risk of sedimentation), a ramp and two sets of stairs all leading to sand access paths, the sand car park at Harnett Street, two sections of dual use path and Harvest Road sealed car park. The main asset is the boating facility and associated facilities. In the medium to longer-term, three Geographe Bay Road culs de sac (reliant on groynes), a dual use path along the foreshore (reliant on groynes), and services along the segmented Geographe Bay Road may also be at risk. In the longer-term 15 residential properties landward of Geography Bay Road and Harnett St, the Aged Care facility and five resorts may be at risk of erosion damage. This broad area is used for walking, swimming, dog walking, fishing, boat launching, kite surfing and windsurfing.</p>
Extent of erosion problem and hotspot characteristics	<p>From Roberts Road carpark to just E of Abbey Beach Resort.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRM status and findings	<p>CHRM Status: Not Scheduled</p> <p>Hazard Assessment: Damara (2011) - Identified as at risk by 2110 under low climate change scenario.</p> <p>Management & Adaptation Options: Shore Coastal (2013) recommends short-term management (up to 2018): site specific monitoring to assess requirement for periodic sand nourishment and maintenance of existing coastal protection structures.</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	9 public assets susceptible to erosion hazard. Toes of multiple access paths, 2 benches at beach access point, boat ramp at risk of sedimentation, ramp to sand access path, sand car park at Harnett Street, sealed path and stairs to sand access path, Harvest Road sealed car park (seaward of DUP), short sealed path and stairs to sand access path.

Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	17 public assets susceptible to erosion hazard. Toes of multiple access paths, 2 benches at beach access point, boat ramp at risk of sedimentation, ramp to sand access path, sand car park at Harnett Street, sealed path and stairs to sand access path, Harvest Road sealed car park (seaward of DUP), short sealed path and stairs to sand access path, *3 cul de sacs (reliant on groynes), *DUP along foreshore (reliant on groynes). Services: Gas, water, power and NBN along Geographe Bay Road
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	17 public assets susceptible to erosion hazard. Toes of multiple access paths, 2 benches at beach access point, boat ramp at risk of sedimentation, ramp to sand access path, sand car park at Harnett Street, sealed path and stairs to sand access path, Harvest Road sealed car park (seaward of DUP), short sealed path and stairs to sand access path, *3 cul de sacs (reliant on groynes), *DUP along foreshore (reliant on groynes). Services: Gas, water, power and NBN along Geographe Bay Road Private Property: 15 residential properties on Geographe Bay Road and Harnett Street, 5 resorts (4 on Bussell Highway, 1 on Little Collins St), and 1 aged care facility on Ray Avenue.
Existing management	Avoid (Y - Small-moderate erosion buffers to infrastructure present along the coast), Retreat (N), Accommodate (N), Protect (Y - General reliance upon alongshore control structures (groynes), Small-scale renourishment have been undertaken)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (Y - relocation of DUP if required), Accommodate (Y - management of beach access; encourage dune growth), Protect (Y - small-scale sediment movement; active management of groynes (altering lengths)) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L (if required) Accommodate - L Protect - M Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Buffer width <5m to DUP on east side of boat ramp and >20m on west side of boat ramp. Monitoring: Buffer width measurements. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - relocation of DUP if required), Accommodate (Y - Occasional bypassing of boat ramp), Protect (Y - change to adaptable active management; build dunes; look for renourishment opportunities; investigate the feasibility of timber/GSC groynes) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L (if required) Accommodate - M Protect - H Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Occasional bypassing insufficient to maintain 10m buffer to road. Monitoring: Aerial imagery (annual). Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y - relocated DUP), Accommodate (N), Protect (Y - Seawalls and groynes)
Works to avoid to achieve long-term plans	Development within the foreshore reserve should only include temporary recreational facilities (as per SPP2.6).

Appendix D.47. Locke Estate

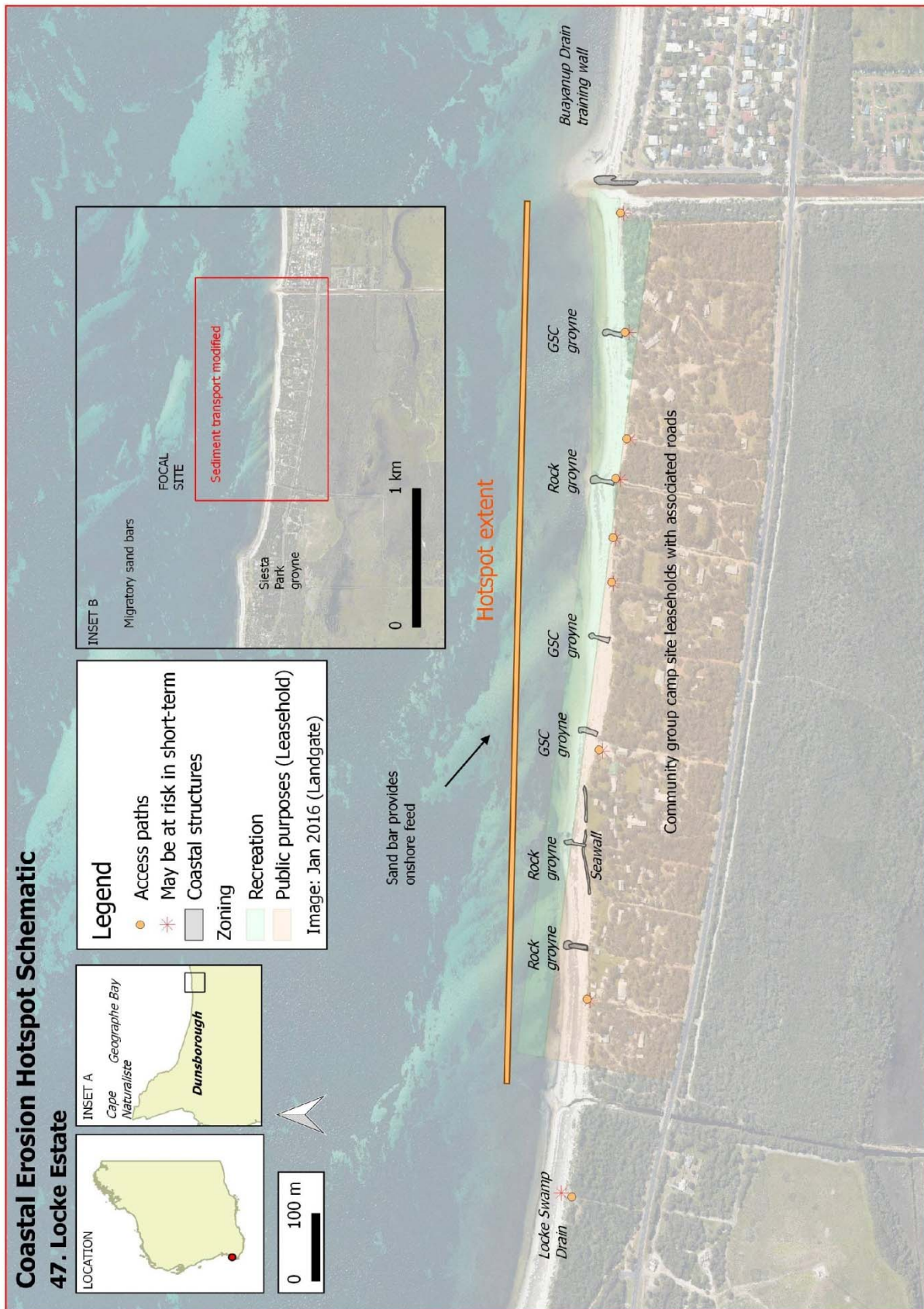


Figure D-47: Locke Estate schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-47: Locke Estate summary information

Hotspot No.	47
Hotspot Name	Locke Estate
Local Coastal Manager	City of Busselton
Hotspot issue	<p>Locke Estate is a parcel of Crown land leased to 16 community groups for recreational campsites and holiday accommodation. The land was leased, with subsequent downdrift erosion that occurred from the construction of the Siesta Park groyne and drainage channels. Many facilities were constructed close to the active shore. The erosion issue at this site is considered as part of the broad scale Geographe Bay planning and management problems attributed to downdrift erosion of coastal structures and broad scale movement of sand bars. Decades of ad-hoc management had resulted in a series of wooden groynes and a rock revetment, all limited by the financial constraints imposed by the proponents. Most recently, the groynes were reconstructed with three rock groynes and three geosynthetic sand container groynes. The present management arrangement requires lessees to progressively remove threatened or dilapidated buildings within a coastal setback zone. Additionally, lessees are required, within a capped limit, to contribute annually towards the cost of coastal protection works.</p> <p>Twelve publicly owned assets, mainly local roads within the leaseholds, may be at risk of erosion damage in the area (see attached figure), with eight beach access points (collectively assessed as one asset) at risk of damage in the short-term. The local roads and other assets within the 16 community group campsite leaseholds are at risk in the longer-term, which fall under the lease arrangements with the City of Busselton for retreat.</p>
Extent of erosion problem and hotspot characteristics	<p>From Locke Swamp Drain to Buayanup Drain</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Damara (2011) - Risk of erosion identified as dependent on integrity of existing groyne structures.</p> <p>Management & Adaptation Options: The City has recently undertaken the replacement of existing groynes and associated sand nourishment.</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Shore Coastal (2013) Busselton Coastal Management Program (2014-2018). Prepared for the City of Busselton by Shore Coastal. Report SCR1211, Apr-2013</p> <p>Damara (2011) Coastal Erosion Assessment of Climate Change Impacts. Prepared for the Shire of Busselton. Report 96-00-01, Aug-2011</p> <p>Damara (2012) Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region. Prepared by Damara WA Pty Ltd for Peron-Naturalist Partnership. Report 169-01, Rev. 0, Oct-2012</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	1 public asset susceptible to erosion hazard. Access paths (8)
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>12 public assets susceptible to erosion hazard. Access paths (8), 11 local roads within leasehold camps.</p> <p>Leasehold: 10 community group camp sites</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>12 public assets susceptible to erosion hazard. Access paths (8), 11 local roads within leasehold camps.</p> <p>Leasehold: 10 community group camp sites</p>

Existing management	6 groynes recently rebuilt. The current management arrangement requires lessees to progressively remove threatened or dilapidated buildings within a coastal setback zone. Additionally, lessees are required, within a capped limit, to contribute annually towards the cost of coastal protection works. Avoid (N), Retreat (Y - Retreat and relocation of selected buildings and facilities has been undertaken), Accommodate (N), Protect (Y - Refurbishment and replacement of several of the previous stabilisation works has been undertaken)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Continued refurbishment and replacement of previous active stabilisation works may be undertaken. Some sand renourishment is appropriate to support installation of new stabilisation structures) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - L Prepare Plans - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Effective function of coastal protection structures potentially threatened by acute erosion. Monitoring: Structural assessment. Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - Remove or relocate structures locally influenced by threatened coastal protection works (approximately 60m)), Accommodate (N), Protect (Y - Maintain existing coastal protections works) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - No public cost Protect - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: General retreat reducing effectiveness of coastal protection works. Monitoring: Regional shoreline monitoring (Siesta Park groyne to Buayanup Drain). Existing Geographe Bay coastal monitoring program, assessing acute and progressive erosion. Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Generalised coastal retreat will compromise the performance of the existing facilities Avoid (N), Retreat (Y -Progressively remove buildings and facilities Relocate coastal defence structures landward), Accommodate (N - Reducing the length of Siesta Park groyne would provide increased sand supply), Protect (Y - Replace existing coastal protection works with equivalent structures to landward (replace every ~20m retreat))
Works to avoid to achieve long-term plans	Extension of Siesta Park groyne.

Appendix D.48. Gnarabup S

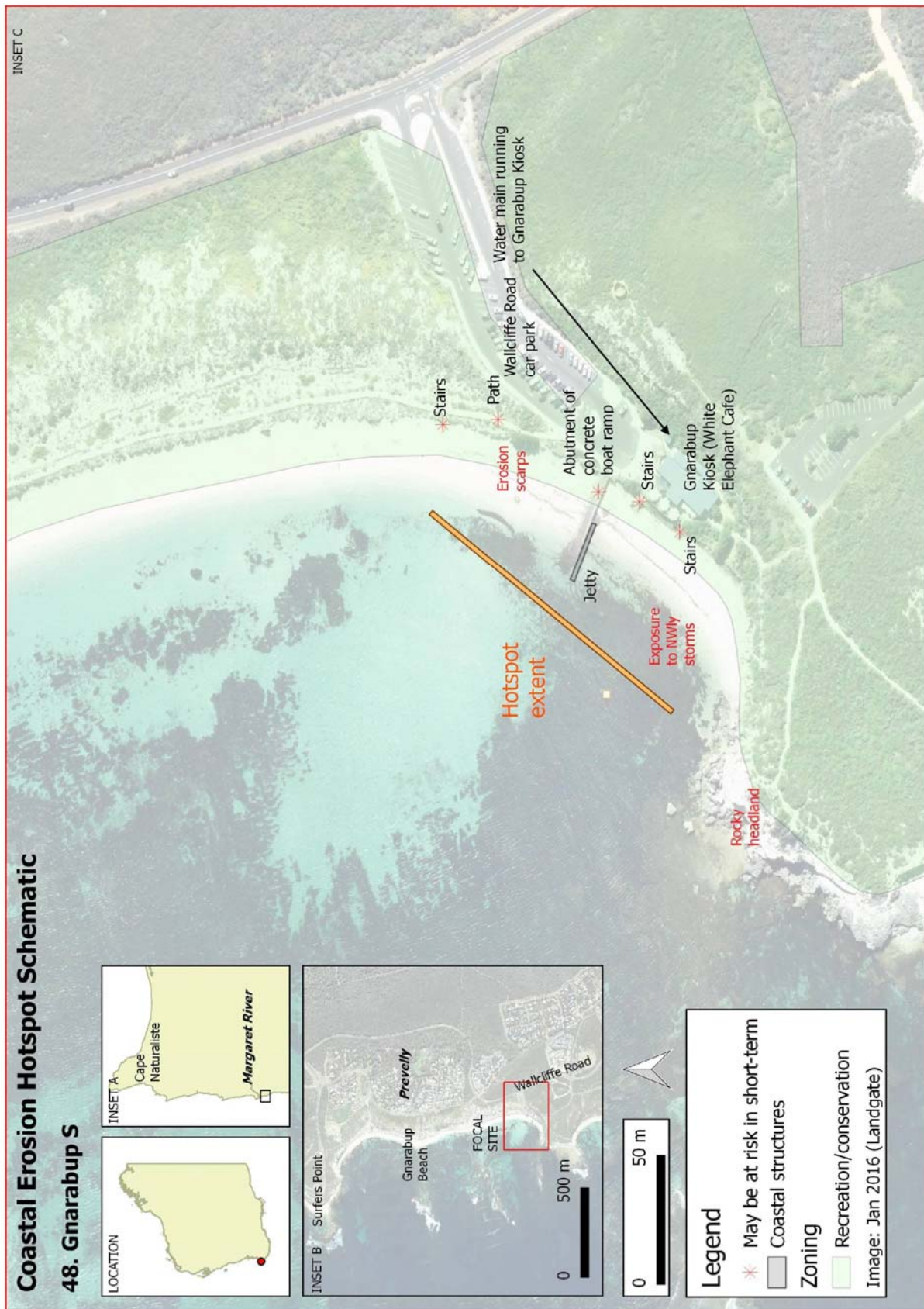


Figure D-48: Gnarabup S schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-48: Gnarabup S summary information

Hotspot No.	48
Hotspot Name	Gnarabup S
Local Coastal Manager	Shire of Augusta-Margaret River
Hotspot issue	<p>Gnarabup Beach S is at the southern, updrift end of a half heart shaped embayment. It is a northwest facing beach immediately adjacent to a rocky headland. Facilities within the area have been built on the seaward edge of the frontal dunes, foredunes and beach, where the coast shows evidence of phases of erosion and recovery. Historically there has been periods of increased activity in the high dunes, demonstrated in part by a scarped frontal dune ridge. The beach has been experiencing a period of erosion from storms in the last five years in the hotspot extent. Management activities include dune stabilisation and planting, as well as modification of the beach access stairs and deck at the White Elephant Café in 2013 to be piled. A recent monitoring program, including waves, water levels and time-lapse beach photos, has been undertaken by the UWA. A report is scheduled to follow this program, with a detailed aerial survey recently collated by the Shire.</p> <p>Eight publicly owned assets may be at risk of erosion damage in the area (see attached figure), five of which may be at risk in the short-term. These assets include three sets of stairs/ramps, the abutment of the concrete boat ramp, and 150m of footpath. Three additional assets that may be at risk in the longer-term include the car park, a water main running to the White Elephant Café and a further 165m of footpath. The White Elephant Café, a leasehold property (lease to expire in 2025), may be vulnerable in the medium-term. Coastal recreational activities in the area include walking, boat launching, fishing and swimming. The lessees at the White Elephant Café and local coastal resident associations are the main non-government stakeholders likely to have an active interest in how this foreshore is managed.</p>
Extent of erosion problem and hotspot characteristics	<p>Southern Gnarabup from rocky headland to the third staircase to the north.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRM status and findings	<p>CHRM status: Completed 2015</p> <p>Hazard Assessment: Shore Coastal (2015) - Immediate risk of erosion identified (existing buffer <S1)</p> <p>Management & Adaptation Options: Shore Coastal (2015) - Study area Shire coastline, with focus on Townsites. Recommended immediate adaptation strategy (Gnarabup Beach) managed retreat, progressive removal of beach access stairs, car park etc. as coast erodes.</p> <p>Additional Comments: Cafe deck was recently reconstructed as a piled structure founded on rock to accommodate a degree of erosion.</p> <p>Reports:</p> <p>Shore Coastal (2015) Coastal Hazard Risk Management and Adaptation Plan. Prepared for Shire of Augusta Margaret. Report SCR1507, Nov-2015</p> <p>CMPAP funded</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Geotechnical and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	5 public assets susceptible to erosion hazard. 3 stairs/ramp access locations, abutment of concrete boat ramp, 150m of footpath.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>8 public assets susceptible to erosion hazard. 3 stairs/ramp accesses, abutment of concrete boat ramp, boat launching car park, 150m of footpath.</p> <p>Leasehold: The White Elephant Café.</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>9 public assets susceptible to erosion hazard. 10m of footpath, 3 stairs/ramp access, abutment of concrete boat ramp, boat launching car park, 150m of footpath.</p> <p>Services: Critical water main running to Private Gnarabup Kiosk PS.</p> <p>Leasehold: The White Elephant Café.</p>

Existing management	Avoid (N), Retreat (N), Accommodate (Y - some dune stabilisation and planting. Decking at White Elephant is stumped without replacement walling), Protect (Y - concrete wall at boat ramp)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (Y - Manage beach access (relocate north), realign coastal path), Accommodate (N), Protect (N) Review lease agreements with White Elephant Cafe to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Boat ramp damage / loss of functionality. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (N), Accommodate (Y - continue to adapt boat ramp), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Beach depth within 0.5m of café foundation capacity for more than one month. Monitoring: Photographic monitoring Alternate option: Retreat - remove boat ramp. Construct new access point.
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y - relocate café and reduce carpark (managed retreat)), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Additional leasehold development without clauses within lease that lessees are responsible for erosion mitigation or replacement construction. Avoid further development of facilities/amenities on foreshore reserve without concurrent creation of clear erosion mitigation agreements.

Appendix D.49. Windy Harbour Foreshore

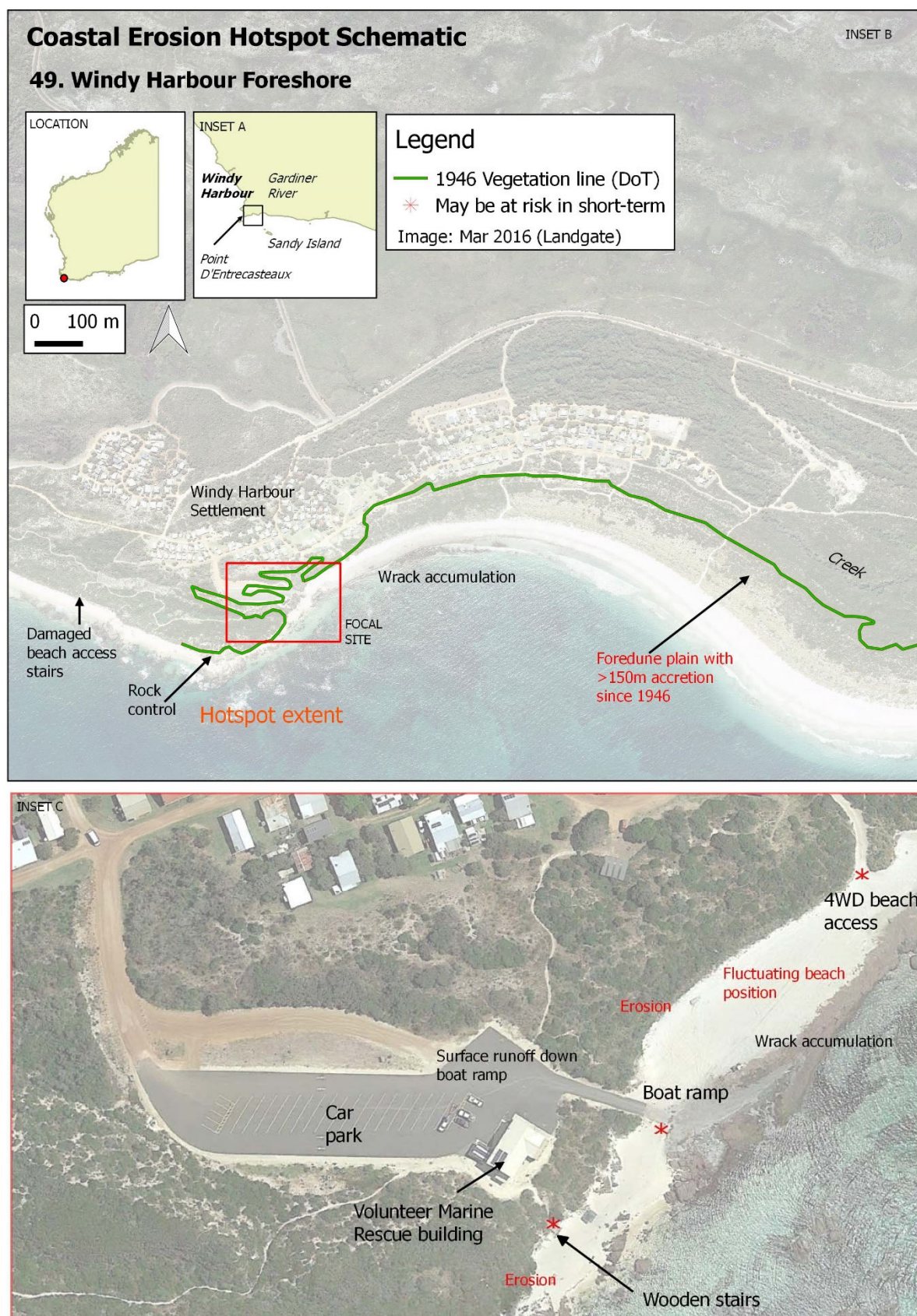


Figure D-49: Windy Harbour Foreshore schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-49: Windy Harbour Foreshore summary information

Hotspot No.	49
Hotspot Name	Windy Harbour Foreshore
Local Coastal Manager	Shire of Manjimup
Hotspot issue	<p>Windy Harbour is a holiday site, popular for fishing, which is a leasehold residential area. Facilities near the boat ramp have recently been upgraded with construction of a bitumen car park, the Volunteer Marine Rescue building (leasehold) and a timber staircase to provide beach access. Issues at the site include seasonal beach erosion and seagrass wrack accumulation, which limit beach access and boat ramp use, as well as the erosion damage to the beach access stairs west of the rocky headland. Erosion and wrack accumulation occur seasonally adjacent to the rock headland, with additional year-to-year variation. Anything built in the active zone will require regular maintenance.</p> <p>Five assets may be at risk of erosion damage in the area (see attached figure), with three having short-term risk including the wooden staircase, the boat ramp and the 4WD access track to the north. Social pressure at this site relates to constraints to boat launching, driving along the beach and beach access.</p>
Extent of erosion problem and hotspot characteristics	<p>Area surrounding the headland to N of the boat ramp</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Nil</p> <p>Management & Adaptation Options: Nil</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Thompson McRobert Edgeloe (2007) Windy Harbour Management Plan 2007 - 2017. Prepared by Thompson McRobert Edgeloe for Shire of Manjimup. Nov-2007</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	<p>3 public assets susceptible to erosion hazard. Wooden stairs, boat ramp, 4wd access track</p> <p>Leasehold: Whole hotspot is leasehold.</p>
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>3-5 public assets susceptible to erosion hazard. Wooden stairs, boat ramp, volunteer marine rescue building, car park, 4wd access track.</p> <p>Leasehold: Whole hotspot is leasehold.</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>5 public assets susceptible to erosion hazard. Wooden stairs, boat ramp, volunteer marine rescue building, car park, 4wd access track.</p> <p>Leasehold: Whole hotspot is leasehold.</p>
Existing management	<p>Avoid (Y - High-value fixed infrastructure has a moderate setback buffer),</p> <p>Retreat (N),</p> <p>Accommodate (N),</p> <p>Protect (N)</p>
Management options for Imminent timeframe (0–5 years)	<p>Avoid (Y - Maintain (or increase) existing setback buffer),</p> <p>Retreat (N),</p> <p>Accommodate (Y - Increase tolerance of structures to shoreline variation (reinforce sides of ramp, deep foundation for stair supports)),</p> <p>Protect (N)</p> <p>Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.</p>
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	<p>Avoid - None</p> <p>Accommodate - L</p> <p>Prepare Plans - 50k</p>

Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Erosion threatens structural stability Monitoring: Structural assessment (annual) Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - Relocate stairs to landward if severe erosion occurs), Accommodate (Y - Repeat (anticipated to be required more than once in ~25 year timeframe) increase tolerance of structures to shoreline variation (reinforce sides of ramp, deep foundation for stair supports)), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L Accommodate - L Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Ramp retaining more than 1.5m height; building at less than 1:2 (V:H) from top of beach level Monitoring: Scarp/face height; Buffer width Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Additional response to sea level rise with further rotation. Avoid (N), Retreat (Y - Rebuild beach access and ramp to landward. Under general coastal retreat, the Sea Rescue building may require relocation, depending on influence of rock), Accommodate (Y - Construction of a deep retaining foundation for the Sea Rescue building may enhance stability), Protect (N)
Works to avoid to achieve long-term plans	High expense infrastructure with low tolerance to coastal movements.

Appendix D.50. Peaceful Bay

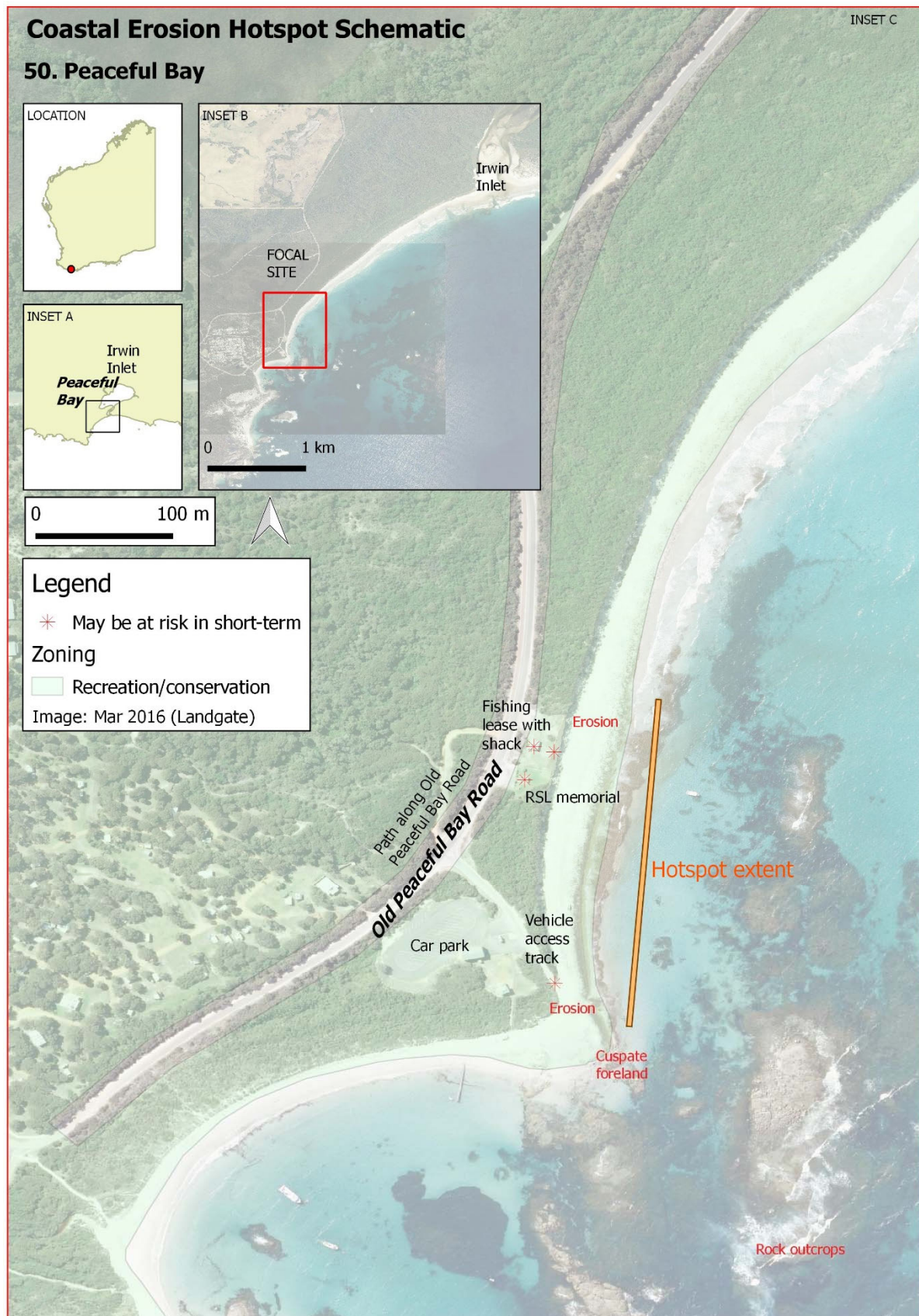


Figure D-50: Peaceful Bay schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-50: Peaceful Bay summary information

Hotspot No.	50
Hotspot Name	Peaceful Bay
Local Coastal Manager	Shire of Denmark
Hotspot issue	<p>The Peaceful Bay hotspot is along the east facing shore of a cusplate foreland, which is tied to a rock outcrop within a small embayment controlled by granite rock outcrops. It is functionally part of the broader bay, also comprising Foul Bay, which includes the entrance to Irwin Inlet and some active dunes in the central part of the bay. Dunes backing the active beach have been scarped, with 16m-24m eroded since 2002, including fine sediments collapsing and being lost from the beach. Erosion is expected to generally follow the shape of the shore, as demonstrated by the beach ridge alignment and older shorelines. Local variability is expected due to rock controls. The existing management has been to maintain an erosion buffer and the retreat of sheds from a fishing lease area. The Peaceful Bay townsite was originally a holiday leasehold area.</p> <p>Five publicly owned assets may be at risk of erosion damage in the area (see attached figure), four of which may be at risk in the short-term. These assets include a sand vehicle access track to the beach which is the main method of boat launching, the RSL Memorial, and the fishing lease area and shack. In the longer-term, 200m of Old Peaceful Bay Road may be at risk. Coastal recreational uses include boat launching, fishing, walking, swimming and driving along the beach. The Returned Services League, Volunteer Marine Rescue group, local fisheries, local residents and the local tourism accommodation providers are the main non-government stakeholders likely to have an active interest in how this foreshore is managed.</p>
Extent of erosion problem and hotspot characteristics	<p>East facing foreshore of the cusplate foreland from the foreland to the north of the RSL memorial park.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Draft CHRMAP Report due Jan 18. To include community consultation for how to increase facilities at site (in accordance with hierarchy).</p> <p>Hazard Assessment: Seashore Engineering Final Report due Feb 2017</p> <p>Management & Adaptation Options: In Progress</p> <p>Additional Comments: Nil</p> <p>Reports: Nil. CMPAP funded</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Possibly geotechnical and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	<p>4 public assets susceptible to erosion hazard. Vehicle access track, fishing lease area, fishing lease shack, and RSL memorial.</p> <p>Leasehold: fishing lease</p>
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>4 public assets susceptible to erosion hazard. Vehicle access track, fishing lease area, fishing lease shack, and RSL memorial.</p> <p>Leasehold: fishing lease</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>5 public assets susceptible to erosion hazard. Vehicle access track, 200m of Old Peaceful Bay Road, RSL memorial, fishing lease area, and fishing lease shack.</p> <p>Leasehold: fishing lease</p>
Existing management	<p>Avoid (Y - most of the town and road has sufficient buffer to development), Retreat (N), Accommodate (N), Protect (N)</p>

Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (Y - relocate access), Accommodate (N), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Review fishing lease agreements to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Retreat - L Prepare Plans - 50k Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Buffer width <5m from facilities. Monitoring: Buffer width measurement Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - remove or relocate facilities (carpark, RSL memorial), access), Accommodate (N), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Buffer width <15m to road. Monitoring: Buffer width measurement Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y - relocate road (managed retreat)), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Permanent fixed boat ramp in the existing location. Protection of the road should be avoided given the large cost of this option in relation to the relocation that is suggested in the 25+ year timeframe.

Appendix D.51. Denmark, Ocean Beach

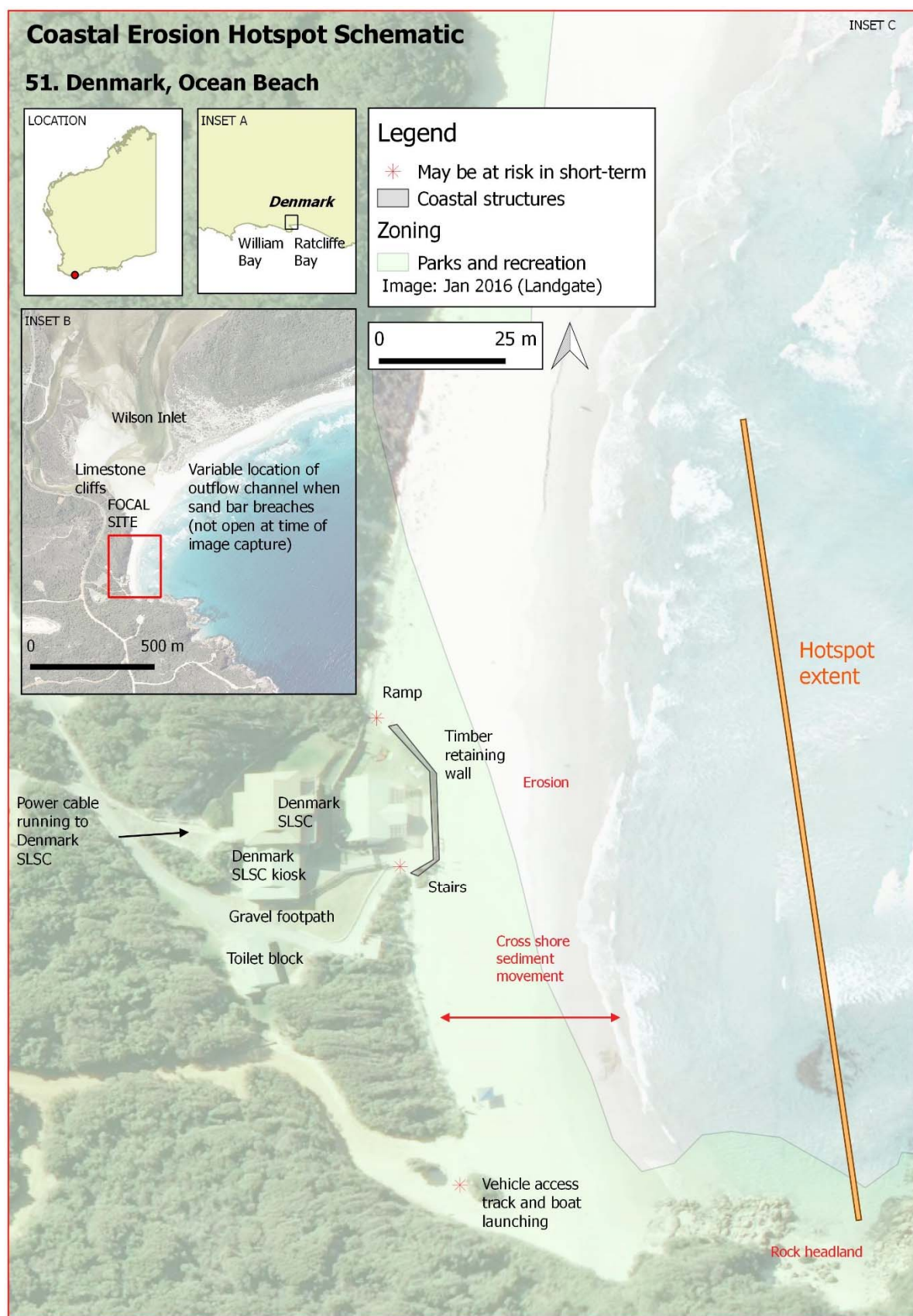


Figure D-51: Denmark, Ocean Beach schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-51: Denmark, Ocean Beach summary information

Hotspot No.	51
Hotspot Name	Denmark, Ocean Beach
Local Coastal Manager	Shire of Denmark
Hotspot issue	<p>Ocean Beach is the main recreational beach for Denmark town and is susceptible to storm erosion. The sandy beach next to the clubhouse generally fronts a rocky scarp, and is sheltered by igneous rock outcrops on the southern side. Erosion problems at the surf club occur during storms, particularly storms with an easterly component, as the general alignment of the sandy beach has not varied significantly in the last 50 years. Behaviour of the site is also influenced by its location on the ebb-tide delta of the Wilson Inlet, with the location of the outflow channel (when open) impacting on beach levels adjacent to the surf club and the broader sediment availability. The Denmark SLSC has been in its existing position since 1987 (replacement of the original, smaller SLSC that was built in 1958), and the current management action has been the construction of the timber retaining wall fronting this facility, built in 1998.</p> <p>Five publicly owned assets may be at risk of erosion damage in the area (see attached figure), three of which may be at risk in the short-term. These assets include a sand vehicle access to the beach for boat launching, stairs, and a northern access ramp. In the longer-term the two additional public assets that may be at risk are a power cable servicing the Denmark SLSC and the toilet block. The leasehold Denmark SLSC (lease term to end in 2031) and kiosk may be at risk in the longer-term. It is assumed the erosion hazard becomes likely if the existing retaining wall is not sufficient to tolerate erosion from storms. Recreational activities include activities related to the SLSC, surfing, swimming, sun bathing and boat launching. The SLSC, the South Coast Surfing lessons group, the Denmark Boating and Angling Club, the Denmark Sea Rescue Group, and the local Denmark community are the main non-government stakeholders likely to have an active interest in how this foreshore is managed.</p>
Extent of erosion problem and hotspot characteristics	<p>Ocean Beach Denmark from the rocky headland to 50m north of the SLSC.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Draft CHRMAP Report due Jan 18. To include community consultation for how to increase facilities at site (in accordance with hierarchy).</p> <p>Hazard Assessment: Seashore Engineering Final Report due Feb 2017</p> <p>Management & Adaptation Options: In Progress</p> <p>Additional Comments: Nil</p> <p>Reports: Nil CMPAP funded</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Possibly geotechnical and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	3 public assets susceptible to erosion hazard. Vehicle access to beach, access ramp, stairs
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>6 public assets susceptible to erosion hazard. Vehicle access to beach, access ramp, stairs, Denmark SLSC building, Denmark SLSC kiosk.</p> <p>Services: LV buried cable to Denmark SLSC.</p> <p>Leasehold: Denmark SLSC, Denmark SLSC kiosk.</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>7 public assets susceptible to erosion hazard. Vehicle access to beach, access ramp, stairs, toilet block, Denmark SLSC building, Denmark SLSC kiosk.</p> <p>Services: LV buried cable to Denmark SLSC.</p> <p>Leasehold: Denmark SLSC, Denmark SLSC kiosk.</p>

Existing management	Existing behaviour: SLSC in existing position since 1987. Avoid (N), Retreat (N), Accommodate (N), Protect (Y - timber seawall)
Management options for Imminent timeframe (0–5 years)	Current behaviour: Erosion patterns linked to behaviour of the beach following the annual breaching of the bar. Avoid (N), Retreat (N), Accommodate (N), Protect (Y - upgrade/extend walling) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Review lease agreements with SLSC to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - M Prepare Plans - 50k Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Lowering of beach due to wall being exposed to wave action. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - Progressively alter beach access (constrained), relocate infrastructure as required), Accommodate (N), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Structural threat to SLSC building / wave action on building > 1x/3 years Monitoring: Photographic monitoring / post-storm inspection Alternate option: Accommodate - flood proof building before relocation.
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y - relocate SLSC at end of building life (no major refurbishment)), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Additional buildings or fixed infrastructure immediately landward of the wall Additional investment in SLSC building

Appendix D.52. Emu Pt, Albany

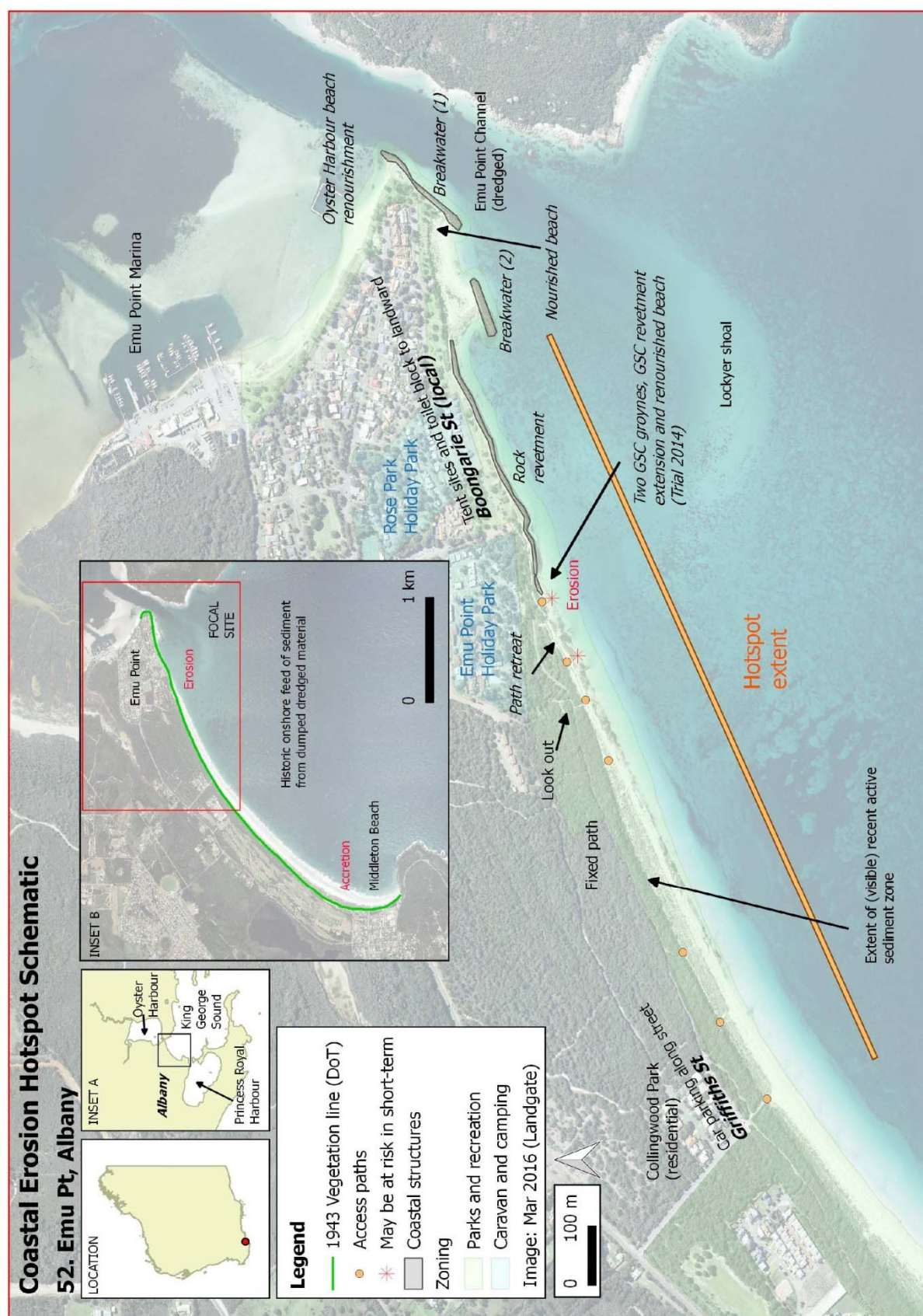


Figure D-52: Emu Pt, Albany schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-52: Emu Pt, Albany summary information

Hotspot No.	52
Hotspot Name	Emu Pt, Albany
Local Coastal Manager	City of Albany
Hotspot issue	<p>The site of erosion concern is at the northern end of a long sandy beach, which had housing development located close to the active shore. Up until the 1990s, the whole beach was stable in the centre but may have been influenced by dumping of a substantial volume of dredged sand (two million cubic yards) a century ago. Erosion concerns required the installation of a training wall at the north-east corner off Emu Point. Erosion then developed at Emu Beach, with the loss of a couple of beach shacks. Nearshore changes also occurred, with the loss of sheltering sea grass beds. A sequence of engineering works has been built, each with a local focus and acting to transfer erosion stress along the beach. Sections of beach are now defended by offshore structures, walls, trial groynes or beach renourishment; with subsequent works undertaken as erosion continued to extend to the west. Ongoing retreat is possible on the beach at the western end of the rock revetment. Monitoring has been undertaken since 2013/2014 including waves, currents, anemometers, tide gauge, fixed cameras, beach photos, structure assessments and beach profiles.</p> <p>Eight assets may be at risk of erosion damage in the area (see attached figure), with only one unprotected asset at risk of damage in the short-term which is the seaward end of two beach access paths west of the revetment. Social pressures at this beach relate to maintaining the existing recreational use as the beach continues to be lost in front of the revetment. The community was surveyed by the City of Albany in 2013 to assess beach use and values.</p>
Extent of erosion problem and hotspot characteristics	<p>Southern side of Emu Point between Boongarrie St and Griffiths St</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: In preparation by Royal Haskoning and Evocoast</p> <p>Hazard Assessment: Nil</p> <p>Management & Adaptation Options: Nil</p> <p>Additional Comments: Nil</p> <p>Reports:</p> <p>Nil</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Possibly sedimentology and possibly sandbar dynamics
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	1 public assets susceptible to erosion hazard. Toe of 2 access paths (east section of beach).
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>4 public assets susceptible to erosion hazard. *Boongarie St, fixed dual use path, 7 access paths.</p> <p>Leasehold: *Caravan Park (Rose Gardens Holiday Park)</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>7 public assets susceptible to erosion hazard. Griffiths Street , *Boongarie St, fixed dual use path, strip parking along Griffiths St, 7 access paths.</p> <p>Leasehold: *Caravan Park (Rose Gardens Holiday Park)</p>
Existing management	<p>Partial retreat of public facilities (paths) has occurred. Leasehold facilities (caravan parks) have been protected.</p> <p>Avoid N),</p> <p>Retreat (Y - paths),</p> <p>Accommodate (N),</p> <p>Protect (Y - Rock revetment, armoured headland, renourishment)</p>

Management options for Imminent timeframe (0–5 years)	Temporary protection of leasehold facilities may continue, to allow sufficient time for retreat strategy to be developed Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Minor works to improve tolerance to shoreline retreat.) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Review lease agreements with Caravan Park to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - L Prepare Plans - 50k Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Facilities adjacent to protective works threatened by acute erosion Monitoring: Buffer width Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Retreat of leasehold facilities to provide erosion buffer Avoid (N), Retreat (Y - Progressively remove facilities adjacent to existing protection works such as paths, seats and beach access locations), Accommodate (N), Protect (N) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - M Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Existing stabilisation works are ineffective for local protection Monitoring: Structural assessment (annual); Photographic monitoring Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	General retreat will limit the effectiveness of revetment structures due to flanking Avoid (N), Retreat (Y - Substantial removal of leasehold facilities and existing stabilisation works. May require land purchase depending on tenure), Accommodate (N), Protect (N)
Works to avoid to achieve long-term plans	Protective works which cause deepening in front are likely to cause additional alongshore transfer of erosion stress; No additional permanent facilities between Emu Point Beach and Middleton Beach; Sand supply to Middleton Beach is considered likely to be a response to dredge spoil disposal from Albany Harbour, as there are no fluvial sources or other apparent geomorphic features. This implies the long-term supply to Middleton Beach is expected to decline over time, although it may be extended over a number of decades. This also suggests that there may have been a period in which net sediment transport patterns were reversed, with supply to the east occurring, which has now ceased.

Appendix D.53. Bremer Bay Fishery Beach

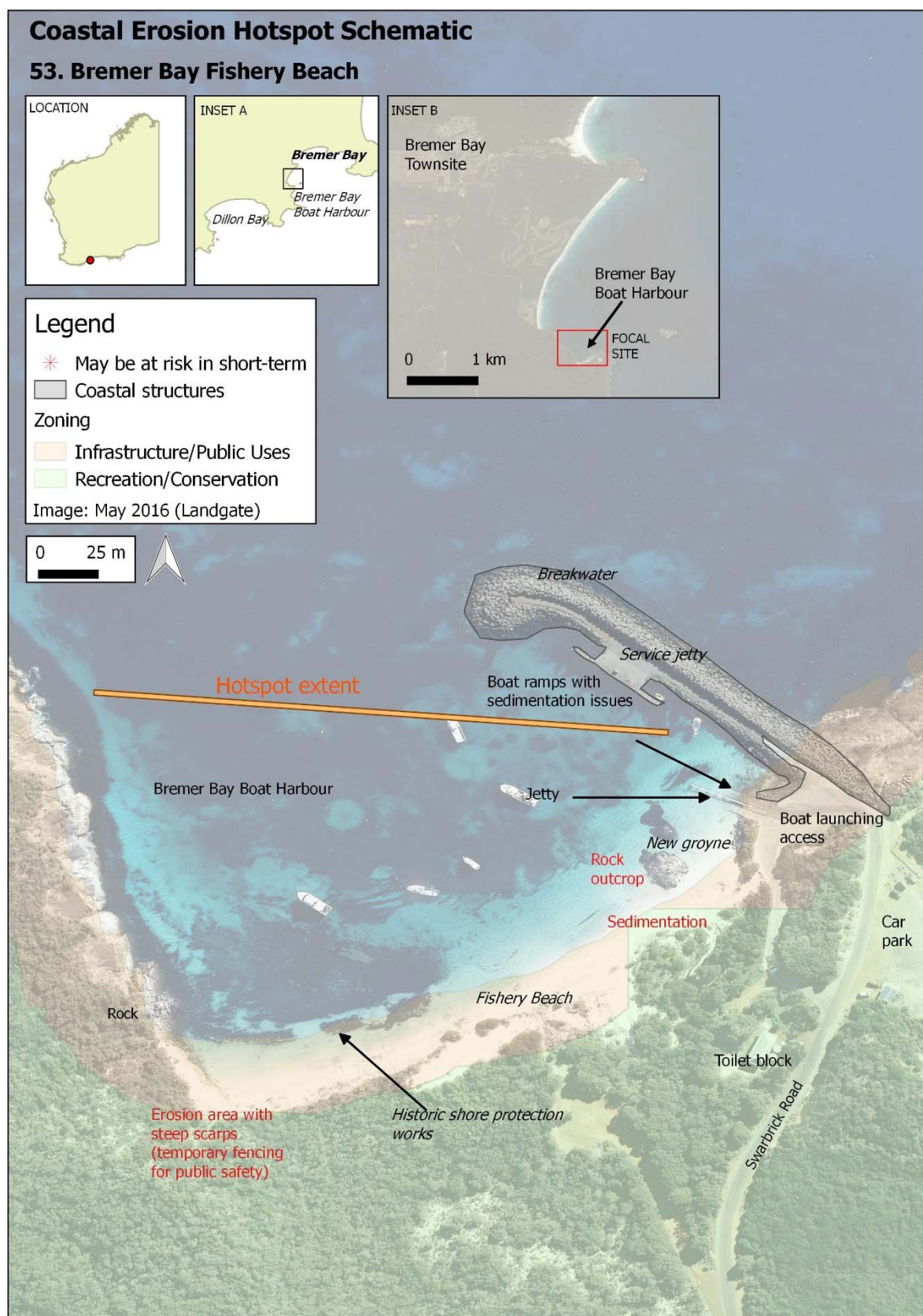


Figure D-53: Bremer Bay Fishery Beach schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-53: Bremer Bay Fishery Beach summary information

Hotspot No.	53
Hotspot Name	Bremer Bay Fishery Beach
Local Coastal Manager	Shire of Jerramungup
Hotspot issue	<p>The western extent of Fishery Beach is eroding in response to the recent Bremer Bay Boat Harbour construction. The scarp erodes under extreme storms, with the harbour limiting the capacity for recovery. Historically the beach would lose all of its sand in a big easterly storm and regain it before the end of the year, superimposed with long-term cyclic behaviour. Increased compartmentalisation by the structures have limited exchange of sediment beyond the harbour. Historic efforts have been undertaken to stabilise the western foreshore, with the present approach of temporary fencing used to keep beach users away from the steeply scarped dunes.</p> <p>There are no public assets susceptible to erosion hazard of erosion damage within the hotspot area. Sedimentation of the boat ramp is an indirect impact from the erosion, which requires management (annual dredging), and DoT plan to build another groyne in response. Erosion will restrict the capacity for recreational use of the beach, and hampers boat launching due to increased sedimentation. Local tourist operators and boat users have an active interest in this foreshore.</p>
Extent of erosion problem and hotspot characteristics	<p>Western Fisheries Beach</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Typically subject to progressive or episodic erosion (instability). • Apparently limited capacity to manage future erosion using existing coastal protection measures where extension of works is likely to exacerbate erosion transfer (transfer). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Nil</p> <p>Management & Adaptation Options: DoT have prepared design for two groyne structures and associated sand nourishment.</p> <p>Additional Comments: Nil</p> <p>Reports: Nil</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	None in this timeframe. However, sedimentation of the boat ramp is a concern.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	None in this timeframe. However, sedimentation of the boat ramp is a concern.
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	None in this timeframe. However, sedimentation of the boat ramp is a concern.
Existing management	<p>Allow foreshore to retreat, excavate sediment from boat ramp.</p> <p>Avoid (N),</p> <p>Retreat (N),</p> <p>Accommodate (Y - Excavate sediment from boat ramp as required. DoT considering a subsequent groyne. Ensure sediment excavated from boat ramp is placed at toe of eroding dune),</p> <p>Protect (N)</p>

Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Continued erosion stress on western dune/scarp face. Avoid (N), Retreat (N), Accommodate (Y - Fence area to restrict access. Partial retreat, cut back dune/cliff to anticipated alignment to address community concern of appearance/safety. Regrade, matting and revegetation.), Protect (N)
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Accommodate - L
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Subsequent intolerable damage to the dune for >3 years. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Continued erosion stress on western dune/scarp face. Avoid (N), Retreat (N), Accommodate (Y - Further retreat, cut back dune/cliff to subsequent anticipated alignment. Regrade, matting and revegetation), Protect (N)
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - L
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Subsequent intolerable damage to the dune for >5 years. Monitoring: Photographic monitoring Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: Additional response to sea level rise with further rotation. Avoid (N), Retreat (N), Accommodate (Y - Retreat of dunes across whole bay to allow for adjustment of the foreshore with projected sea level), Protect (N)
Works to avoid to achieve long-term plans	Holding the line and not allowing for response to the breakwater. Increased investment in fixed infrastructure in areas of projected retreat.

Appendix D.54. Hopetoun Foreshore

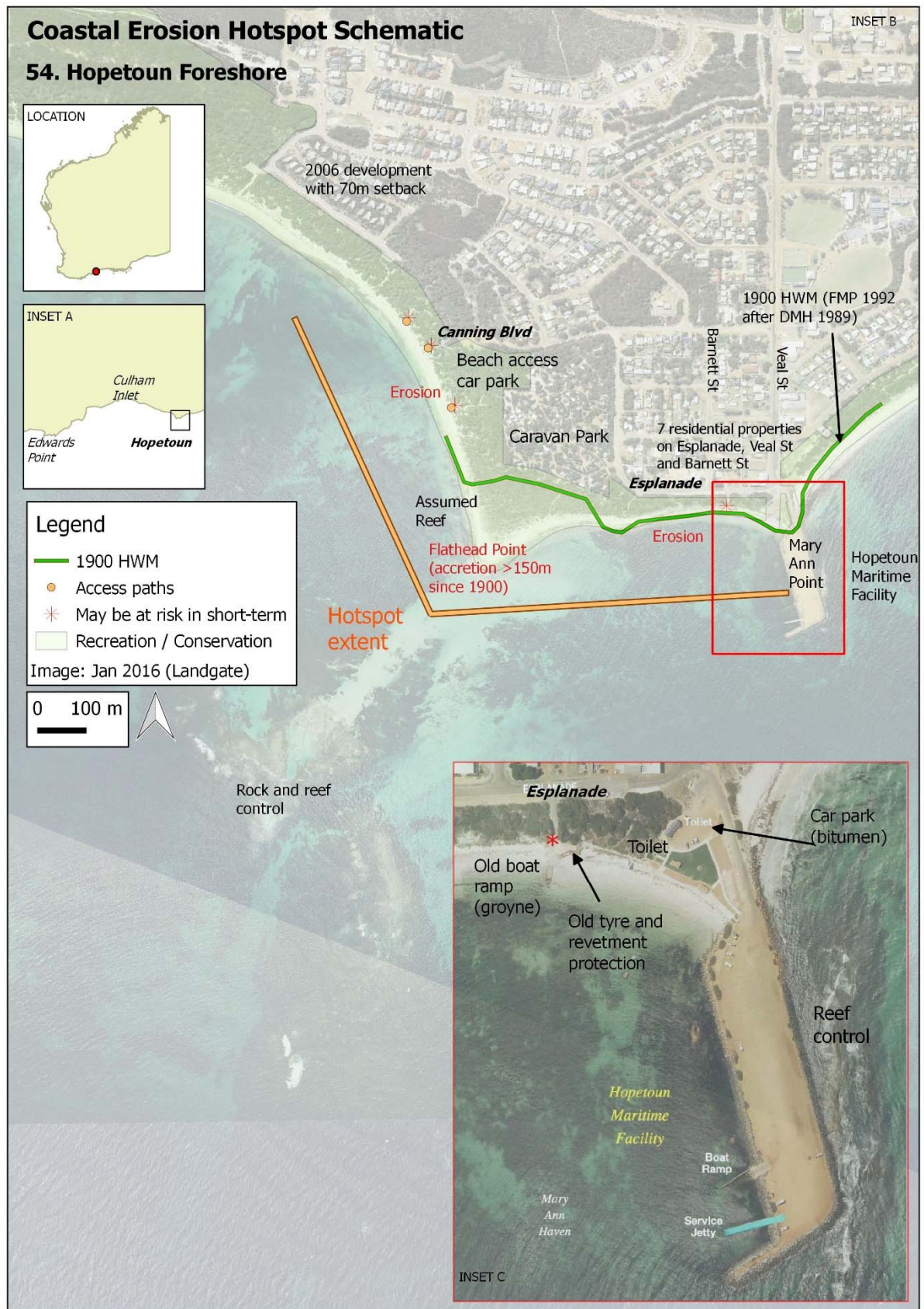


Figure D-54: Hopetoun Foreshore schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-54: Hopetoun Foreshore summary information

Hotspot No.	54
Hotspot Name	Hopetoun Foreshore
Local Coastal Manager	Shire of Ravensthorpe
Hotspot issue	<p>The Hopetoun foreshore has changed noticeably since European settlement, with most change being natural. The site is a complex cusped foreland with a small salient between two larger ones. Flathead point is located between the two eroding beaches of concern, which has accreted more than 150m since 1900; possibly due to a pulse of sand from the Culham Inlet bar break around 1900. The accretion appears to be continuing, with some sediment sourced from the two adjacent eroding beaches. Erosion is episodic and linked to phases of storminess and direction of the prevailing waves. Erosion has occurred at the boat ramp site on the foreshore, near the previous abutment of a majority jetty removed in 1980, with an ad-hoc groyne constructed to minimise sedimentation causing local downdrift erosion. The potential future retreat at the site may be limited by reef control based on a consideration of the 1900 High Water Mark map. The Hopetoun Maritime Facility to the east of the hotspot is constructed on a natural rock bar, influencing waves at the shore, but not significantly interrupting sand supply.</p> <p>Eleven publicly owned assets may be at risk of erosion damage in the area (see attached figure), with four assets at risk of damage in the short-term, including staircase from Esplanade, three access points from the caravan park, consolidated access from Canning Boulevard car park area, and the old boat ramp (still used in certain conditions). In the longer term, the Esplanade, associated services (critical water pipeline, phone cables, and power) and street lights, part of the leasehold caravan park and seven private properties are high-value assets that may be at risk. Seven private properties are considered at risk in the long term from projected mean sea level rise, and if there is a loss of reef control. Recreation activities are walking, swimming, boat launching and snorkelling.</p>
Extent of erosion problem and hotspot characteristics	<p>The S facing and W facing shores either side of Flathead Point. This is unit 1 and unit 2 of the FMP. West facing shore is known as West Beach</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Sites typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Not Scheduled</p> <p>Hazard Assessment: Nil</p> <p>Management & Adaptation Options: Nil</p> <p>Additional Comments: Nil</p> <p>Reports: Nil</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Possibly geotechnical and ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	4 public assets susceptible to erosion hazard. Old boat ramp (still used in certain conditions), stairs access (Esplanade), fixed access (Canning Blvd), and three access paths.
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>7 public assets susceptible to erosion hazard. Old boat ramp (still used in certain conditions), stairs access (Esplanade), fixed access (Canning Blvd), access road to old boat ramp, and three access paths.</p> <p>Services: Street lights.</p>
Assets susceptible to erosion hazard in Projected timeframe (25+ years)	<p>12 public assets susceptible to erosion hazard. The Esplanade, old boat ramp (still used in certain conditions), stairs access (Esplanade), fixed access (Canning Blvd), access road to old boat ramp, car park (Canning Blvd), car park (Esplanade), toilet block (Canning Blvd), and three access paths.</p> <p>Services: Street lights, water, telecommunications, power.</p> <p>Private property: 7 (25+ only if rock control not present). 1 on Veal St, 5 on the Esplanade, 1 on Barnett St.</p> <p>Leasehold: Caravan Park</p>

Existing management	Avoid (Y - Buffer of foreshore reserve), Retreat (N), Accommodate (N), Protect (N)
Management options for Imminent timeframe (0–5 years)	Anticipated behaviour: Continued retreat. Avoid (Y - Buffer of foreshore reserve), Retreat (N), Accommodate (N), Protect (N)
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Avoid - None
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Short-term and small scale erosion of buffer (dune can be reconstructed) Monitoring: Buffer width, along the coast Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Anticipated behaviour: Continued progressive loss of buffer. Avoid (N), Retreat (N), Accommodate (Y - Remove or relocate old boat ramp (relocate if main facility not upgraded to be all access)), Protect (Y - Repeated local renourishment along Esplanade following episodic event, sediment sourced from Flathead Point)
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Accommodate - M Protect – M
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Third dune reconstruction Monitoring: Photographic monitoring and tracking renourishment rates Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Anticipated behaviour: General coastal retreat, potentially reaching a tipping point of retreat at Flathead point Avoid (N), Retreat (N), Accommodate (N), Protect (Y -Construction of marine quality seawall along the Esplanade. This will act to transfer downdrift erosion pressure further along the coast and enhance the risk to the caravan park access. Local renourishment along Esplanade following episodic event, sediment sourced from Flathead Point until revetment constructed)
Works to avoid to achieve long-term plans	High value facilities south of the Esplanade. Stabilisation works that interrupt the alongshore transport. Do not freehold the caravan park.

Appendix D.55. Esperance Town Beach

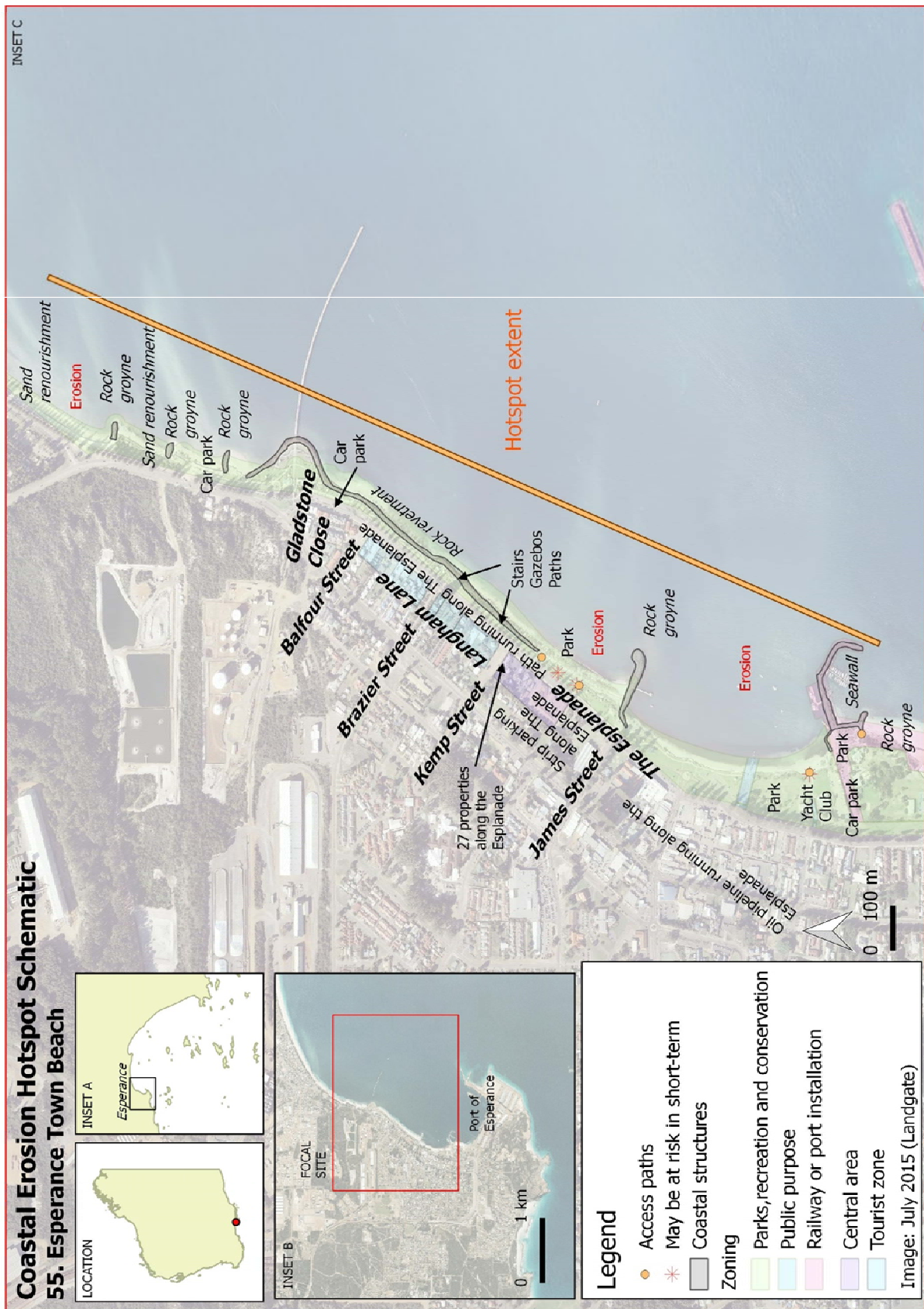


Figure D-55: Esperance Town Beach schematic

This hotspot profile must be read in conjunction with the Disclaimer on p.78 on the cover of Appendix D.

Table D-55: Esperance Town Beach summary information

Hotspot No.	55
Hotspot Name	Esperance Town Beach
Local Coastal Manager	Shire of Esperance & Southern Ports Authority
Hotspot issue	<p>The Esperance Town Beach is a reclaimed foreshore (widened >50m), with sand disposed to the foreshore from the original port dredging campaign. Development was undertaken on this reclaimed foreshore, with the subsequent erosion resulting in armouring of the majority of the foreshore, including a 1.1km seawall and headland around the Tanker Jetty area in 2013. The Newtown Beach has been annually renourished, following the total trapping of the littoral sand volume by the port breakwater. This action was found to be the most cost-effective defence process, though the sand used has been sourced on an opportunistic basis, and has normally had a poor renourishment factor resulting in rapid loss of the sand. Downdrift erosion is occurring at a broader scale by the extension of the port and locally occurring adjacent to the new groynes, revetments and headlands.</p> <p>Nineteen publicly owned assets may be at risk of erosion damage in the area (see attached figure), with three assets at risk of damage in the short-term, including James Street park (not behind rock revetment), beach access (2) and a staircase access. In the longer term, The Esplanade, services, Langham Lane, Kemp Street, Brazier Street, Balfour Street, Gladstone Close, the leasehold Esperance Bay Yacht Club, and up to 27 private properties along the Esplanade are high-value assets at risk.</p>
Extent of erosion problem and hotspot characteristics	<p>Grey Settlement for 250m north of the rocky headland.</p> <p>Hotspot characteristics:</p> <ul style="list-style-type: none"> • Infrastructure close to the existing shore, or landward of progressively and rapidly eroding coast (proximity). • Sites typically subject to progressive or episodic erosion (instability). • Very highly valued by the community, as nominated by local government (community).
CHRMAP status and findings	<p>CHRMAP Status: Complete</p> <p>Hazard Assessment: BMT JFA (2014) - Area north of Norsman Rd identified as immediate medium risk of erosion, remaining area as immediate low risk.</p> <p>Management & Adaptation Options: BMT JFA (2016) - Study area Dempster Head to Bandy Creek Boat Harbour (BCBH). Recommendations: west of Norsman Road immediately and ongoing maintenance of existing coastal protection structures. East from Norsman Road (eastern groyne) adaptation options:</p> <p>2010 - Accommodate with reduction in foreshore buffer or Protect (1st km) 2060 - Accommodate with reduction in foreshore buffer or Protect (2 km's) 2110 - Managed retreat or Protect (all the way to BCBH)</p> <p>Additional Comments: Large portions of the site are protected by existing seawalls and/or groynes, with periodic sand nourishment undertaken by the Shire.</p> <p>Reports: BMT JFA (2016) Esperance Coastal Hazard Adaptation Strategy. Prepared for the Shire of Esperance. Report 224.10-01, Rev. 0, Jul-2016. BMT JFA (2014) Esperance Coastal Hazard and Vulnerability Assessment. Prepared for the Shire of Esperance. Report 224.01-01, Rev. 0, Nov-2014.</p>
Coastal dynamics studies for a level 3 assessment. Further detail in Table 4-2.	Ongoing coastal movement data collection
Assets susceptible to erosion hazard in Imminent timeframe (0–5 years)	3 public assets susceptible to erosion hazard. stairs access, park (James St (not behind rock revetment)), access paths (2)
Assets susceptible to erosion hazard in Expected timeframe (5–25 years)	<p>6 public assets susceptible to erosion hazard. Stairs access, 3 parks (2 at Yacht Club, James Street (not behind rock revetment)), and access paths (2).</p> <p>Services: *Oil pipeline.</p> <p>Leasehold: Esperance Bay Yacht Club</p>

Assets susceptible to erosion hazard in Projected timeframe (25+ years)	20 public assets susceptible to erosion hazard. Esplanade, Langham Lane, Kemp Street, Brazier Street, Balfour Street, Gladstone Close, *path, stairs access, *car park (Gladstone Close), *strip parking, car park (James street), 4 parks (2 at Yacht Club, James Street (not behind rock revetment)*town beach), *gazebos, 2 non-rigid access. Services: Oil pipeline, power, water, gas, telecommunications. Leasehold: Esperance Bay Yacht Club building Private property: 27 along the Esplanade
Existing management	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Rock groynes, with coastal revetment. Ongoing sand renourishment)
Management options for Imminent timeframe (0–5 years)	Avoid (N), Retreat (N), Accommodate (N), Protect (Y - Maintain existing structures for seawall at southern beaches and tanker jetty headland. Ongoing sand renourishment with beach grade sand N of tanker jetty) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms. Review lease agreements with Yacht Club to clarify responsibilities for coastal erosion mitigation
Approximation of cost for Imminent timeframe (0–5 years) options (L/M/H)	Protect - M Prepare plans - 50k Review Lease Agreement - 50k
Trigger for next level management, monitoring and alternate management option (Imminent timeframe 0–5 years)	Trigger for next level management: Goldfields Rd subject to erosion or sand drift; Limited beach amenity Monitoring: Buffer width; Photographic monitoring Alternate option: N/A
Management and adaptation options for Expected timeframe (5–25 years)	Avoid (N), Retreat (Y - Relocate caravan park and YHA entrances), Accommodate (N), Protect (Y -Extension of selected groynes to provide beach amenity; Upgrade of sections. Ongoing sand renourishment) Preparation of planning frameworks for retreat in next level of management and identify funding mechanisms.
Approximation of cost for Expected timeframe (5–25 years) options (L/M/H)	Retreat - L Protect - H Prepare plans - 50k
Trigger for next level management, monitoring and alternate management option (Expected timeframe 5–25 years)	Trigger for next level management: Goldfields Rd facilities threatened by acute erosion; Revetment damage >10%; Monitoring: Buffer width; structural assessment (annual) Alternate option: N/A
Management and adaptation options for Projected timeframe (25+ years).	Avoid (N), Retreat (Y -Removal of carparks and relocation of caravan park along Goldfields Road. Truncate Goldfields Rd, with coastal access via Phyllis St. Removal of the oil pipeline may support increased use of retreat), Accommodate (N), Protect (Y - Revetment likely to require replacement. Ongoing sand renourishment for selected areas)
Works to avoid to achieve long-term plans	Permanent or high value infrastructure placed along Goldfields Rd.