



Attachment A Coastal Hazard Mapping

Legend

Peaceful Bay



- 10 Year Allowance for Coastal Processes
- 50 Year Allowance for Coastal Processes
- 100 Year Allowance for Coastal Processes

- Public Parking Facilities
- Public Toilets

BEACH ACCESS

- PEDESTRIAN BEACH ACCESS
- VEHICULAR BEACH ACCESS



						NOTES: 1. AERIAL IMAGE JANUARY 2016 2. CONTOURS FROM LANDSCAPE 3. COASTAL EROSION ALLOWANCES HAVE BEEN DETERMINED USING METHODS OUTLINED IN SCHEDULE 1 OF BPFC 4. ALLOWANCES ARE BASED ON AVAILABLE DATA AT THE TIME OF STUDY 5. ALLOWANCES ARE NOT A PREDICTION OF THE SHORELINE POSITION AT THE END OF THE RESPECTIVE PLANNING PERIODS 6. THESE PLANS DO NOT HAVE THE PRECISION REQUIRED TO DEFINE THE EROSION RISK TO INDIVIDUAL PROPERTIES 7. ALLOWANCES FOR COASTAL PROCESSES HAVE BEEN ROUNDED TO THE NEAREST 5 METERS AND HAVE BEEN OFFSET FROM THE HORIZONTAL SETBACK DATUM (HSD) 8. THE HSD IS DEFINED AS THE 1.5m AHD CONTOUR, WHICH IS NOMINALLY THE VEGETATION LINE 9. COASTAL HAZARDS IN THE VICINITY OF LIMESTONE CLIFFS REQUIRE FURTHER ASSESSMENT BY A GEOTECHNICAL ENGINEER. UNDERLYING ROCK HAS THE POTENTIAL TO SIGNIFICANTLY AFFECT THE EXTENT OF COASTAL HAZARD												SHIRE OF DENMARK COASTAL HAZARD RISK MANAGEMENT AND ADAPTATION PLAN PEACEFUL BAY ALLOWANCE FOR COASTAL PROCESSES			
C		31/05/16	FINAL	OS	SB	SCALE 1:5,000 50 0 50 100 150 200 DATUM				ACTION NAME SIGNATURE DATE ENGINEER SB 22/12/16 DRAWN OS 22/12/16 ENGINEERING CHECK DRAFTING CHECK											
B		06/02/17	REVISED FOLLOWING CLIENT REVIEW	OS	SB	VERTICAL AUSTRALIAN HEIGHT DATUM (AHD)				Seashore Engineering											
A		22/12/16	PRELIMINARY	OS	SB	HORIZONTAL MAP GRID OF AUSTRALIA, BASED ON GDA94				APPROVED PROJECT MANAGER											
REV		DATE	AMENDMENT		DRN	DESIGN APPROVAL															
A3		22/12/16	Seashore Projects/SE050 Denmark CHRM/03 CHRM/03 Hazard Assessment		SE050																
														DRAWING NUMBER SE050-01-01							

Legend

Ocean Beach




- 10 Year Allowance for Coastal Processes
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				NOTES:		SCALE 1:5,000			ACTION		SIGNATURE		DATE			SHIRE OF DENMARK COASTAL HAZARD RISK MANAGEMENT AND ADAPTATION PLAN OCEAN BEACH ALLOWANCE FOR COASTAL PROCESSES	
C	31/05/18	FINAL	OS	SB	1. AERIAL IMAGE JANUARY 2018 2. CONTOURS FROM LANDSAT 3. COASTAL EROSION ALLOWANCES HAVE BEEN DETERMINED USING METHODS OUTLINED IN SCHEDULE 1 OF SP/CA 4. ALLOWANCES ARE BASED ON AVAILABLE DATA AT THE TIME OF STUDY 5. ALLOWANCES ARE NOT A PREDICTION OF THE SHORELINE POSITION AT THE END OF THE RESPECTIVE PLANNING PERIODS 6. THESE PLANS DO NOT HAVE THE PRECISION REQUIRED TO DEFINE THE EROSION RISK TO INDIVIDUAL PROPERTIES 7. ALLOWANCES FOR COASTAL PROCESSES HAVE BEEN ROUNDED TO THE NEAREST 5 METERS AND HAVE BEEN OFFSET FROM THE HORIZONTAL SETBACK DATUM (HSD) 8. THE HSD IS DEFINED AS THE 15m AND 50m CONTOUR, WHICH IS NORMALLY THE VEGETATION LINE 9. COASTAL HAZARDS IN THE VICINITY OF LIMESTONE CLIFFS REQUIRE FURTHER ASSESSMENT BY A GEOTECHNICAL ENGINEER. UNDERLYING ROCK HAS THE POTENTIAL TO SIGNIFICANTLY AFFECT THE EXTENT OF COASTAL HAZARD.	50	0		50	100	150	200	ENGINEER	SB			22/12/16
B	06/02/17	REVISED FOLLOWING CLIENT REVIEW	OS	SB	DATUM	VERTICAL AUSTRALIAN HEIGHT DATUM (AHD)			DRAWN	OS	22/12/16						
A	22/12/16	PRELIMINARY	OS	SB	HORIZONTAL	MAP GRID OF AUSTRALIA, BASED ON GDA94			ENGINEERING CHECK								
REV	DATE	AMENDMENT	DRN	DESIGN APPROVAL					DRAFTING CHECK			Seashore Engineering					
A3		PROJECT: <u>Seashore Projects\SE050 - Denmark CRRM\A3 - CRRM\A1 Hazard</u>	SE050							APPROVED PROJECT MANAGER				DRAWING NUMBER SE050-01-02		REV C	

10yr	Coastal node	Peaceful Bay (Boat Launching Beach)	Foul Bay (In front of Memorial and Fishermans Lease)	Ocean Beach (In front of Surf Club)
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	24	18	8
Long-term Trend	S2	0	14	5
Erosion due to SLR	S3	4	4	4
Factor of Safety	FoS	2	2	2
Inundation	S4	5m AHD contour		
	Subtotal (m)	30	38	19
	10yr Coastal Processes Allowance Including Rounding (m)	30	40	20

50yr	Coastal node	Peaceful Bay	Foul Bay	Ocean Beach
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	46	24	16
Long-term Trend	S2	0	70	25
Erosion due to SLR	S3	35	35	35
Factor of Safety	FoS	10	10	10
Inundation	S4	5m AHD contour		
	Subtotal (m)	91	139	86
	20yr Coastal Processes Allowance Including Rounding (m)	90	140	85

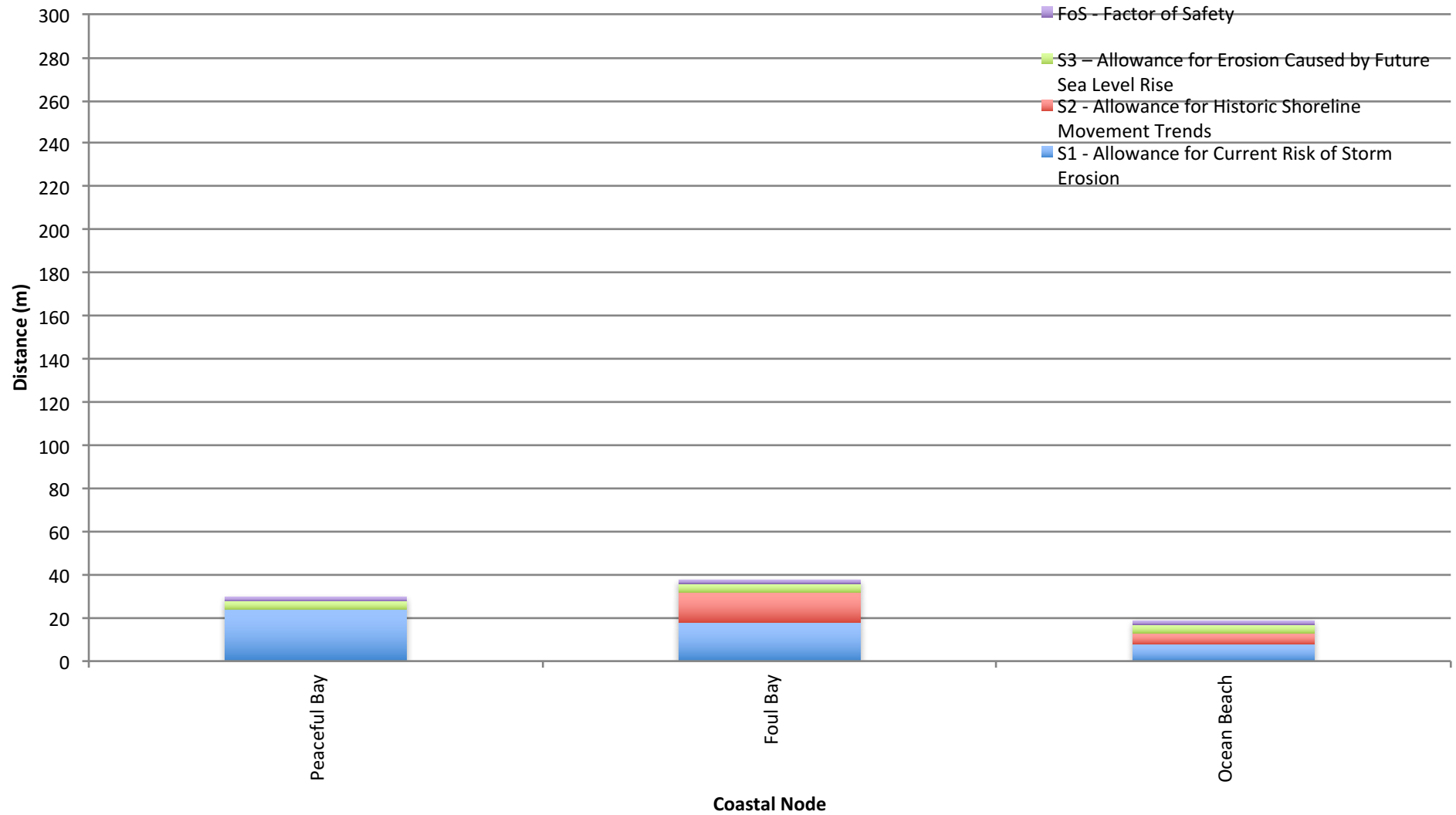
100yr	Coastal node	Peaceful Bay	Foul Bay	Ocean Beach
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	46	24	16
Long-term Trend	S2	0	140	50
Erosion due to SLR	S3	90	90	90
Factor of Safety	FoS	20	20	20
Inundation	S4	5m AHD contour		
	Subtotal (m)	156	274	176
	100yr Coastal Processes Allowance Including Rounding (m)	155	275	175

Notes	Coastal node	Peaceful Bay (Boat Launching Beach)	Foul Bay (In front of Memorial and Fishermans Lease)	Ocean Beach (In front of Surf Club)
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	Sand coast erosion based on recession of 1.5m AHD contour during a single run of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during a single run of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during a single run of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore
Long-term Trend	S2	2002 to 2016 aerial imagery shows accretion of 0.4m/year, so trend assumed to be 0m/year	2002 to 2016 aerial imagery shows erosion of 1.4m/year	2002 to 2016 aerial imagery shows erosion of 0.5m/year
Erosion due to SLR	S3	Assumed default value as per SPP2.6 (100 x SLR (0.04))	Assumed default value as per SPP2.6 (100 x SLR (0.04))	Assumed default value as per SPP2.6 (100 x SLR (0.04))
Factor of Safety	FoS	0.2m/year	0.2m/year	0.2m/year
Inundation	S4	5m AHD contour		

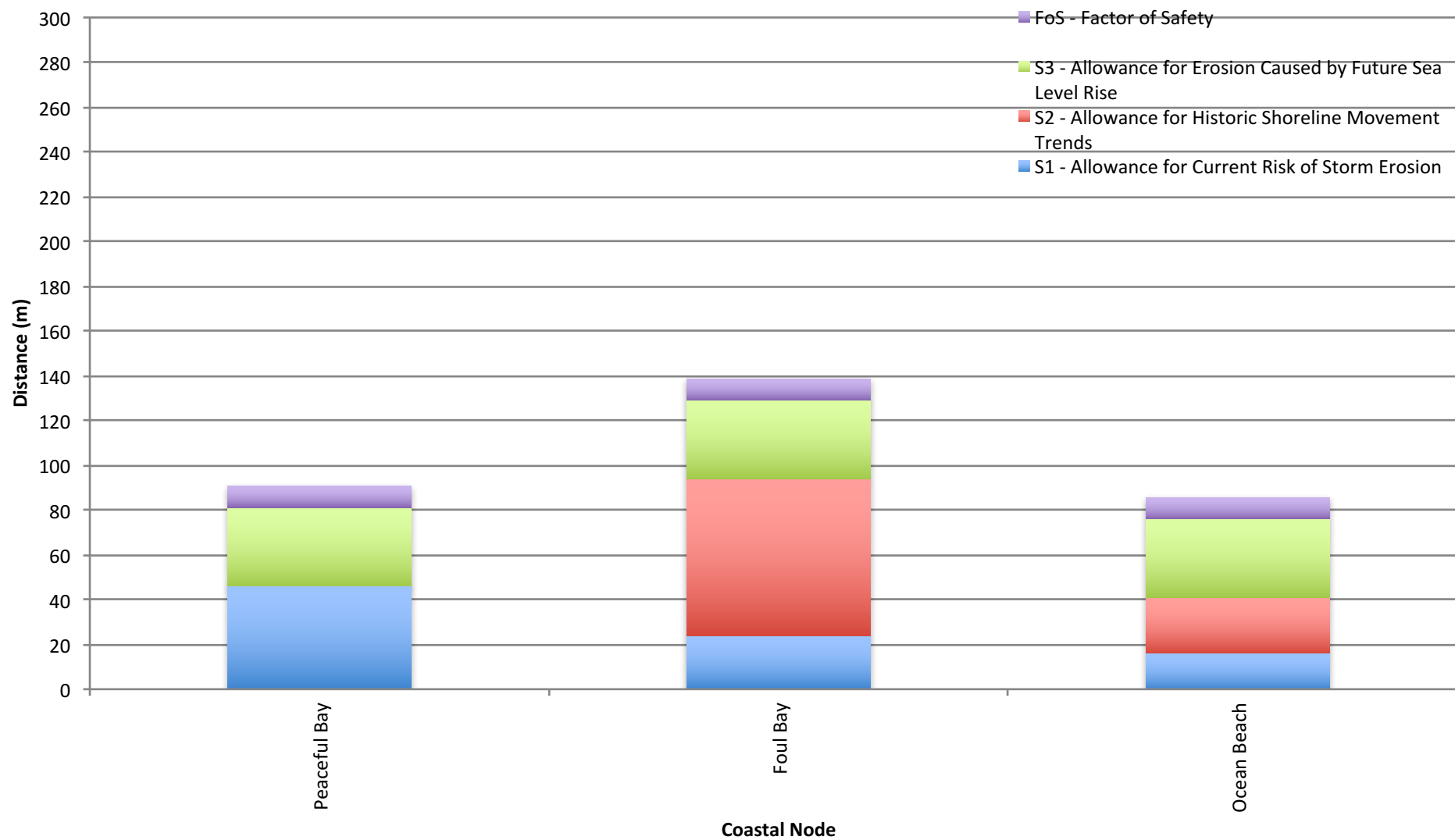
Notes	Coastal node	Peaceful Bay (Boat Launching Beach)	Foul Bay (In front of Memorial and Fishermans Lease)	Ocean Beach (In front of Surf Club)
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore
Long-term Trend	S2	2002 to 2016 aerial imagery shows accretion of 0.4m/year, so trend assumed to be 0m/year	2002 to 2016 aerial imagery shows erosion of 1.4m/year	2002 to 2016 aerial imagery shows erosion of 0.5m/year
Erosion due to SLR	S3	Assumed default value as per SPP2.6 (100 x SLR (0.35))	Assumed default value as per SPP2.6 (100 x SLR (0.35))	Assumed default value as per SPP2.6 (100 x SLR (0.35))
Factor of Safety	FoS	0.2m/year	0.2m/year	0.2m/year
Inundation	S4	5m AHD contour		

Notes	Coastal node	Peaceful Bay (Boat Launching Beach)	Foul Bay (In front of Memorial and Fishermans Lease)	Ocean Beach (In front of Surf Club)
	Coastal Type	Sandy Coast	Sandy Coast	Sandy Coast
Storm erosion	S1	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore	Sand coast erosion based on recession of 1.5m AHD contour during 3 successive runs of the July 2007 storm with water levels modified to account for wave attenuation in the nearshore
Long-term Trend	S2	2002 to 2016 aerial imagery shows accretion of 0.4m/year, so trend assumed to be 0m/year	2002 to 2016 aerial imagery shows erosion of 1.4m/year	2002 to 2016 aerial imagery shows erosion of 0.5m/year
Erosion due to SLR	S3	Assumed default value as per SPP2.6 (100 x SLR (0.9))	Assumed default value as per SPP2.6 (100 x SLR (0.9))	Assumed default value as per SPP2.6 (100 x SLR (0.9))
Factor of Safety	FoS	0.2m/year	0.2m/year	0.2m/year
Inundation	S4	5m AHD contour		

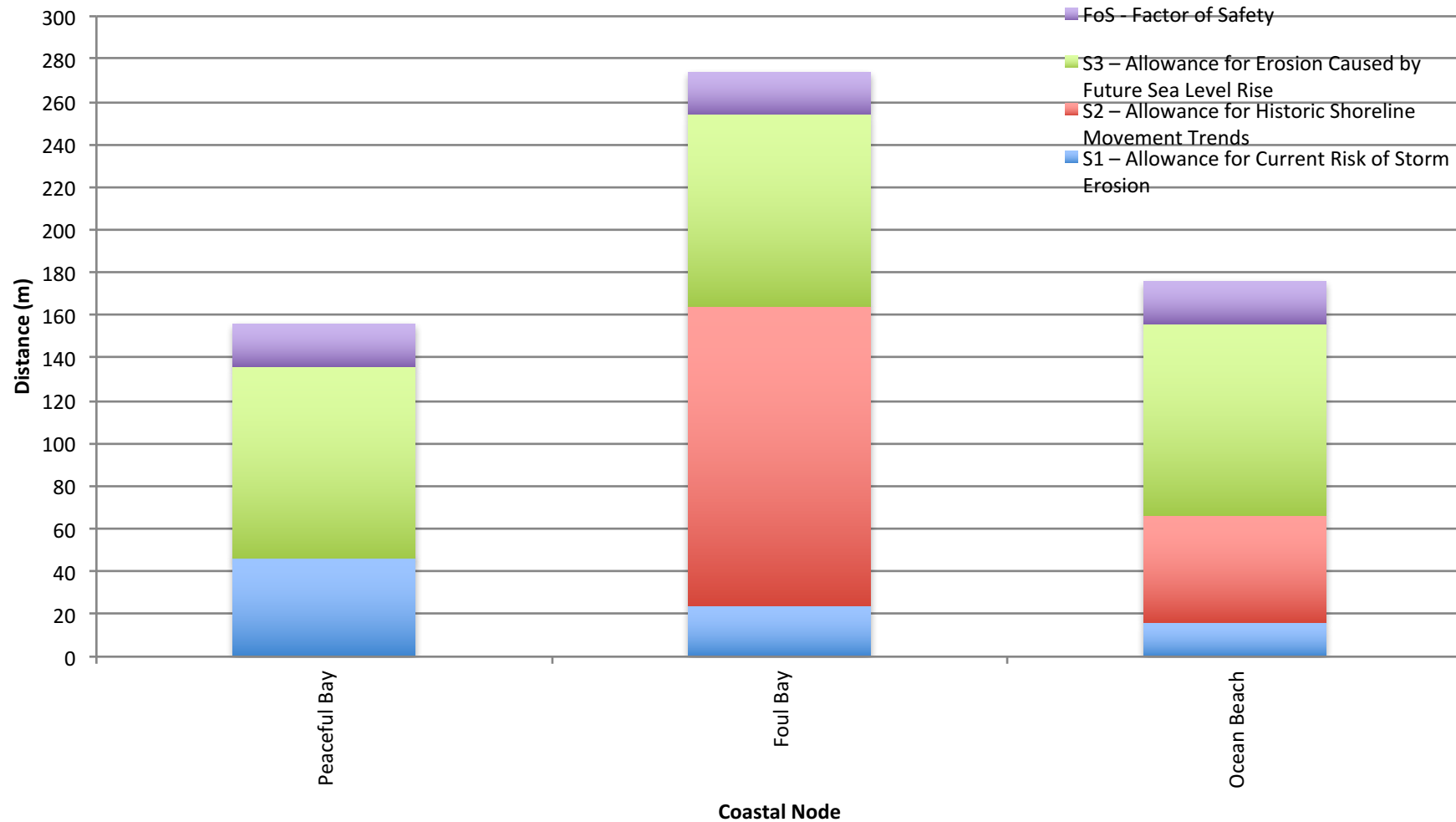
10 Year Coastal Processes Allowance from HSD



50 Year Coastal Processes Allowance from HSD



100 Year Coastal Processes Allowance from HSD





Attachment B Risk Analysis Table

OCEAN BEACH RISK ASSESSMENT - EXISTING ASSETS

Ocean Beach - Asset Cost

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Shelters	Subtotal
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	\$ 80,000	\$ 28,000		\$ 292,300					\$ 10,000	\$ 410,300
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	\$ 27,000	\$ 66,500		\$ 216,200		\$ 2,250				\$ 311,950
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC and Boat Shed, toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	\$ 63,100	\$ 172,324	\$ 1,474,691	\$ 140,300		\$ 65,000			\$ 19,000	\$ 1,935,215
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	\$ 81,000	\$ 38,000		\$ 211,000						\$ 330,000
														\$ 2,987,465

High Asset Cost (>\$500,000)
Moderate Asset Cost
Low Asset Cost (<\$100,000)

Ocean Beach - Asset Exposure to Coastal Processes

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Shelters
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	H	H		H					H
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	H	H		M		H			
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC and Boat Shed, toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	H	M	M	L		H			H
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	L	L		L					

High Coastal Exposure (within 10 year area)
Moderate Coastal Exposure (10-50 year area)
Low Coastal Exposure (50-100 year area)

Ocean Beach - Asset Risk

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Shelters
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	M	M		H					M
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	M	M		M		M			
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC and Boat Shed, toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	M	M	H	L		M			M
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	L	L		L					

High Asset Risk
Moderate Asset Risk
Low Asset Risk

Coastal Risk Evaluation Matrix

Notes:

1. Asset costs are based on values provided by the Shire and/or based on assume rates and quantities for typical assets.
2. Asset cost represents present day replacement costs with no allowance for depreciation or maintenance.
3. Asset exposure to coastal processes has been assesed based on Hazard assessment maps.
4. Valuation have been undertaken for coastal planning purposes. They may not be sufficient for other purposes.

		Exposure to Coastal Processes (Likelihood)		
		High (within 10yr area)	Moderate (10-20 year area)	Low (20-100yr area)
Asset Cost (Consequence)	High	Very High	High	Mod
	Moderate	High	Mod	Low
	Low	Mod	Low	Low

OCEAN BEACH RISK ASSESSMENT - 10yr CONCEPT DESIGNS

Ocean Beach - Asset Cost

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters	Subtotal
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	\$ 88,000	\$ 28,000		\$ 292,300					\$ 10,000	\$ 410,300
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	\$ 427,000	\$ 66,500		\$ 216,200		\$ 2,250				\$ 711,950
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC (top and lower), toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), universal access to SLSC building, stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	\$ 62,600	\$ 172,324	\$ 4,726,891	\$ 140,300		\$ 47,500			\$ 19,000	\$ 5,168,615
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	\$ 81,000	\$ 38,000		\$ 211,000						\$ 330,000
			1050											\$ 6,620,865

	High Asset Cost (>\$500,000)
	Moderate Asset Cost
	Low Asset Cost (<\$100,000)

Ocean Beach - Asset Exposure to Coastal Processes

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Shelters
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	H	H		H					H
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	H	H		M		H			
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC (top and lower), toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), universal access to SLSC building, stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	H	M	M	L		H			H
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	L	L		L					

	High Coastal Exposure (within 10 year area)
	Moderate Coastal Exposure (10-50 year area)
	Low Coastal Exposure (50-100 year area)

Ocean Beach - Asset Risk

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Shelters
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	300	Seaward end of Prawn Rock Channel, including Prawn Rock Channel footbridge, gravel car park, 300m section of Ocean Beach Road and Prawn Rock Channel gazebo and seats.	M	M		H					M
OB_2	Weakly lithified sedimentary rock coast	Ocean Beach Lookout	350	Bitumen car park with access road, path leading to Ocean Beach Lookout, Ocean Beach lookout platform and 320m section of Ocean Beach Road.	H	M		M		M			
OB_3	Sandy coast	Ocean Beach	300	Ocean Beach SLSC (top and lower), toilet block, Denmark Boating and Angling Club and sealed car park, bitumen car park (SLSC), universal access to SLSC building, stairs to beach (rail and no rail), ramp to beach (pedestrian), viewing platform fronting lower SLSC, viewing platform at railed stairs, Ocean Beach Road, vehicle access to beach, path to railed stairs, surf club shower and grassed area, and Denmark Boating and Angling Club grassed area and gazebo.	M	M	H	L		M			M
OB_4	Discontinuous rocky shoreline	Lion's Lookout	100	Lion's lookout with gravel car park and Ocean Beach Road.	L	L		L					

	High Asset Risk
	Moderate Asset Risk
	Low Asset Risk

Coastal Risk Evaluation Matrix

Notes:

1. Asset costs are based on values provided by the Shire and/or based on assume rates and quantities for typical assets.
2. Asset cost represents present day replacement costs with no allowance for depreciation or maintenance.
3. Asset exposure to coastal processes has been assesed based on Hazard assessment maps.
4. Valuation have been undertaken for coastal planning purposes. They may not be sufficient for other purposes.

		Exposure to Coastal Processes (Likelihood)		
		High (within 10yr area)	Moderate (10-20 year area)	Low (20-100yr area)
Asset Cost (Consequence)	High	Very High	High	Mod
	Moderate	High	Mod	Low
	Low	Mod	Low	Low

PEACEFUL BAY RISK ASSESSMENT - EXISTING ASSETS

Peaceful Bay - Asset Cost																
ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters	Subtotal
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	\$ 97,620	\$ 189,701	\$ 289,854	\$ 306,350		\$ 19,250	\$ 438,862	\$ 1,185,188	\$ 12,600	\$ 2,539,425
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	\$ 27,000	\$ 7,600		\$ 724,100	\$ 10,000	\$ 5,000		\$ 12,000	\$ 30,000	\$ 815,700
			2050		56000											\$ 3,355,125

High Asset Cost (>\$500,000)

Moderate Asset Cost

Low Asset Cost (<\$100,000)

Peaceful Bay - Asset Exposure to Coastal Processes

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Car parks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	H	M	M	M		H	H	L	L
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	M	M		M	L	H		H	H

High Coastal Exposure (within 10 year area)

Moderate Coastal Exposure (10-50 year area)

Low Coastal Exposure (50-100 year area)

Peaceful Bay - Asset Risk															
ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	M	M	M	M		M	H	M	L
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	L	L		H	L	M		M	M

High Asset Risk

Moderate Asset Risk

Low Asset Risk

Notes:

1. Asset costs are based on values provided by the Shire and/or based on assume rates and quantities for typical assets.
2. Asset cost represents present day replacement costs with no allowance for depreciation or maintenance.
3. Asset exposure to coastal processes has been assessed based on Hazard assessment maps.
4. Valuation have been undertaken for coastal planning purposes. They may not be sufficient for other purposes.

Coastal Risk Evaluation Matrix				
		Exposure to Coastal Processes (Likelihood)		
		High (within 10yr area)	Moderate (10-20 year area)	Low (20-100yr area)
Asset Cost (Consequence)	High	Very High	High	Mod
	Moderate	High	Mod	Low
	Low	Mod	Low	Low

PEACEFUL BAY RISK ASSESSMENT - 10yr CONCEPT

Peaceful Bay - Asset Cost

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters	Subtotal
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	\$ 166,440	\$ 189,701	\$ 289,854	\$ 306,350		\$ 28,500	\$ 438,862	\$ 1,185,188	\$ 12,600	\$ 2,617,495
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	\$ 27,000	\$ 7,600		\$ 724,100	\$ 10,000	\$ 5,000		\$ 12,000	\$ -	\$ 785,700
			2050		56000											\$ 3,403,195

	High Asset Cost (>\$500,000)
	Moderate Asset Cost
	Low Asset Cost (<\$100,000)

Peaceful Bay - Asset Exposure to Coastal Processes

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	H	M	M	M		H	H	L	L
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	M	M		M	L	H		H	H

	High Coastal Exposure (within 10 year area)
	Moderate Coastal Exposure (10-50 year area)
	Low Coastal Exposure (50-100 year area)

Peaceful Bay - Asset Risk

ID	Coastal Type	Coastal Node	Length of Coastal Node (m)	Average Sandy Beach Width (m)	Nominal Sandy Beach Area (m ²)	Description	1. Coastal Stairs and Platforms	2. Carparks	3. Buildings (large structures, toilets, changerooms etc)	4. Roads & Adjacent Paths	5. Coastal Walkways	6. Coastal Access Paths	7. Public Marine Structures (Boat Ramps / Jetties)	8. Leasehold or Residential Property	9. Landscaping and Playgrounds and Shelters
PB_1	Sandy Coast	Peaceful Bay	550	20	11000	Stairs with attached ramp and boardwalk (from Sea Rescue building), bitumen car park (Sea Rescue), western beach access point with bitumen car park, toilet, boardwalk path and stairs, Peaceful Bay Sea Rescue Group (boat shed and building), Old Peaceful Bay Road, caravan park with grassed area (BBQ and gazebo) and gravel/sand path from caravan park, and finger jetty.	H	M	M	M		M	H	M	L
PB_2	Sandy Coast	Foul Bay	1500	30	45000	Lookout landward of Old Peaceful Bay Road with gravel car park, Old Peaceful Bay Road, section of Bibbulmun track, vehicle beach access track, RSL memorial and Fisherman's lease area.	L	L		H	L	M		M	

	High Asset Risk
	Moderate Asset Risk
	Low Asset Risk

Notes:

1. Asset costs are based on values provided by the Shire and/or based on assume rates and quantities for typical assets.
2. Asset cost represents present day replacement costs with no allowance for depreciation or maintenance.
3. Asset exposure to coastal processes has been assessed based on Hazard assessment maps.
4. Valuation have been undertaken for coastal planning purposes. They may not be sufficient for other purposes.
5. 10yr Concept Designs provided by Shire of Denmark

Coastal Risk Evaluation Matrix

		Exposure to Coastal Processes (Likelihood)		
		High (within 10yr area)	Moderate (10-20 year area)	Low (20-100yr area)
Asset Cost (Consequence)	High	Very High	High	Mod
	Moderate	High	Mod	Low
	Low	Mod	Low	Low

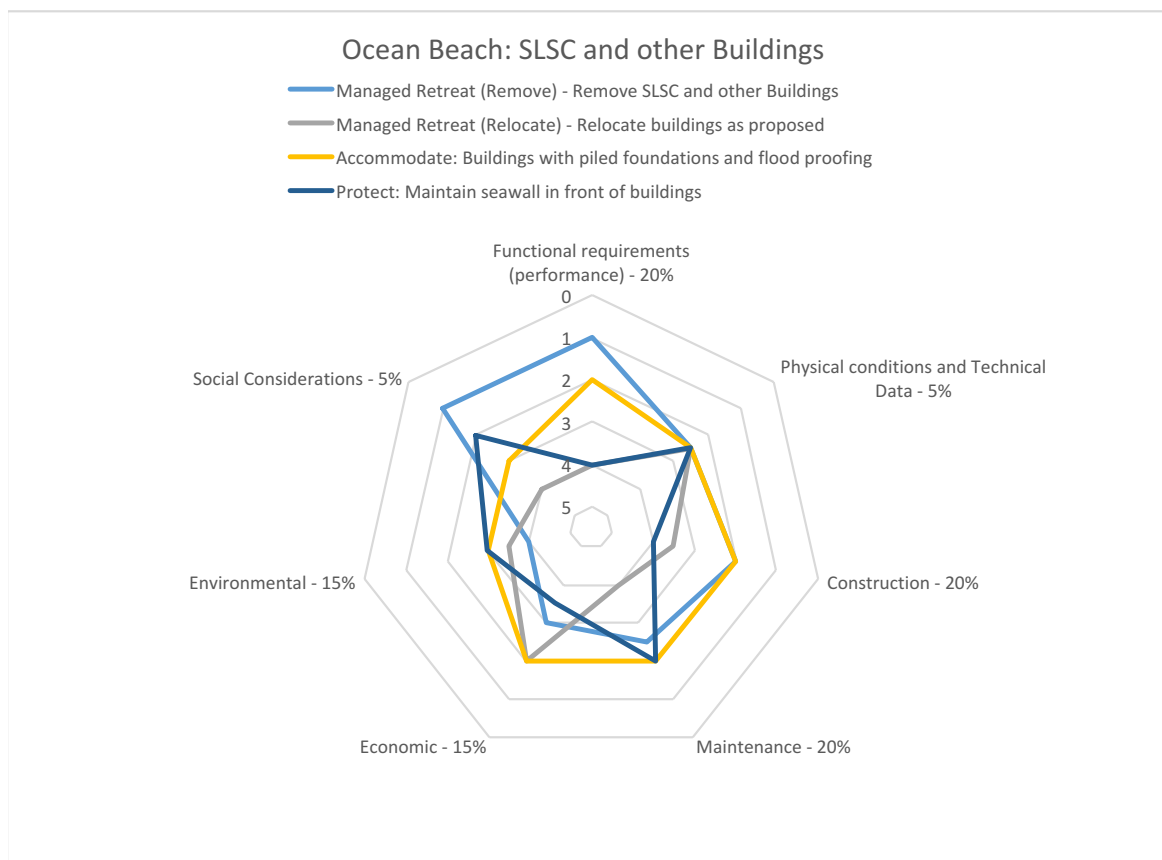


Attachment C Adaptation Option Assessment

MCA Criteria	Managed Retreat (Remove)	Managed Retreat (Relocate)	Accommodate	Protect
	Managed Retreat (Remove) - Remove SLSC and other Buildings	Managed Retreat (Relocate) - Relocate buildings as proposed	Accommodate: Buildings with piled foundations and flood proofing	Protect: Maintain seawall in front of buildings
Functional requirements (performance) - 20%	1.0	4.0	2.0	4.0
Physical conditions and Technical Data - 5%	2.5	2.5	2.5	2.5
Construction - 20%	2.0	3.5	2.0	4.0
Maintenance - 20%	2.5	4.0	2.0	2.0
Economic - 15%	3.0	2.0	2.0	3.5
Environmental - 15%	4.0	3.5	3.0	3.0
Social Considerations - 5%	1.0	4.0	3.0	2.0
	11.625	17.25	11.125	16

Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.

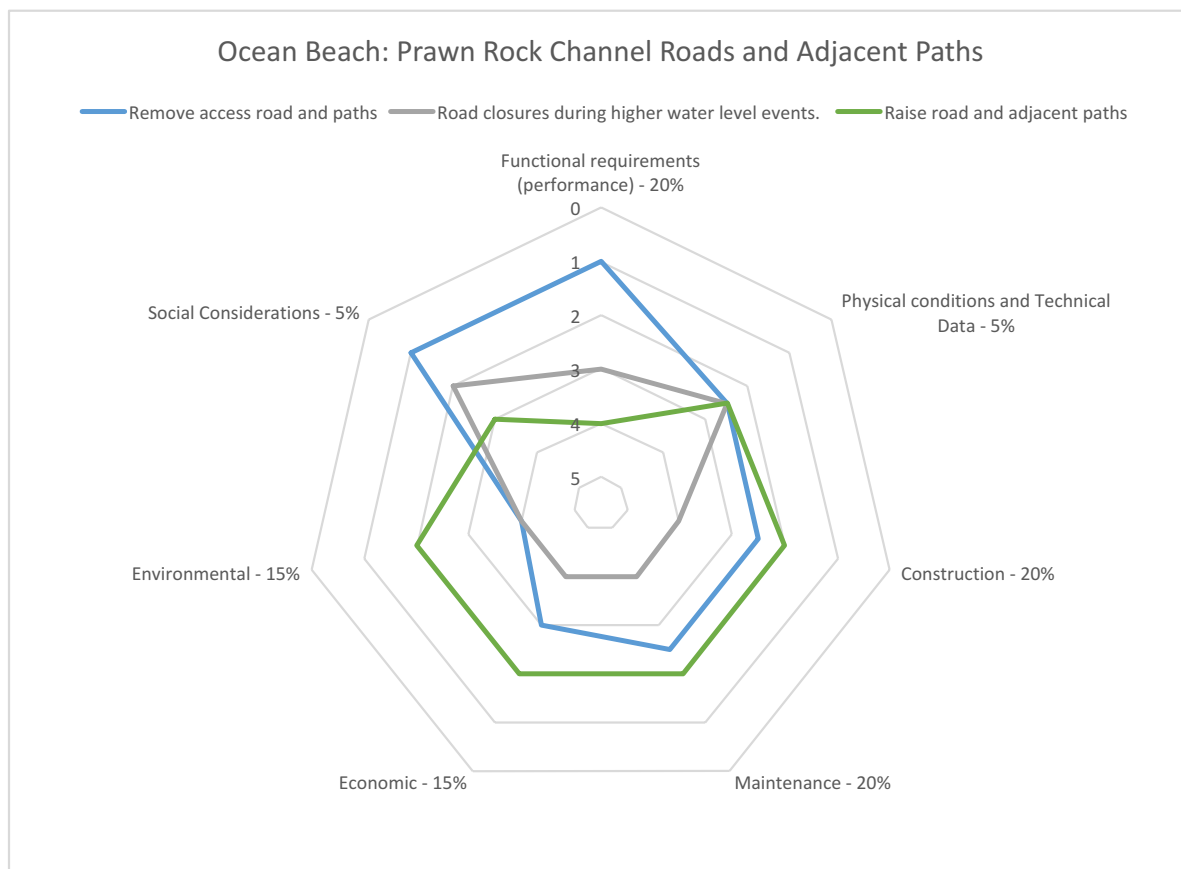
A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



	Managed Retreat (Remove)	Accommodate	Protect
	Remove access road and paths	Road closures during higher water level events.	Raise road and adjacent paths
Functional requirements (performance) - 20%	1.0	3.0	4.0
Physical conditions and Technical Data - 5%	2.5	2.5	2.5
Construction - 20%	2.5	4.0	2.0
Maintenance - 20%	2.5	4.0	2.0
Economic - 15%	3.0	4.0	2.0
Environmental - 15%	4.0	4.0	2.0
Social Considerations - 5%	1.0	2.0	3.0
	12.125	18.125	12.375

Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.

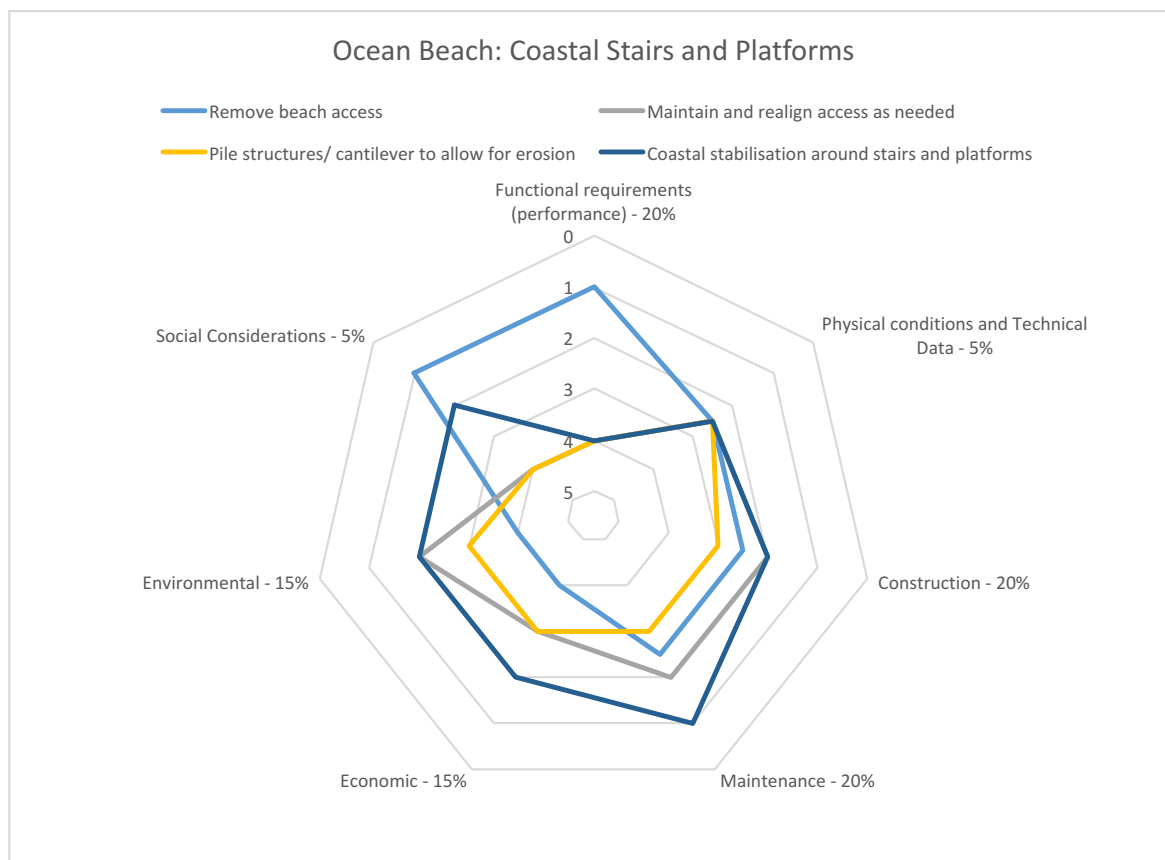
A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



	Managed Retreat (Remove)	Managed Retreat (Relocate)	Accommodate	Protect
	Remove beach access	Maintain and realign access as needed	Pile structures/ cantilever to allow for erosion	Coastal stabilisation around stairs and platforms
Functional requirements (performance) - 20%	1.0	4.0	4.0	4.0
Physical conditions and Technical Data - 5%	2.5	2.5	2.5	2.5
Construction - 20%	2.5	2.0	3.0	2.0
Maintenance - 20%	2.5	2.0	3.0	1.0
Economic - 15%	4.0	3.0	3.0	2.0
Environmental - 15%	4.0	2.0	3.0	2.0
Social Considerations - 5%	1.0	4.0	4.0	2.0
	12.875	13.375	16.125	11.125

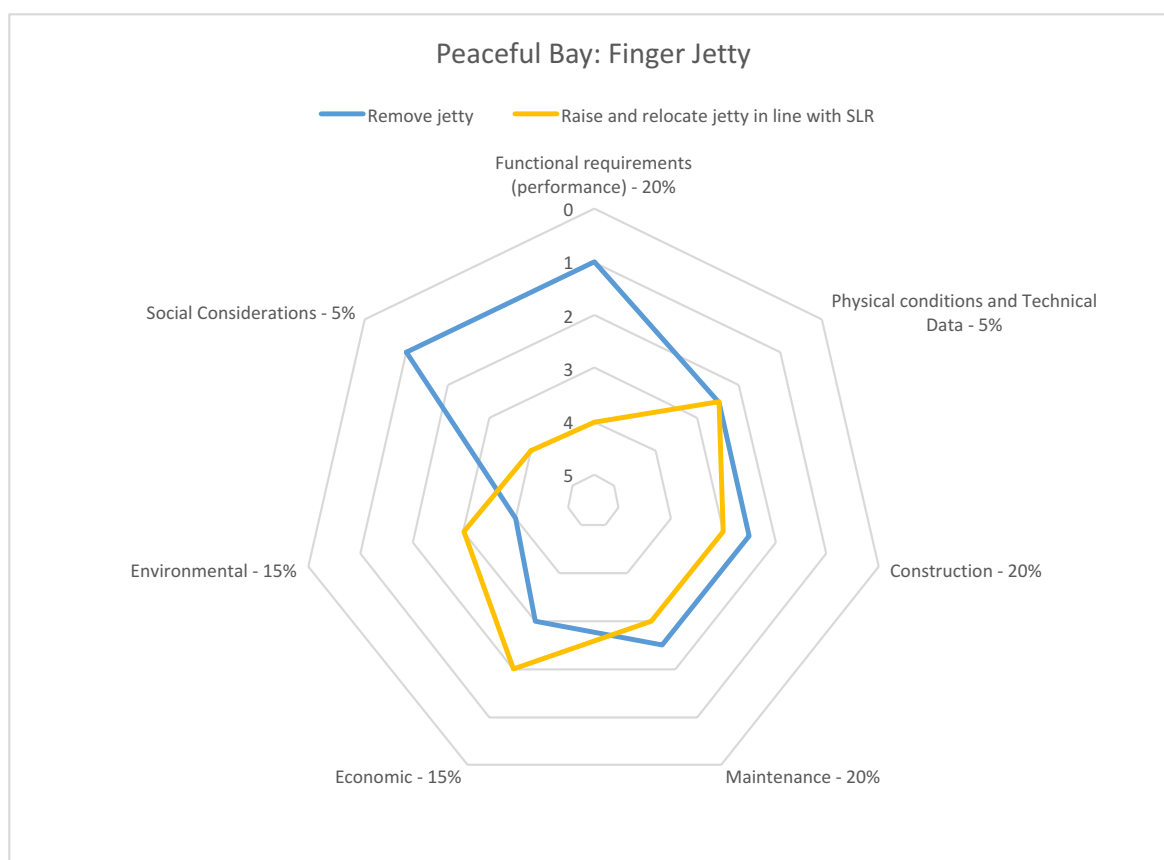
Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.

A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



	Managed Retreat (Remove)	Accommodate
	Remove jetty	Raise and relocate jetty in line with SLR
Functional requirements (performance) - 20%	1.0	4.0
Physical conditions and Technical Data - 5%	2.5	2.5
Construction - 20%	2.5	3.0
Maintenance - 20%	2.5	3.0
Economic - 15%	3.0	2.0
Environmental - 15%	4.0	3.0
Social Considerations - 5%	1.0	4.0
	12.125	15.375

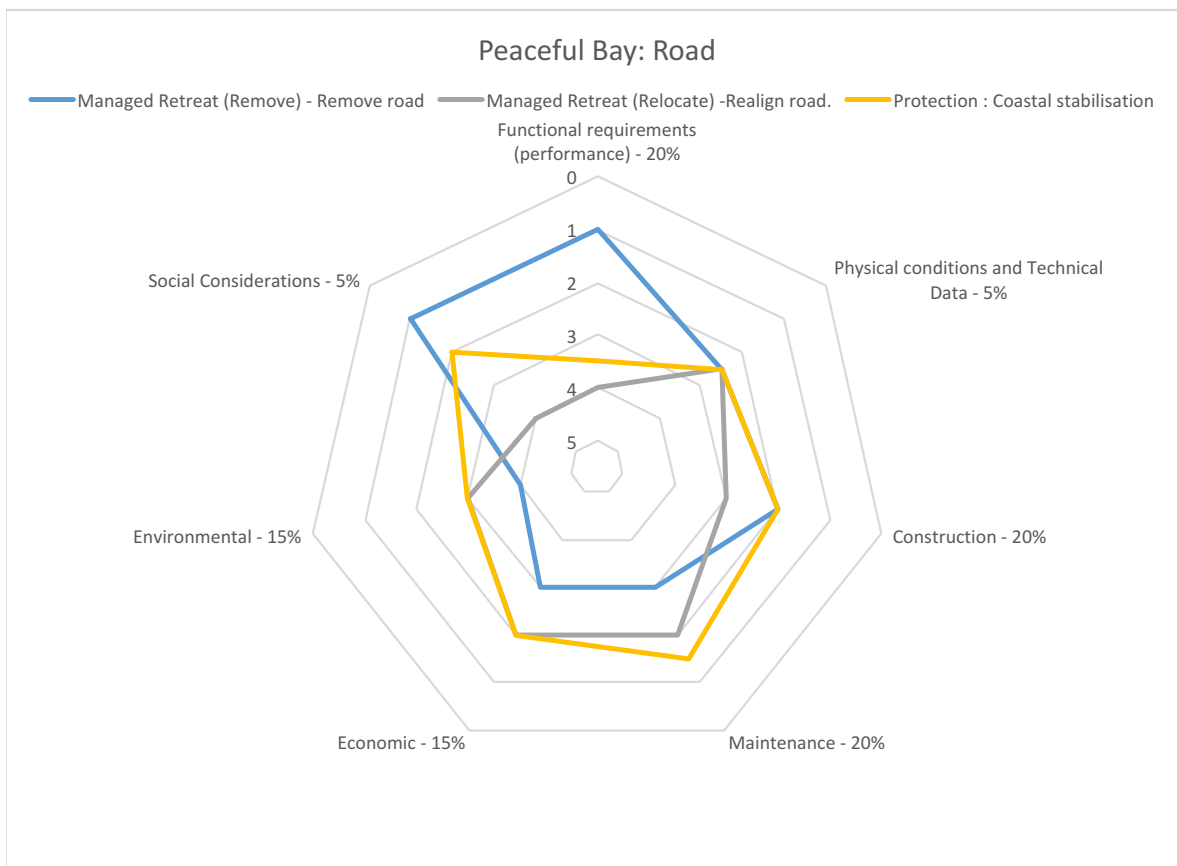
Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.
A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



	Managed Retreat (Remove)	Managed Retreat (Relocate)	Protect
	Managed Retreat (Remove) - Remove road	Managed Retreat (Relocate) -Realign road.	Protection : Coastal stabilisation
Functional requirements (performance) - 20%	1.0	4.0	3.5
Physical conditions and Technical Data - 5%	2.5	2.5	2.5
Construction - 20%	2.0	3.0	2.0
Maintenance - 20%	3.0	2.0	1.5
Economic - 15%	3.0	2.0	2.0
Environmental - 15%	4.0	3.0	3.0
Social Considerations - 5%	1.0	4.0	2.0
	12.125	14.375	11.875

Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.

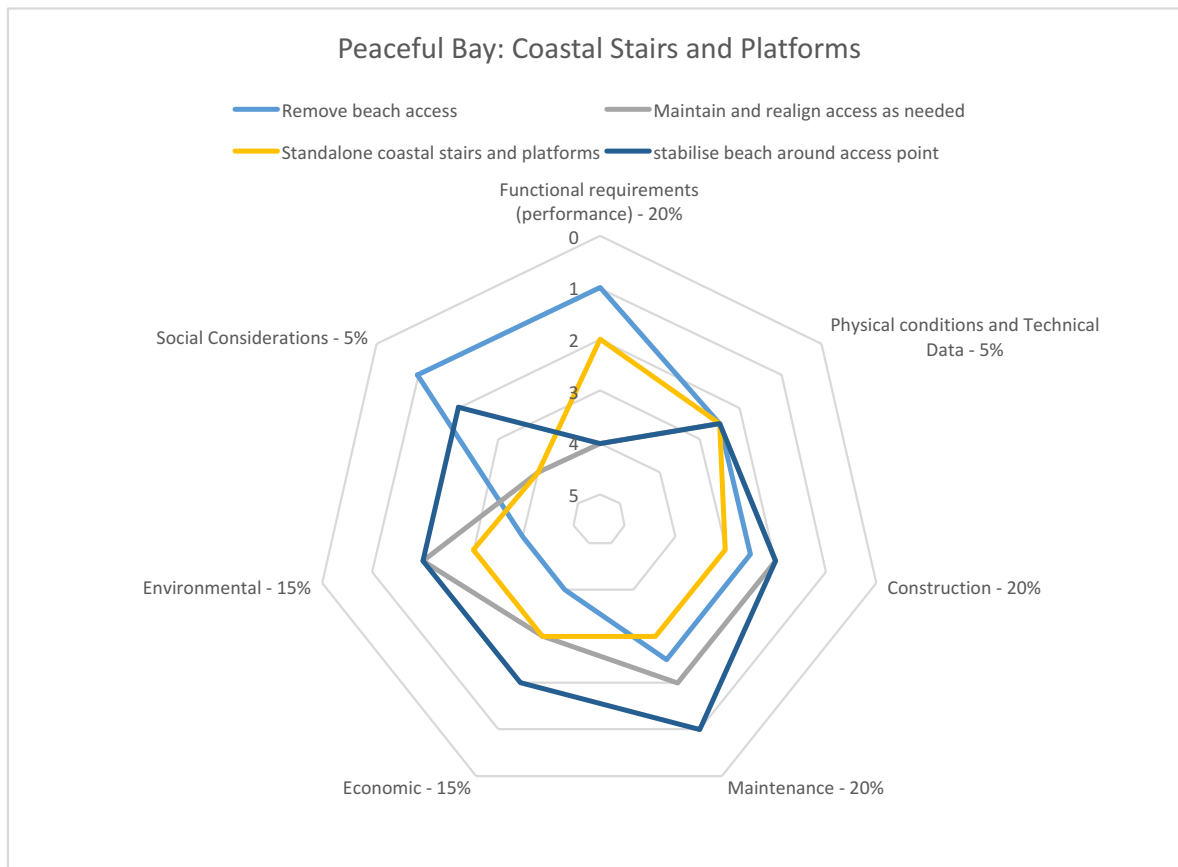
A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



	Avoid	Managed Retreat	Accommodate	Protect
	Remove beach access	Maintain and realign access as needed	Standalone coastal stairs and platforms	stabilise beach around access point
Functional requirements (performance) - 20%	1.0	4.0	2.0	4.0
Physical conditions and Technical Data - 5%	2.5	2.5	2.5	2.5
Construction - 20%	2.5	2.0	3.0	2.0
Maintenance - 20%	2.5	2.0	3.0	1.0
Economic - 15%	4.0	3.0	3.0	2.0
Environmental - 15%	4.0	2.0	3.0	2.0
Social Considerations - 5%	1.0	4.0	4.0	2.0
	12.875	13.375	14.125	11.125

Note: 5 = excellent; 4 = good; 3 = satisfactory; 2 = below average; 1 = poor.

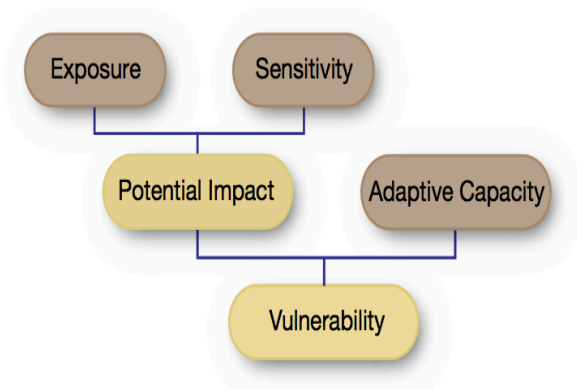
A value of 2.5 is used where the condition is not applicable, i.e. constructability for "Do Nothing" is not applicable



					Exposure	Sensitivity		Potential Impact	Adaptive Capacity				Asset Risk	
						Coastal Erosion	Coastal Inundation		Avoid	Managed Retreat	Accommodate	Protect		
ID	Coastal Type	Coastal Node	Asset Type	Description										Risk Management and Adaptation Options
OB_1	Tidal reaches of inland waters	Prawn Rock Channel	Roads and Adjacent Paths	Coastal road and footpath along channel, including wooden bridge	High	×	XX	1) Bank instability associated with bank erosion due to increase in MSL and variable climatic conditions 2) Exposure of seaward edge of road and adjacent paths to slope instability 3) Road inundated during higher tides due to increase in MSL			✓	✓	High	Accommodate: Road closures during higher water level events. Protect: raise road and path to above flood waters and provide erosion protection
OB_3	Sandy coast	Ocean Beach	Buildings	SLSC and Sea Rescue Buildings, and toilet block	Medium	XX	×	1) Slope instability associated with toe erosion of dune due to increase in MSL and variable climatic conditions 2) Exposure of seaward edge of buildings to slope instability 3) Exposure of foundation of timber retaining wall and reduced support for structure 4) Increased frequency and depth of inundation of buildings due to increased MSL		✓	✓	✓	High	Managed Retreat: rolling retreat of platform, Sea Rescue Building and toilet block as needed (relocate to proposed location) Accommodate: ensure buildings have piled foundations sufficiently deep to accommodate the risk of erosion and design buildings to be flood proof or ensure minimal damage to buildings during flooding. Protect: Maintain existing timber retaining wall in front of the buildings to protect from erosion and inundation.
OB_4	Sandy coast	Ocean Beach	Coastal Stairs and Platforms	Wooden stairs, ramps and viewing platforms	High	×	×	1) Increased erosion adjacent to lower stair 2) Exposure of footings for timber supports of stairs and platforms and reduced support for structure		✓	✓	✓	Medium	Managed Retreat: Progressively move stairs and platforms in line with erosion. Accommodate: Relocate stairs and platforms to be founded on rock and behind naturally occurring rock. Protect: install coastal stabilisation to protect coastal stairs and platforms.

Notes:

1. Asset exposure based on Risk Analysis (Phase 2). High exposure means assets within 10yr coastal processes zone.
2. × means coastal asset is sensitive to coastal erosion or inundation
3. XX means visual inspection indicated high sensitivity to coastal erosion or inundation.
4. Adaptive capacity identifies most feasible options. Other options may be considered.
5. Asset risk based on Risk Evaluation (Phase 3) and is based on asset cost (consequence) and asset exposure (likelihood).
6. There is not sufficient beach survey and design information to quantitatively assess the sensitivity of individual assets to coastal erosion or inundation. For example, the sensitivity of beach access stairs to erosion requires regular beach survey and design details including the depth of vertical supports.
7. The vulnerability of individual assets, as defined, cannot presently be assessed with confidence due to limited information on their sensitivity to erosion/inundation. This could however be assessed at a project scale where beach survey and design information is collected or collated.



Vulnerability Assessment Flowchart (CHRM Guidelines)

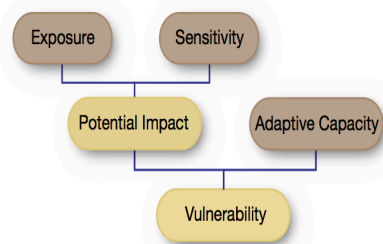


Risk Management and Adaptation Hierarchy (CHRM Guidelines)

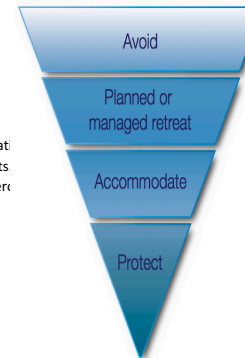
ID	Coastal Type	Coastal Node	Asset Type	Description	Exposure	Sensitivity		Potential Impact	Adaptive Capacity				Asset Risk	Risk Management and Adaptation Options
						Coastal Erosion	Coastal Inundation		Avoid	Managed Retreat	Accommodate	Protect		
PB_1	Sandy Coast	Peaceful Bay	Public Marine Structures	Finger jetty	High	×		1) Jetty inundated during higher tides due to increase in MSL 2) Jetty damage due to increased exposure to waves 3) Exposure of jetty piles and reduced support for structure 4) Damage to jetty 5) Reduction in frequency of safe launching conditions			✓		High	Accommodate: Inform public of when to expect jetty to be inundated (higher tides). Inspect and maintain jetty to required standards. Design jetty deck level to accommodate future sea level rise at time of replacement or major maintenance. Jetty to be pulled back in line with coastal erosion during future maintenance operations
PB_2	Sandy Coast	Foul Bay	Roads and Adjacent Paths	Coastal road with section leading to Sea Rescue Group car park	Medium	×	×	1) Slope instability associated with toe erosion of dune due to increase in MSL and variable climatic conditions 2) Exposure of seaward edge of road and adjacent paths to slope instability 3) Road inundated during higher tides due to increase in MSL		✓		✓	High	Managed Retreat: realign road as required Protect: install seawall or similar coastal protection to protect road
PB_3	Sandy Coast	Peaceful Bay	Coastal Stairs and Platforms	Wooden stairs and ramp	High	×	×	1) Increased erosion adjacent to lower stair 2) Exposure of footings for timber supports of stairs and platforms and reduced support for structure 3) Slope instability associated with toe erosion of dune due to increase in MSL and variable climatic conditions		✓	✓	✓	Medium	Managed Retreat: Progressively move stairs and platforms in line with erosion. Accommodate: Design access infrastructure to be piled self supporting structures. Protect: install coastal stabilisation to protect coastal stairs and platforms.

Notes:

1. Asset exposure based on Risk Analysis (Phase 2). High exposure means assets within 10yr coastal processes zone.
2. ✖ means coastal asset is sensitive to coastal erosion or inundation
3. ✖✖ means visual inspection indicated high sensitivity to coastal erosion or inundation.
4. Adaptive capacity identifies most feasible options. Other options may be considered.
5. Asset risk based on Risk Evaluation (Phase 3) and is based on asset cost (consequence) and asset exposure (likelihood).
6. There is not sufficient beach survey and design information to quantitatively assess the sensitivity of individual assets to coastal erosion or inundation. For example, the sensitivity of beach access stairs to erosion requires regular beach survey and design details including the depth of vertical supports
7. The vulnerability of individual assets, as defined, cannot presently be assessed with confidence due to limited information on their sensitivity to erosion. This could however be assessed at a project scale where beach survey and design information is collected or collated.



Vulnerability Assessment Flowchart (CHRM Guidelines)



Risk Management and Adaptation Hierarchy (CHRM Guidelines)



Attachment D Community Consultation Feedback



Shire of Denmark

Minutes

Ocean Beach and Peaceful Bay Concept Plan Working Group

Meeting held on Friday 3 March 2017 at the Denmark Surf Life Saving Club, commencing at 9.25 am.

1. DECLARATION OF OPENING/ANNOUNCEMENT OF VISITORS

In the absence of Cr Allen, Cr Gearon assumed the Chair.

2. RECORD OF ATTENDANCE/APOLOGIES

MEMBERS IN ATTENDANCE

Cr Ceinwen Gearon	Councillor (Acting Chair) (<i>until 1.15 pm</i>)
Mrs Annette Harbron	Director of Planning & Sustainability
Ms Donna Sampey	Sustainability Officer
Mr Sam Bishopp	Department of Planning (<i>via phone</i>)
Mr Mark Jendrzczak	Department of Planning
Mr Brett Dal Pozzo	South Coast Natural Resource Management
Mr Martin Norwood	Denmark Surf Life Saving Club
Ms Mavis Jones	Peaceful Bay Progress Association
Mr Lee Shelley	Community Member
Ms Diane Harwood	Community Member

APOLOGIES:

Cr Mark Allen (Chair)	Councillor
Mr Gilbert Arlandoo	Director of Infrastructure Services
Ms Deborah Millener	Department of Planning

VISITORS:

Mr Stuart Barr	Seashore Engineering
Mr Michael Taylforth	Land Insights
<i>Ocean Beach site visit:</i>	
Mr Murray Thornton	Denmark Surf Life Saving Club
Ms Jane Kelsbie	Denmark Surf Life Saving Club (President)
Mr Mike Neunuebel	South Coast Surfing Lessons
Mr Don Smith	Denmark Boating and Angling Club (President)
<i>Peaceful Bay site visit:</i>	
Mr Ray Walker	Peaceful Bay Returned Services League Sub-Branch
Mr Garry Bevan	Bevans (WA) Pty Ltd (Managing Director)
Ms Glenda Bevan	Bevans (WA) Pty Ltd
Ms Janine Phillips	Peaceful Bay Progress Association (proxy)

DECLARATION OF INTEREST:

Name	Item No	Interest	Nature
Cr Ceinwen Gearon	4	Impartiality	Member of the Denmark Surf Life Saving Club
Mr Lee Shelley	4	Impartiality	Member of the Denmark Boating and Angling Club
Ms Diane Harwood	4	Impartiality	Member of the Denmark Weed Action Group

3. ANNOUNCEMENT BY THE PERSON PRESIDING

All members and visitors present introduced themselves.

4. GENERAL BUSINESS

4.1 Project re-cap and document review. Mr Barr presented a summary of the Coastal Hazard Risk Management Adaptation Plan (CHRMAP) and Issues Paper.

Comments provided on the draft documents for review (at the meeting and before/after the meeting) are below:

Issues Paper

- Lee Shelley – 1st paragraph under heading “Ocean Beach” – add “boating” to the list of uses.
 - Include page numbers
- Mark Jendrzeczak – “Ocean Beach” “key issues for consideration” paragraph, 2nd dot point – reword to improve understanding/clarity
- Mavis Jones – make the document simpler to maximize community understanding
- Annette Harbron – “FOS” has not been defined
 - Include a schematic of S1 to S4 to aid in understanding
 - Include under “Where to from here?” the other methods of consultation ie. Other ways to access the community survey
 - Include Shire logo on front page
 - Synopsis – add “ie.” at start of brackets in 3rd paragraph.
 - Change all references of “town of Denmark” to “Town of Denmark”
 - “Ocean Beach” end paragraph, 1st dot point – change “capacity of provide” to “capacity to provide”
- Brett Dal Pozzo – make reference to the coastal systems being dynamic and system recovery (not just erosion)
- Donna Sampey – Suggest deleting the link to the survey on the cover page, since there are other ways of obtaining the survey
 - “Synopsis” section – include a dash after “Managed Retreat” and “Accommodation”
 - Add full stops after first two dot points.
 - Replace “Denmark SLSC” with “buildings”
 - Add full stop at end of last paragraph.
 - Need to make reference to the concept planning process (10 year future assets) as part of the CHRMAP
 - Ocean Beach “Allowance for Coastal Processes” section – word missing first sentence.
 - Figure 3 – “HSD” needs defining
 - Change “surf club” to Denmark Surf Life Saving Club (can abbreviate after first mention).
 - Table 1 and 2 – would it be easier to understand if the full table from the Hazard Assessment was included? Could then delete some of the text above it.
 - Table 2 – add units after “Coastal Processes Allowances”
 - Change “old surf club building” to “old Denmark SLSC building”
 - 3rd dot point – delete “particularly at Ocean Beach”
 - 6th dot point – change “Wilsons” to “Wilson”
 - Peaceful Bay section – change “boat ramp” to “boat launching area”
 - “Jetty beach” – does this refer to Peaceful Bay?
 - Change “access road” to “Peaceful Bay Road”

Stakeholder and Community Engagement Strategy

- Annette Harbron – make reference to inclusion of other relevant documents eg. State Planning Policy 2.6, Coast Adapt, on Shire website during community consultation periods.
- Donna Sampey – Section 2.4 – word “be” missing in 2nd sentence
 - Section 2.5 – add 2 x Councillors to the list of Working Group members (refer to Working Group Terms of Reference).
 - Table 2 - Add “Seashore Engineering and Land Insights” to personnel in 1st row.
 - Spelling error – “Action” column, last row under “Priority 1”
 - Pg 11 – “Working Group meeting” wasn’t included under the list of meetings on pg 4
 - “Review of submissions” – change “2018” to “2017”
 - Another Working Group meeting will be required to review submissions and finalise draft CHRMAP.

Community Survey

- There was consensus to break the survey up into two – one for Peaceful Bay and one for Ocean Beach. Ensure then that the answer options are relevant to each site eg. 4WD, motor biking, dog exercise and horse riding does not occur at Ocean Beach.
- Lee Shelley – questions relating to “threats/activities” may be better only referred to as “activities”.
 - Q7a and b – need to have reference to safe boat launch facilities &/or upgrade to existing facilities
- Ceinwen Gearon – Include in the introduction a short explanation of what the survey is trying to achieve ie. What is most valued about the sites, concept planning etc.
- Brett Dal Pozzo – include a question relating to usage and behaviours at each site.
- Annette Harbron – Include RSL memorial (Peaceful Bay) into list of current assets that need to be safeguarded
 - Further explanation of options in Q9 may be needed
- Donna Sampey – ensure numbering correct when referring to ranking answers ie. May list order from 1 to 6, but there are only 5 options.
 - Footnote – letter missing from the end of “Plan”
 - “Flooding” may need more explanation as a threat – does this mean flooding of the beach, foreshore area or other? Hasn’t been an issue currently, except associated with rising Wilson Inlet water levels at Prawn Rock Channel (Ocean Beach) ie. Not coastal related (yet).
 - Change “Quiet beaches to fish and walk” to just “quiet beaches”
 - Peaceful Bay assets – there are currently no seasonal patrols, playgrounds or SLSC
 - Erosion of the coast at Peaceful Bay – answer relating to damage from 4WDs etc does not strictly fit with the question, because there could also be a perception that the erosion is caused by these factors (not added to by them).
 - Q9 – delete full stops at end of row 2 and 3.
 - Options for hand-delivering surveys – change “Shire office” to “Shire Administration office”
 - When splitting survey into two, please reference at the end that the other site’s survey is also available and where it can be obtained.
- Sam Bishopp – Addition of questions which have appeared in other CHRMAP projects:
 - Do you live in the Shire of Denmark?
 - Yes

- *No*

How well informed do you consider yourself to be on coastal impacts (e.g. erosion, storm surges) that may happen due to rising sea levels?

- *Uninformed*
- *Not well informed*
- *Have some idea*
- *Well informed*
- *Very well informed*
- *Expert*

If you would like to receive updates about this project, please fill out your details below:

- *Name*
- *Address*
- *Address 2*
- *City/Town*
- *State/Province*
- *Post code*
- *Email address*
- Suggested amendments to current questions:
 - Qu 6a & b – Add the following option: “Important environmental sites and plant and animal communities”.
 - Qu 9 – amend ‘Relocation’ option to: “RELOCATION of assets at the coast exposed to erosion (i.e planned or managed retreat)”
 - Q7 – delete extra question mark at end of question
 - Q9 – delete extra word (“to”) in question

ACTIONS:

- Shire staff (Annette Harbron and Donna Sampey) to liaise with Michael Taylforth and Stuart Barr about best ways to accommodate concept planning in the CHRMAP process and include in Stakeholder and Community Engagement Strategy.
- Brett Dal Pozzo to provide a copy of the Mutton Bird Reserve community survey to Donna Sampey, for forwarding to the consultants.

4.2 Site visit – Ocean Beach.

- Murray Thornton – The original (lower) SLSC building was built in 1958 without any coastal protection. At that time, the Wilson Inlet sandbar was opened on the east, which would dump sand on the beach.
 - In the early 1960s, a minor wall was built in front of the lower SLSC building, mainly for aesthetic reasons.
 - In 1998, a major event occurred (not a storm). The Wilson Inlet sandbar was opened on the west. A large rainfall event occurred, which meant the discharge from the inlet flowed in front of the SLSC and out through the rip at the rocky headland (southern end of Ocean Beach). The wall failed due to loss of sand and the beach disappeared.
 - A new wall was then built to the underlying limestone bedrock, which lies ~ 5 m below the sand surface. The bedrock slopes up towards the inlet and inland. Sand was backfilled behind the new wall. The timber sleepers will stay in place even if sand is washed from behind the wall. The timber pylons were driven into the sand until rock was hit. The bottom sleeper was laid in 1999, at the lowest water level possible.

- The end of the wall closest to the Inlet receives more energy. Sand is washed from this end and the sand behind the wall drops. Wind blows into this corner from the east.
- The SLSC seek to protect the bottom building. As protection, Murray suggests laying sheet pile behind the wall, which is then capped by concrete and buried. The sheet pile can be driven into the underlying limestone, which will stop the leakage of sand from behind the wall. More sheet pile could be used further up slope (between the bottom and top buildings) to protect the top building.
- The top building is situated on a mobile foredune, which is moving. There haven't been issues with this, since the top building is constructed from timber. There is a peat layer about 2 m below the surface behind this building. When constructing the top SLSC building, limestone was encountered ~ 4 m below the surface
- The ocean has come in behind the bottom building.
- Bottom wall should last another 30 years.
- Bannister has given a historical account of natural openings of the Wilson Inlet. Natural openings occur in the east when there are large flows. The opening moves west when flow starts to decrease. The catchment was reforested in the 1990s, which has decreased flows.
- First memories of the beach are from 1968 – doesn't think the foredune location has changed
- The pedestrian ramp at the SLSC (end closest to the Inlet) is flexible at the moment (bottom not fixed)
- A small blowout between the SLSC and the inlet has rehabilitated itself
- In the 1960s, the limestone cliffs between the SLSC and the Inlet were covered by sand
 - There is limestone in this area about 1.5 m below the sand
- Sand from the opening of the inlet ends up at Ocean Beach
- Plans for the SLSC redevelopment – wall of the existing top building will be new front ie. Veranda to be removed. Seeking a 30 – 40 year life for 'new' building.
 - If had to replace the lower building, would move it further inland. The building is used for gear. Happy for gear storage and kiosk to be located further inland. Estimates cost would be \$500k to replace the building – is protection cheaper?
- Annette Harbron - Disabled access from the car park to the beach is an issue
 - Activities at Prawn Rock Channel – swimming (protected), dog exercise area, paddle boards, kayaking
 - Water can inundate road adjacent to Prawn Rock Channel when inlet levels are high (prior to inlet opening).
 - SLSC to consider whether to include redevelopment into the concept planning process.
 - The Denmark Boating and Angling Club car park is used for overflow parking
 - Completion of the Wilderness Ocean Walk Trail Stage 2 will place additional pressure on car parking
- Mike Neunuebel – over the last 10 – 15 years the beach is getting 'higher'
 - In 2013, the beach never returned after winter, so had to be replaced manually.
 - Beach access from the boat launch area is an issue.
- Lee Shelley – boats can't launch from the beach when there is a lot of weed or sand on the beach. Launching can only occur under certain wave

conditions. There is no boat ramp – it is an over-beach launch. 4WD is required to launch from the beach. Need to be experienced.

- Parking for vehicles with boat trailers can occur in the bottom car park. Can't park on beach when there is no sand.
- Interactions with swimmers, surfers and other boat launchers causes issues. The Ocean Beach User Group attempts to address this conflict.
- In 2013, could drive onto the beach from the car park.
- The big logs around the edge of the car park were installed in 2008. The boat launch and car park have been manually built up over time.
- The Denmark Boating and Angling Club (DBAC) has a live-in caretaker.
 - Shed is used for boat storage.
 - Hall is available.
 - 150 members.
 - Host monthly competitions and annual open competitions, which aren't necessarily held at Ocean Beach
 - New 9 m boat can't use the dedicated access to the beach from behind the DBAC building (boat too big and track too narrow)
- Brett Dal Pozzo – in 2015, a sand trap fence was installed along the base of the foredunes to exclude people.
- Martin Norwood – seeking a new access for the SLSC behind the public toilets to the beach when moving equipment, to avoid conflict with pedestrians on the path
 - Plans for the redevelopment of the SLSC are being compiled now, but will not be finalised until after the CHRMAP project. The design will include some commercial component

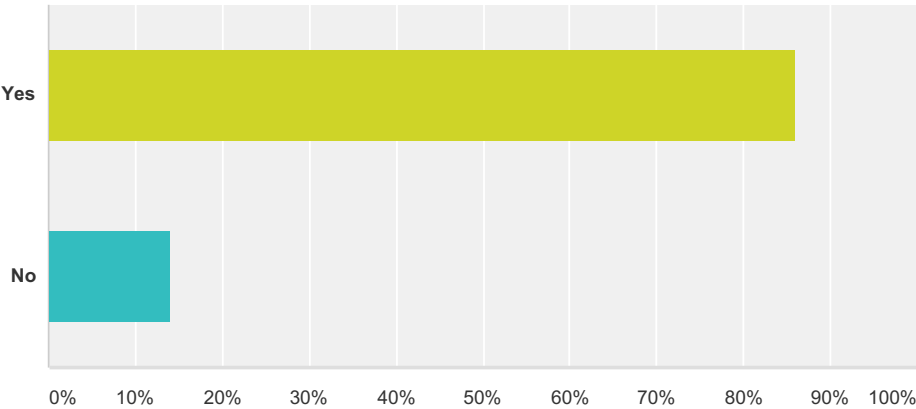
4.3 Site visit – Peaceful Bay.

- Mavis Jones – swimming beach has not changed over the past 50 years. Changes to the beach at Foul Bay have occurred more recently.
 - Erosion at the base of the steps from the toilets seasonally (Peaceful Bay). Shire will manually push up sand to replenish on occasion.
- Janine Phillips – Peaceful Bay – dunes less steep in past.
 - Erosion under cutting foredunes to about head height – risk of dune failure (southern extent more so)
 - Creek flows most of the year
 - Rock never observed at surface on swimming beach
 - Southern headland used to be bare sand – now colonized by marram grass
 - Would like to see disabled access to swimming beach
 - Sand drift issues on vehicle access ramp to beach
 - New car park behind Sea Rescue building – more so provides overflow parking when no room to park on the beach
 - Concerned with mixing swimmers and boats
 - User conflicts on boat ramp
- Ray Walker - Marram grass was used in the past to stabilise dunes
 - Around 60 – 80 years ago, used to be steep dunes in front of the Sea Rescue building – was able to go straight from dunes into water (no beach). Over time, beach has increased (water receded)
 - Estimates ~ 20 feet of land lost (seaward side) within RSL Memorial area – 2 side boundary fence panels removed
 - RSL memorial constructed in 2007
 - Contains 2 pine tree seedlings from Gallipoli
 - Relocation of the memorial is a more cost efficient option
- Bevans have fished in the area since 1952

- Have in the past sand bagged in front of the foredune – protection was destroyed by ocean
- Beach in front of Bevans' lease area was twice as wide in past – used to process fish there. Not enough room on beach now.
- In the last 12 – 18 months, there has been no erosion and some recovery
- Dunes erode during big SW swells
- Accessibility issues – no direct access from beach to lease area.
- When the ocean is up to the dunes, aren't able to fish (can't access water with boat from beach)
- Concerned with failure of overhangs (safety for kids). Warning signs needed for overhanging dunes?
- Original hut on lease area has been moved 3 times
- Lease area used to contain 3 additional huts (removed)
- Sand lost from Foul Bay may be depositing around inlet
- Annette Harbron – opportunities to move the fishing lease area?
 - Realigning Peaceful Bay Road or a portion of?

Q1 Do you live in the Shire of Denmark?

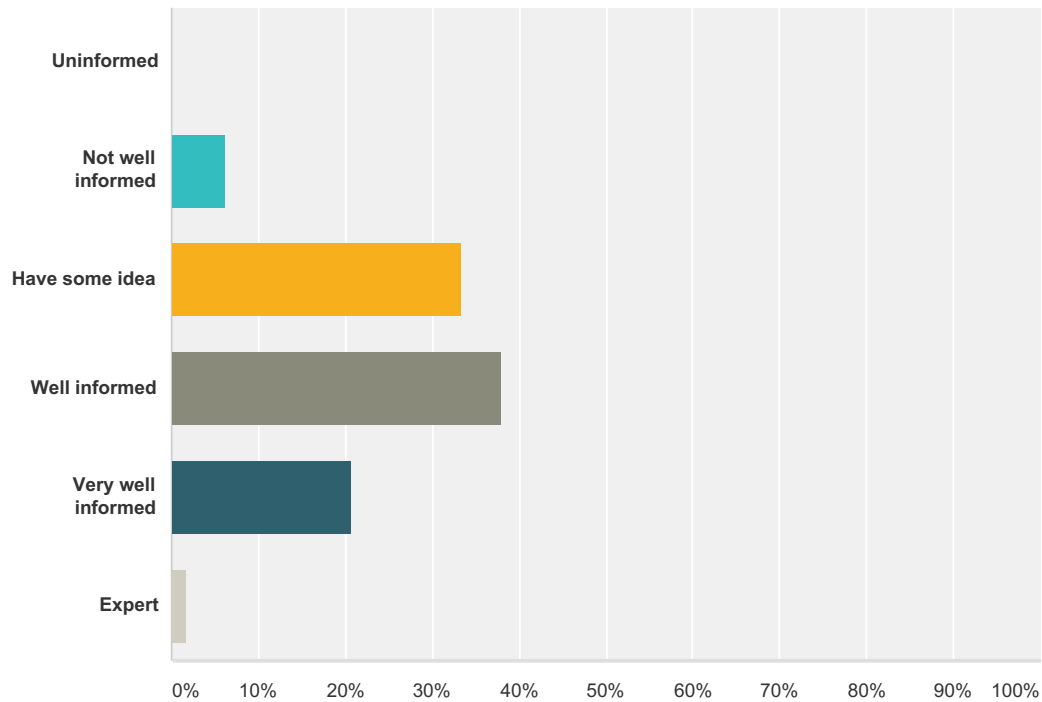
Answered: 64 Skipped: 0



Answer Choices	Responses	
Yes	85.94%	55
No	14.06%	9
Total		64

Q2 How well informed do you consider yourself to be on coastal impacts (erosion, storm surges) that may happen due to rising sea levels?

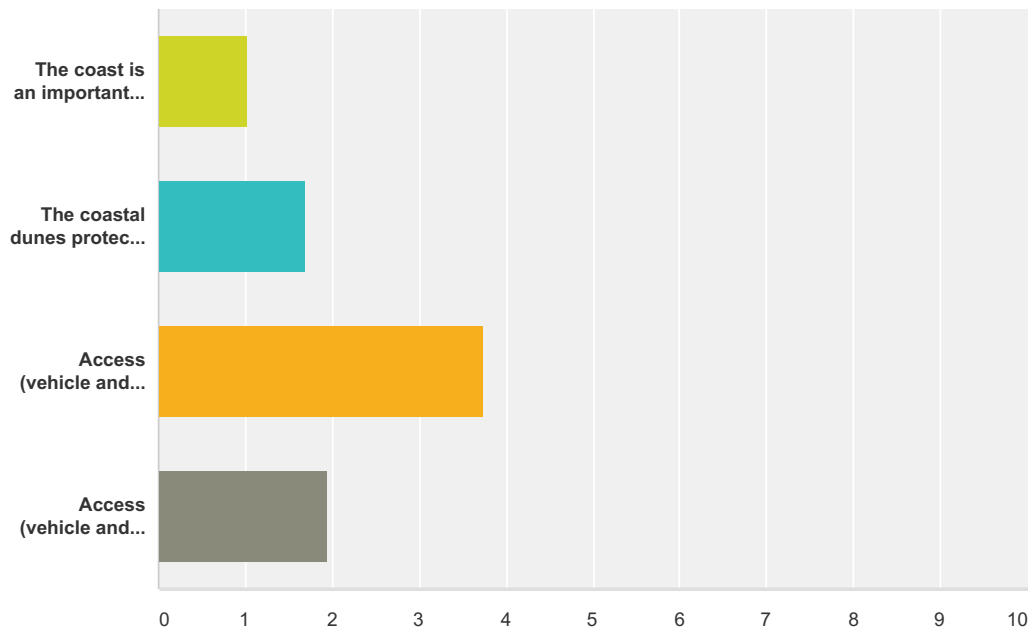
Answered: 63 Skipped: 1



Answer Choices	Responses	
Uninformed	0.00%	0
Not well informed	6.35%	4
Have some idea	33.33%	21
Well informed	38.10%	24
Very well informed	20.63%	13
Expert	1.59%	1
Total		63

Q3 How much do you agree with the following statements?

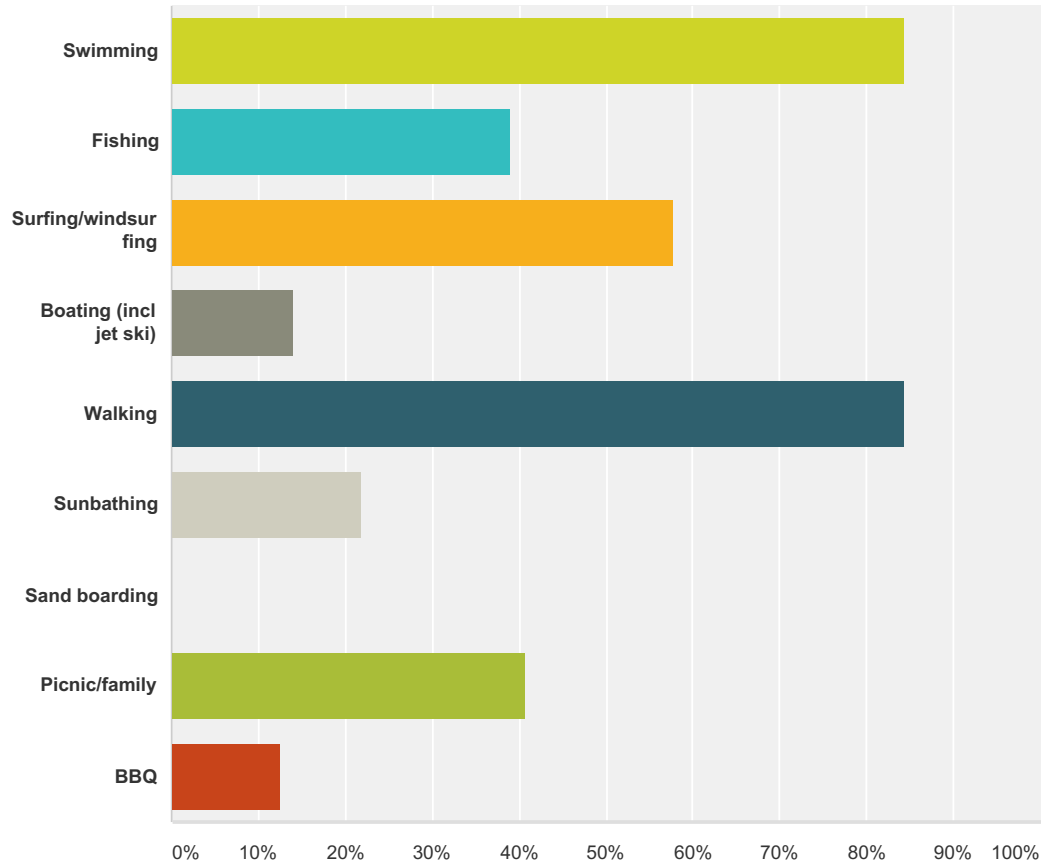
Answered: 63 Skipped: 1



	Strongly agree	Agree	No clear opinion	Disagree	Strongly disagree	Total	Weighted Average
The coast is an important part of the Shire of Denmark's lifestyle	96.83% 61	3.17% 2	0.00% 0	0.00% 0	0.00% 0	63	1.03
The coastal dunes protect public and private property	46.03% 29	42.86% 27	6.35% 4	4.76% 3	0.00% 0	63	1.70
Access (vehicle and pedestrian) should be provided to all parts of the coast	13.11% 8	6.56% 4	4.92% 3	44.26% 27	31.15% 19	61	3.74
Access (vehicle and pedestrian) should only be provided to specific areas of the coast	40.32% 25	43.55% 27	4.84% 3	3.23% 2	8.06% 5	62	1.95

Q4 What are your main activities at the Ocean Beach beach and foreshore? (Please tick all relevant)

Answered: 64 Skipped: 0



Answer Choices	Responses
Swimming	84.38% 54
Fishing	39.06% 25
Surfing/windsurfing	57.81% 37
Boating (incl jet ski)	14.06% 9
Walking	84.38% 54
Sunbathing	21.88% 14
Sand boarding	0.00% 0
Picnic/family	40.63% 26
BBQ	12.50% 8
Total Respondents: 64	

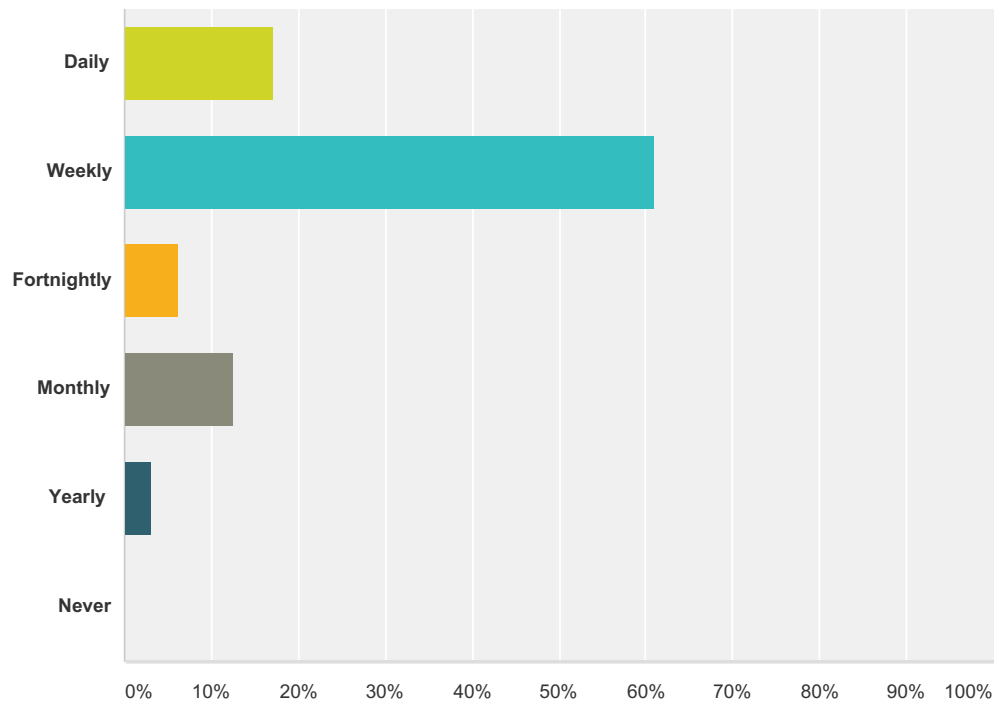
#	Other (please specify)	Date
1	bird watching	6/22/2017 3:04 PM

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2	kayaking	5/26/2017 3:26 PM
3	Beach patrol for Denmark SLSC & coaching	5/25/2017 8:49 AM
4	Surf Club	5/22/2017 2:42 PM
5	Sea Rescue	5/19/2017 4:10 PM
6	seasonal prawning	5/19/2017 11:25 AM
7	Surf club	5/18/2017 8:25 PM
8	photography	5/18/2017 3:55 PM
9	horse-riding when access across the inlet	5/17/2017 6:11 PM
10	SLSC	5/17/2017 4:14 PM
11	Bird watching	5/17/2017 12:09 PM
12	Walking dog (when the channel is open)	5/17/2017 11:17 AM
13	Running and Playing	5/17/2017 10:48 AM
14	Surf Club ... patrol, training, IRB, surf ski, boards	5/17/2017 8:35 AM
15	surf lifesaving	5/16/2017 1:59 PM
16	Birdwatching and photography	5/16/2017 9:37 AM
17	Dog exercise	5/16/2017 9:25 AM

Q5 How often to you visit the beach and foreshore at Ocean Beach?

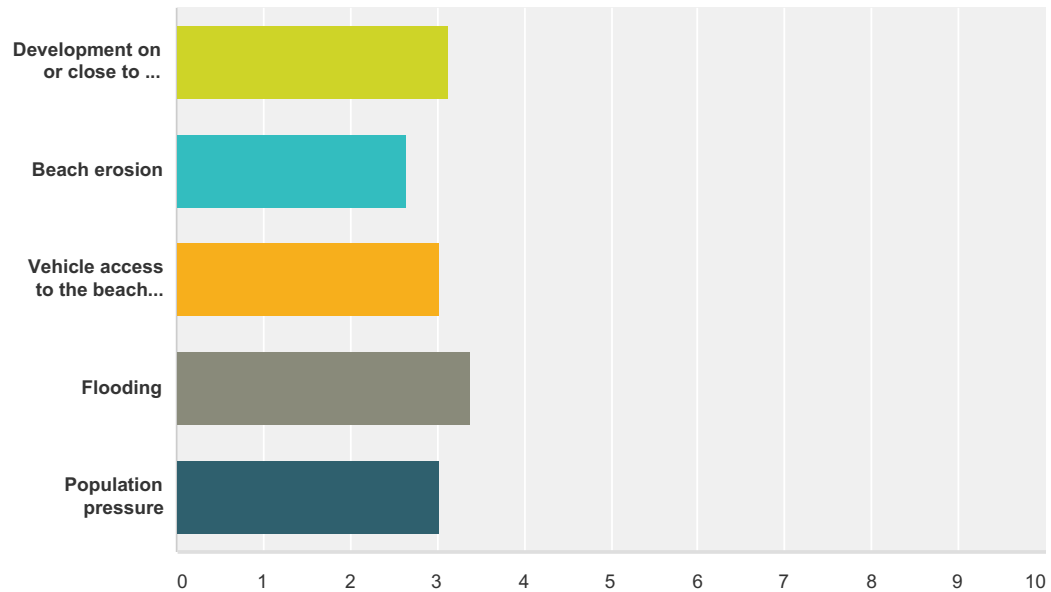
Answered: 64 Skipped: 0



Answer Choices	Responses	
Daily	17.19%	11
Weekly	60.94%	39
Fortnightly	6.25%	4
Monthly	12.50%	8
Yearly	3.13%	2
Never	0.00%	0
Total		64

Q6 Which of these threats/activities currently impact your use of the coastal areas of Ocean Beach? (Please rank the threats from 1 to 5 with 1 being a great threat and 5 being no threat)

Answered: 64 Skipped: 0



	1	2	3	4	5	Total	Weighted Average
Development on or close to the beach	26.56% 17	7.81% 5	20.31% 13	17.19% 11	28.13% 18	64	3.13
Beach erosion	25.00% 16	20.31% 13	29.69% 19	14.06% 9	10.94% 7	64	2.66
Vehicle access to the beach (4WD's)	24.59% 15	18.03% 11	16.39% 10	13.11% 8	27.87% 17	61	3.02
Flooding	6.45% 4	22.58% 14	22.58% 14	22.58% 14	25.81% 16	62	3.39
Population pressure	18.33% 11	13.33% 8	36.67% 22	10.00% 6	21.67% 13	60	3.03

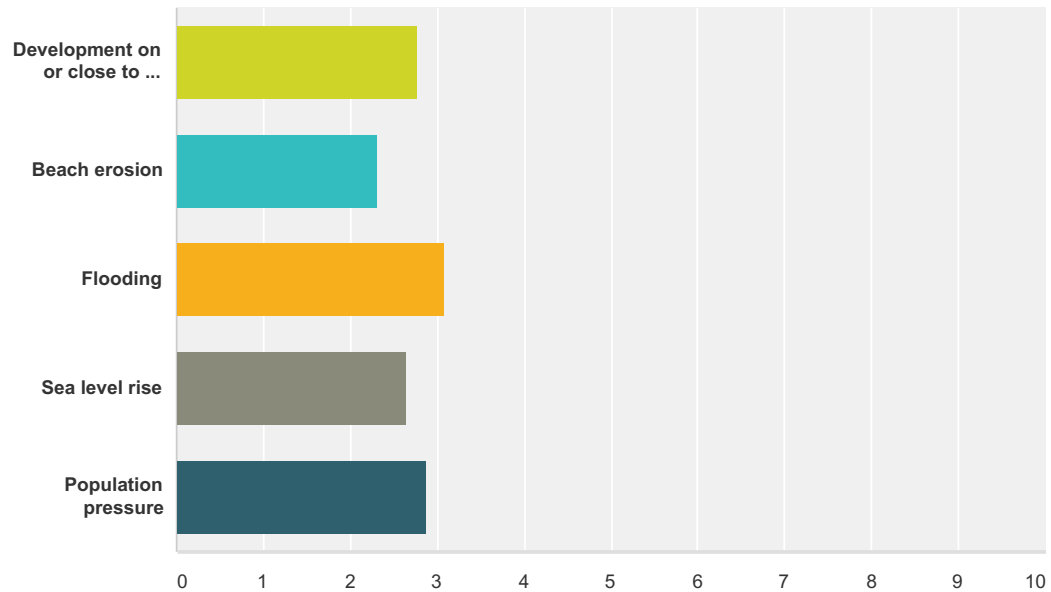
#	Other (please specify)	Date
1	Dogs at Prawn Rock Channel. Jet skis - bar area	6/22/2017 3:10 PM
2	dogs at Prawn Rock Channel exercise area	6/22/2017 3:04 PM
3	burning coastal vegetation	6/22/2017 2:32 PM
4	Note - not concerned with current level of 4WD access for boat launching	6/5/2017 11:59 AM
5	unregulated dog access	6/1/2017 11:27 PM
6	Boat launching & kite surfing	5/25/2017 8:49 AM
7	Ocean Beach is a shared use zone. Individuals who are not community minded and want Ocean Beach for their own use and want to ban others activities have been and could be again a threat. Ocean Beach must remain a shared use area.	5/19/2017 4:10 PM

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8	Degradation of the inlet (which has a follow on effect to the beach and coastline) from farming and fishing.	5/17/2017 4:14 PM
9	Dogs in habitat areas	5/17/2017 12:09 PM
10	Strangely worded question. I mean that 4WD access has no threat to my activities to clarify	5/17/2017 10:48 AM
11	Boats, Jet Skis, Fishing, Vehicles & Dogs on the beach	5/17/2017 8:35 AM
12	Flooding is only significant to the extent that it prevents access to the dog exercise areas	5/16/2017 9:25 AM

Q7 Which activities do you think are likely to impact the coastal areas of Ocean Beach in the future? (Please rank the threats 1 to 5 with 1 being a great threat and 5 being no threat)

Answered: 63 Skipped: 1



	1	2	3	4	5	Total	Weighted Average
Development on or close to the beach	31.75% 20	14.29% 9	20.63% 13	11.11% 7	22.22% 14	63	2.78
Beach erosion	38.10% 24	22.22% 14	17.46% 11	14.29% 9	7.94% 5	63	2.32
Flooding	13.56% 8	18.64% 11	32.20% 19	16.95% 10	18.64% 11	59	3.08
Sea level rise	21.67% 13	28.33% 17	25.00% 15	13.33% 8	11.67% 7	60	2.65
Population pressure	23.73% 14	20.34% 12	20.34% 12	15.25% 9	20.34% 12	59	2.88

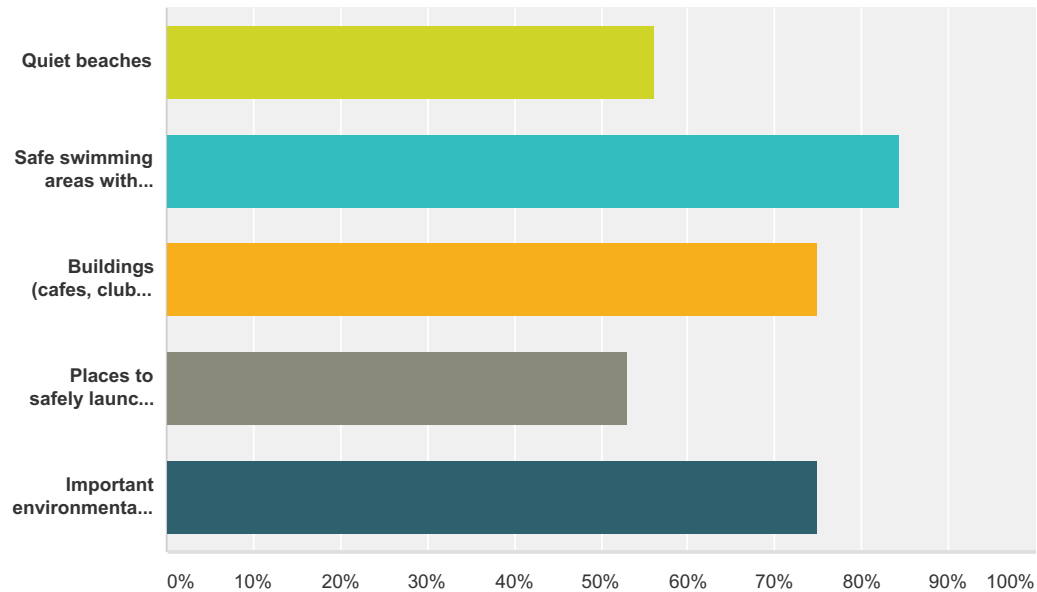
#	Other (please specify)	Date
1	dune erosion	6/22/2017 3:10 PM
2	dune erosion	6/22/2017 3:04 PM
3	prescribed or unsuppressed fire if left in a strong and healthy condition and unburnt. Coastal vegetation will sustain the coastal dunes and avoid wind and human damage	6/22/2017 2:32 PM
4	By flooding I presume this means storm surge? If not both questions relating to flooding can score 1.	6/5/2017 11:59 AM
5	Boat launching & kite surfing	5/25/2017 8:49 AM
6	Development of access to alternate local beaches should continue	5/19/2017 4:10 PM
7	I can't really answer the above, don't have the info	5/19/2017 9:39 AM

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8	Weed / pest species negatively impacting the dune system and ecosystem.	5/17/2017 6:11 PM
9	sandboarding, fishing/boating	5/17/2017 8:35 AM

Q8 Which of these uses or assets do you think should be safeguarded so they continue to be available at Ocean Beach beach and foreshore? (Please tick all relevant)

Answered: 64 Skipped: 0



Answer Choices	Responses
Quiet beaches	56.25% 36
Safe swimming areas with seasonal patrols and swimming lessons	84.38% 54
Buildings (cafes, clubs, SLSC), ablution blocks, parking and playgrounds	75.00% 48
Places to safely launch recreational boats	53.13% 34
Important environmental sites and plant and animal communities	75.00% 48
Total Respondents: 64	

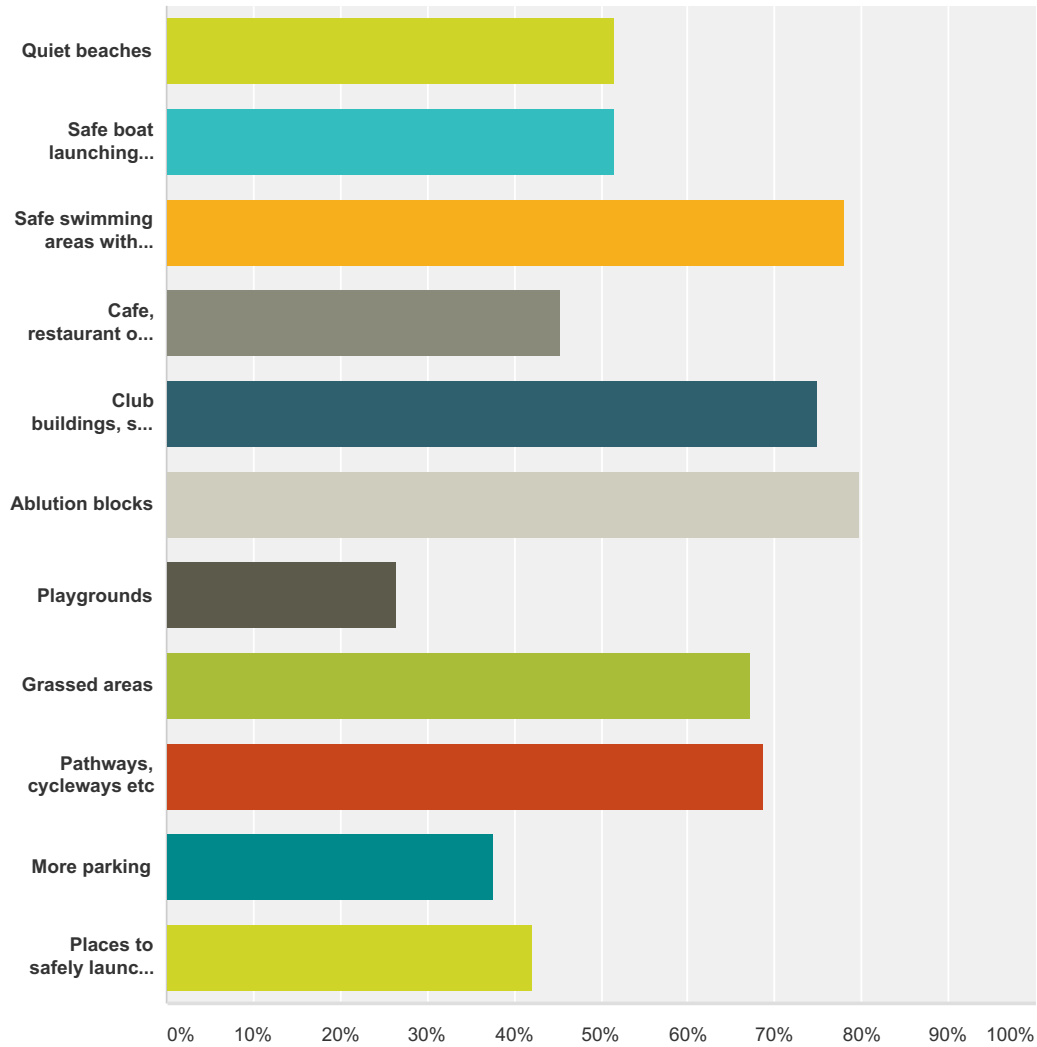
#	Other (please specify)	Date
1	Not playground. Shorebird protection at Prawn Rock Channel.	6/22/2017 3:10 PM
2	shore birds/migratory and resident	6/22/2017 3:04 PM
3	current surf club facilities very important	6/22/2017 2:59 PM
4	protecting adjacent flora	6/22/2017 2:32 PM
5	minimal traditional infrastructure - minimal traditional SLSC, functional ablution, grassed area for passive recreation	6/1/2017 11:27 PM
6	pedestrian access to areas	5/26/2017 3:26 PM
7	Boats launch facility elsewhere too unsafe here	5/25/2017 8:49 AM
8	A cafe or restaurant development on or overlooking Ocean Beach would spoil the area. The two clubs are enough and neither should encroach further into the vista.	5/19/2017 4:10 PM
9	should have vehicle access to beach out of tourist season	5/19/2017 11:25 AM

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10	if alternate boat launch areas can be provided elsewhere then boat access could be stopped or becomes less important	5/18/2017 3:55 PM
11	Safe launching for Sea Rescue, Relocate old SLSC building, NOT swimming lessons, Not playgrounds, lawn & BBQ	5/17/2017 8:35 AM
12	Recreational boat launches at limited hours (early morning)	5/16/2017 9:39 AM

**Q9 What facilities, uses or assets would you like to see at the beach and foreshore at Ocean Beach over the next 10 years?
(Please tick all relevant)**

Answered: 64 Skipped: 0



Answer Choices	Responses	
Quiet beaches	51.56%	33
Safe boat launching facilities and/or upgrades to existing facilities	51.56%	33
Safe swimming areas with seasonal patrols and swimming lessons	78.13%	50
Cafe, restaurant or kiosk	45.31%	29
Club buildings, surf lifesaving clubs	75.00%	48
Ablution blocks	79.69%	51
Playgrounds	26.56%	17

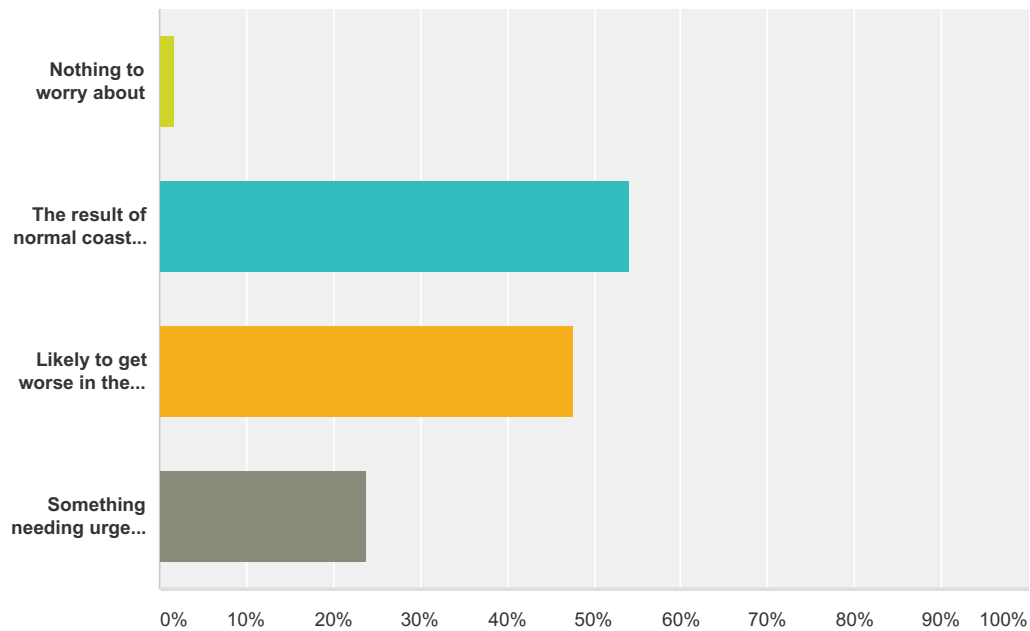
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Grassed areas	67.19%	43
Pathways, cycleways etc	68.75%	44
More parking	37.50%	24
Places to safely launch recreational boats	42.19%	27
Total Respondents: 64		

#	Other (please specify)	Date
1	BBQ at Ocean Beach. Minimal infrastructure but protection/fence for coastal dunes	6/22/2017 3:10 PM
2	BBQ	6/22/2017 3:04 PM
3	shade shelter in grassed area	6/22/2017 2:59 PM
4	BBQ	6/22/2017 2:36 PM
5	protecting adjacent vegetation	6/22/2017 2:32 PM
6	Possibly Cafe franchise within Surf Club	6/8/2017 10:30 AM
7	see above Q8	6/1/2017 11:27 PM
8	Boat launch facilities elsewhere too dangerous here	5/25/2017 8:49 AM
9	Maintain over beach launch as there is no local alternative, make track to beach safer with a footpath alongside. Better no-parking signs in lower turn around area.	5/19/2017 4:10 PM
10	if alternate boat launch areas can be provided elsewhere then boat access could be stopped or becomes less important	5/18/2017 3:55 PM
11	Protection of native vegetation along the coast.	5/17/2017 6:11 PM
12	Not swimming lessons, Launching for sea rescue, BBQ, kiosk (seasonal)	5/17/2017 8:35 AM
13	A proper boat launching facility - somewhere close to Ocean Beach if not in the current place. This is one of the biggest failures in this shire, the provision of safe boat launching facilities.	5/17/2017 6:41 AM
14	BBQs	5/16/2017 8:17 PM
15	Barbeques at Ocean Beach	5/16/2017 9:24 AM

Q10 Do you think erosion of the coast at Ocean Beach is (Please tick all relevant)

Answered: 63 Skipped: 1

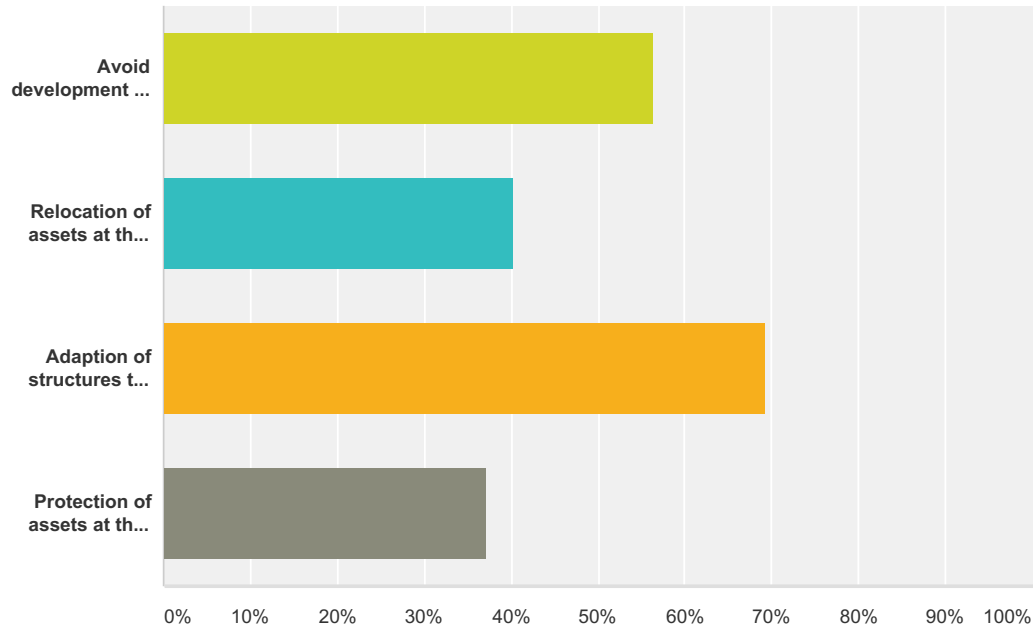


Answer Choices	Responses
Nothing to worry about	1.59% 1
The result of normal coastal processes	53.97% 34
Likely to get worse in the future	47.62% 30
Something needing urgent attention by the Shire	23.81% 15
Total Respondents: 63	

#	Other (please specify)	Date
1	Dune systems close to SLSC need protection	6/22/2017 3:10 PM
2	dune erosion due to people	6/22/2017 3:04 PM
3	Ocean Beach seems fairly stable	6/22/2017 2:59 PM
4	if existing vegetation is protected and left unburnt	6/22/2017 2:32 PM
5	situating SLSC and other infrastructure a sensible distance from intertidal zone is mandatory. intervention e.g hard armouring is PROVEN ineffective with unintended consequences	6/1/2017 11:27 PM
6	However, sea level rise and declining rainfall is likely to have significant impacts on erosion and depositional processes	5/27/2017 6:27 PM
7	Don't really know	5/19/2017 9:39 AM
8	There is not that much erosion.	5/17/2017 4:14 PM
9	Relocate old SLSC building, more grass area	5/17/2017 8:35 AM
10	build up of sand causing expansion of shallows appears to be effecting the hydrology of the beach	5/17/2017 8:03 AM
11	Seems to be due to the deliberate opening of the inlet. Perhaps if the inlet was allowed to operate naturally or the inlet was opened in line with the channel on the east side then there would be better data on coastal erosion in front of the beach/surf club.	5/17/2017 6:41 AM

Q11 What options would you like the Shire to consider to adapt to coastal erosion over the next 50 years? (Please tick all relevant)

Answered: 62 Skipped: 2



Answer Choices	Responses	
Avoid development in coastal areas of potential future coastal erosion	56.45%	35
Relocation of assets at the coast exposed to erosion (ie planned or managed retreat)	40.32%	25
Adaption of structures to accommodate erosion (eg beach access stairs)	69.35%	43
Protection of assets at the coast exposed to erosion	37.10%	23
Total Respondents: 62		

Q12 Is there anything else you would like to add about the value of the beach and foreshore at Ocean Beach?

Answered: 30 Skipped: 34

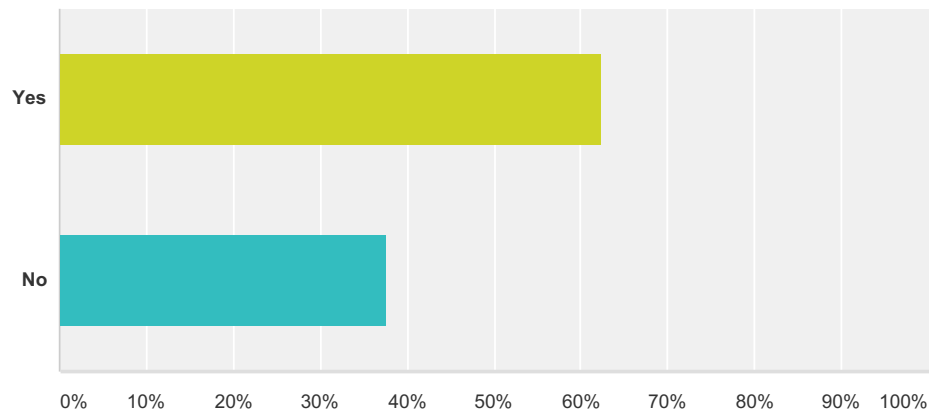
#	Responses	Date
1	Keep it as natural as possible. No more "Hazard signs" - there are already too many. Prawn Rock Channel - informative signs about the shorebirds and the threats posed by dogs. No future development/buildings along foreshore area. I do not want to see any development between Ocean Beach and Lights Beach - particularly roads. Recycling bins during peak season (minimum). Shade shelters - during summer months.	6/22/2017 3:10 PM
2	Protection of shorebirds both migratory and resident from threats such as people, dogs, horses, vehicles. Birds breed and feed in the Prawn Rock Channel dog exercise area!	6/22/2017 3:04 PM
3	No jetties or boat launching slipways! Could change beach dynamics with serious consequences!!	6/22/2017 2:59 PM
4	Ocean Beach and adjacent coast is in very good condition, if existing vegetation and man made structures are maintained and improved the long term future of Ocean Beach should be able to cope with increased population. However, if fire whether deliberate or poor capacity to suppress is allowed to damage the coast then erosion will have a severe impact. I believe it is most important that the natural character currently existing with beaches and coastal reserves under the control of the Shire of Denmark be valued and maintained, in time this undeveloped or unmanaged landscapes will become valuable tourist and local assets. Interestingly this careful and respectful form of land care is very different to that now used by DPaW whereby spectacular natural icons are being developed radically to attract tourists and gain money with entry fees while the balance of National Parks and reserves within DPaW's control are set ablaze and species become extinct, if Denmark's natural environment is treated with respect it will become a valuable asset to our community. Good luck with your valuable work.	6/22/2017 2:32 PM
5	It would be lovely to have a restaurant near the beach that remains open all year.	6/8/2017 10:33 AM
6	Given projected population increases human pressures will only increase on this relatively small area (the study area). Additionally there are limited alternatives for people wanting to enjoy the coast. William Bay is obviously an alternative but the activities that occur in the two areas have different levels of involvement -eg Ocean beach is very important for surfing, William Bay less so. Protecting the coastline and managing competing uses will not be easy. Dynamic and adaptive planning is required. With regard to question 8, it is unclear what it is meant by "quiet beaches". ie - no noisy activities like jet ski's of areas of beach not heavily used? If "maintaining environmental sites" means all the existing dunes etc this will not be practical nor achievable given this steady increase in demand for access to the area.	6/5/2017 11:59 AM
7	Ocean Beach must be acknowledged as a local , regional and perhaps international asset - but it should be remembered that the drawback for the myriad of locals and outside visitors is the laid back, traditional Australian beach experience with only enough development to ensure safety and cleanliness	6/1/2017 11:27 PM
8	I really believe a quick rescue response of a jet ski at the all times either by the surf club or sea rescue for the increase in rescues for the future. Many unrecorded rescues by surfers occur and will increase.	5/28/2017 3:21 PM
9	Natural and undeveloped coast lines and beaches are a significant part of the appeal of the south coast, low impact (ie pedestrian) access should be maintained in all areas, motorised access should likely be restricted in various areas	5/26/2017 3:26 PM
10	BBQ and picnic facilities Protect dunes by fencing off	5/25/2017 8:49 AM
11	Better facilities for Denmark Surf Life Saving Club. They do a wonderful job with limited facilities.	5/20/2017 10:55 AM
12	The growth of the sand dune to the east of the opening due to marron grass (and those against an eastern opening) could have further impact on erosion at the beach by taking sand out of the system.	5/19/2017 4:10 PM
13	prime area should have development to suit all beach users and vehicle access to alban end of beach out of tourist season like it use to be when channel is closed. beach access could be easily made by track down beach from prawn rock channel lookout to beach (limestone base easy make track) to be open at given times. No need then to go past surf club area and opens mostly unused area of beach to people for activities prawning/fishing specially at night	5/19/2017 11:25 AM
14	Just keep it simple- no boat launch, no JetSki use, no cafe needed as there are plenty in Denmark.	5/19/2017 9:39 AM
15	It is a significant tourist destination and needs management	5/18/2017 8:25 PM
16	It is one of Denmark's greatest assets as it exists today and steps need to be taken to preserve it with very minimal further development	5/18/2017 6:33 PM

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17	I would love to see more awareness of litter and how it affects the ecosystem and particularly animal life. I regularly pick up rubbish at OB - a lot of is made up of deteriorating fishing nets, plastic drink bottle lids, bait bags and cigarette butts when the fishermen are on the rocks. I also think visitors love the beach in its undeveloped state. I personally would hate to see it developed too much more than it is - sensitive low impact development is critical to maintain the character of the main Denmark beach and the town in general.	5/18/2017 6:22 PM
18	Enhancement of the Surf Life Saving Facilities for club and community use and potential future commercial opportunities (café), also surrounding precinct (pathways, parking, access, landscape, lighting and public amenities)	5/17/2017 7:53 PM
19	At some times of the year mainly winter there is considerable erosion that only impacts beach access and summer seabreeze s/e winds returns sand to the beach. Money would be better spent on the wilson inlet health	5/17/2017 7:08 PM
20	Every once in a while the beach does wash away, but this is part of a seasonal natural process. Severe storms usually emphasise this, as do the tides. The beach and foreshore are well managed. Please don't do anything unnecessary.	5/17/2017 4:14 PM
21	The Ocean Beach area has a variety of habitat values and coastal vegetation/landscape types. Risk management should look at all the types separately as they have different hazards.	5/17/2017 12:09 PM
22	Don't play "god" by fighting nature. Encourage walking, cycling to get to the beach. Storms and erosion are part of nature ... have greater setbacks for buildings. Redesign access or be prepared to loose and re make.	5/17/2017 8:35 AM
23	The Surf Club is a value asset as it allows the community life savers to keep our beach safe and to educate and strengthen our kids and communities.	5/16/2017 8:17 PM
24	Erosion at Ocean Beach during winter is part of the natural cycle, it is probably getting worse due to rising sea levels hence the impact on facilities currently in-situ. There is nothing that can be realistically done to protect these facilities, sea protection will only move the erosion along the coast.	5/16/2017 2:25 PM
25	one of the shires greatest assets as far as tourism visitors like a beach that is patrolled .and one of the best beaches for young surfers to learn. so keep what is there for future generations.	5/16/2017 1:59 PM
26	Tick first three boxes for question 11 Limit recreational jetski and boat use to certain hours of the day Reassess the area where many surfers park to watch the waves (Boat launch area)	5/16/2017 9:39 AM
27	Keep it in its natural state. That's why people visit Denmark for.	5/16/2017 9:37 AM
28	Dog access to the beach should be retained all year round. Limit the use of jet skis in the bay and inlet and ensure that the beach is a facility that should be available to ALL members of the community and not exculively the domain of any specific group.	5/16/2017 9:32 AM
29	Ocean beach should also extend to past prawn channel and improve the foreshore overlooking the inlet. A coffee shop with deck overlooking the inlet could be considered. Perhaps located opposite the caravan park so that it gets good patronage and therefore viable	5/16/2017 9:29 AM
30	I think it is important to establish access to encourage use of areas but reduce risk of people forging their own access. But some areas should be restricted to 4WD only to protect coastal processes/environmental values from excessive disturbance.	5/16/2017 9:27 AM

Q1 Do you live in the Shire of Denmark?

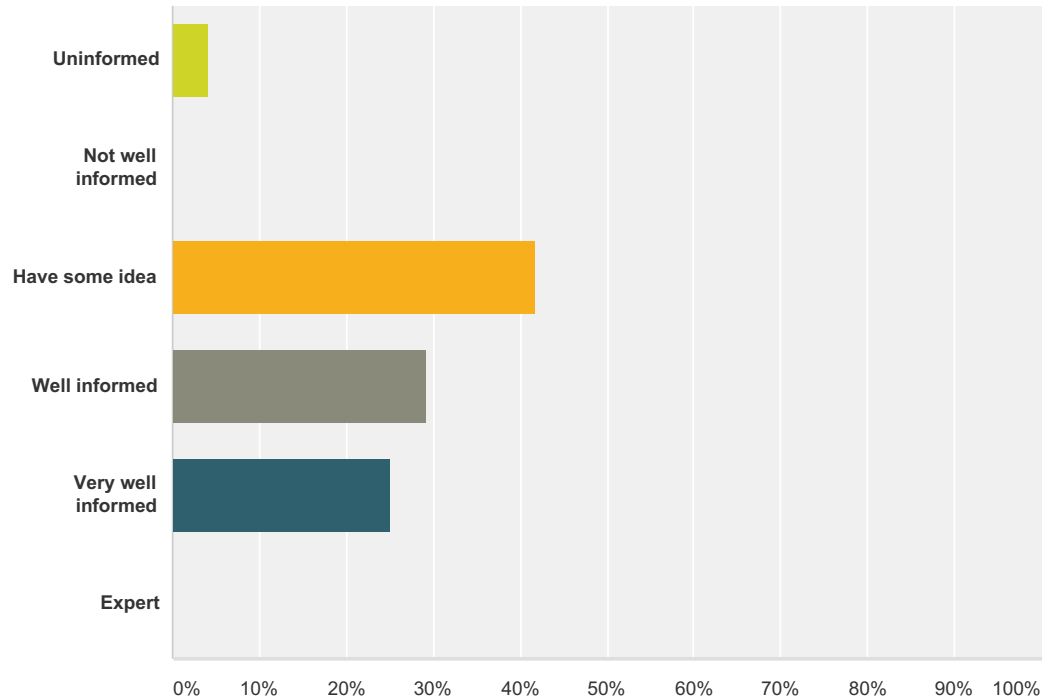
Answered: 24 Skipped: 0



Answer Choices	Responses	
Yes	62.50%	15
No	37.50%	9
Total		24

Q2 How well informed do you consider yourself to be on coastal impacts(eg erosion, storm surges) that may happen due to rising sea levels?

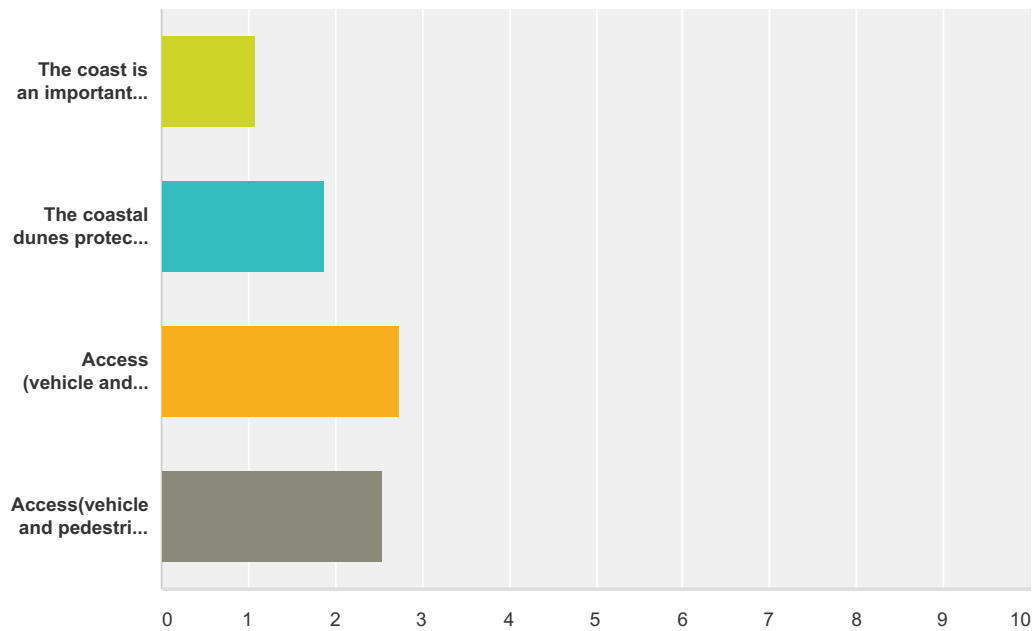
Answered: 24 Skipped: 0



Answer Choices	Responses	
Uninformed	4.17%	1
Not well informed	0.00%	0
Have some idea	41.67%	10
Well informed	29.17%	7
Very well informed	25.00%	6
Expert	0.00%	0
Total		24

Q3 How much do you agree with the following statements?

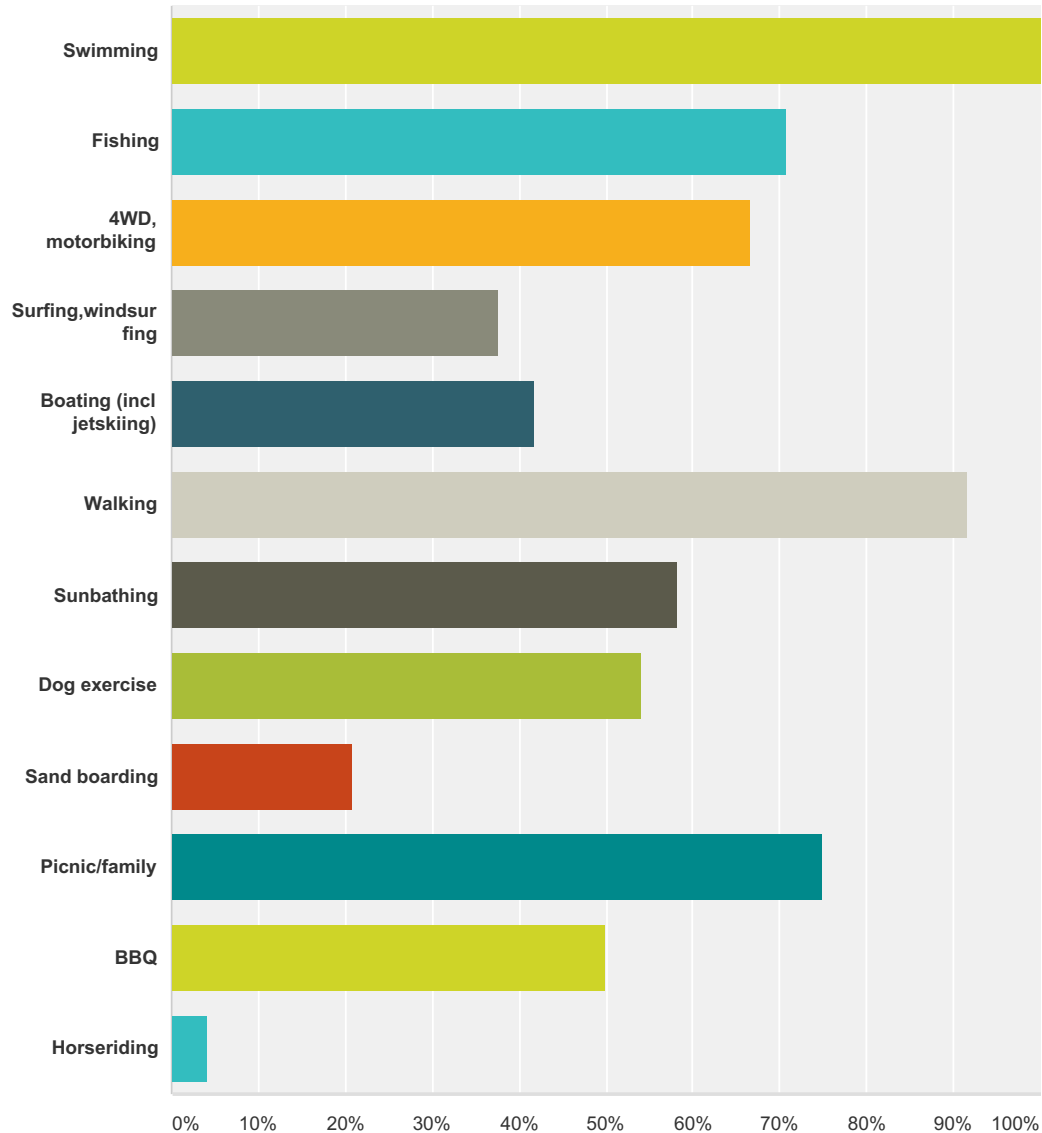
Answered: 24 Skipped: 0



	Strongly agree	Agree	No clear opinion	Disagree	Strongly disagree	Total	Weighted Average
The coast is an important part of the Shire of Denmark's lifestyle	91.67% 22	8.33% 2	0.00% 0	0.00% 0	0.00% 0	24	1.08
The coastal dunes protect private and public property	47.83% 11	34.78% 8	4.35% 1	8.70% 2	4.35% 1	23	1.87
Access (vehicle and pedestrian) should be provided to all parts of the coast	31.82% 7	18.18% 4	0.00% 0	45.45% 10	4.55% 1	22	2.73
Access(vehicle and pedestrian) should only be provided to specific areas of the coast	20.83% 5	50.00% 12	0.00% 0	12.50% 3	16.67% 4	24	2.54

Q4 What are your main activities at the Peaceful Bay beach and foreshore? (tick all that are relevant)

Answered: 24 Skipped: 0



Answer Choices	Responses	
Swimming	100.00%	24
Fishing	70.83%	17
4WD, motorbiking	66.67%	16
Surfing, windsurfing	37.50%	9
Boating (incl jetskiing)	41.67%	10
Walking	91.67%	22

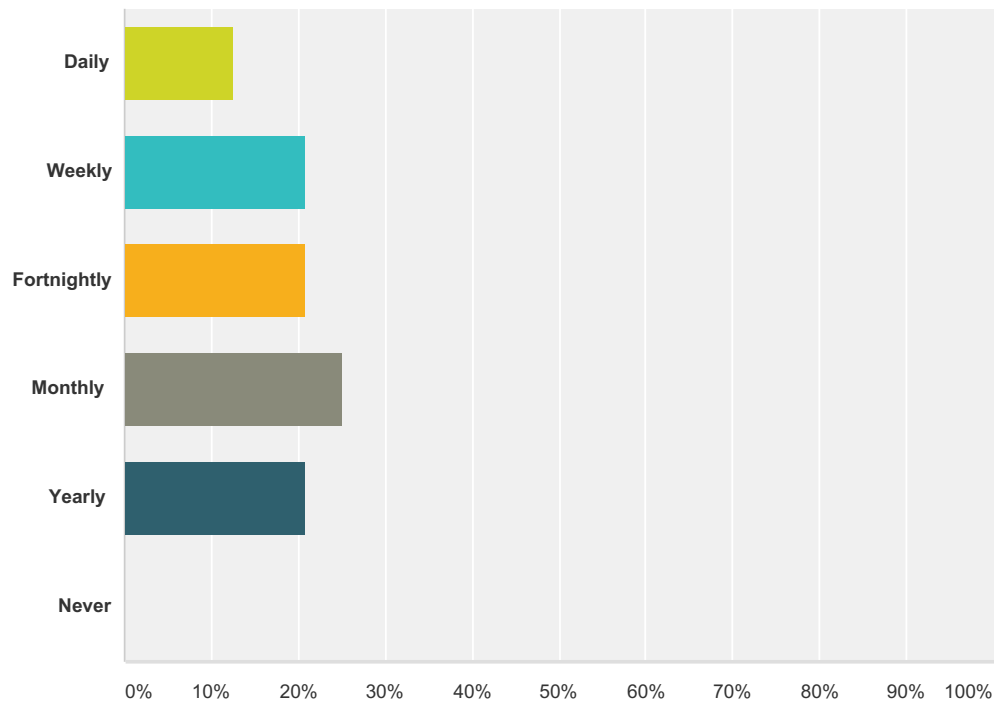
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Sunbathing	58.33%	14
Dog exercise	54.17%	13
Sand boarding	20.83%	5
Picnic/family	75.00%	18
BBQ	50.00%	12
Horseriding	4.17%	1
Total Respondents: 24		

#	Other (please specify)	Date
1	camping	6/22/2017 2:01 PM
2	camping	6/22/2017 1:59 PM
3	snorkelling and scuba diving	5/21/2017 3:25 PM
4	Peaceful Bay Memorial services	5/16/2017 11:56 AM

Q5 How often do you visit the beach and foreshore at Peaceful Bay?

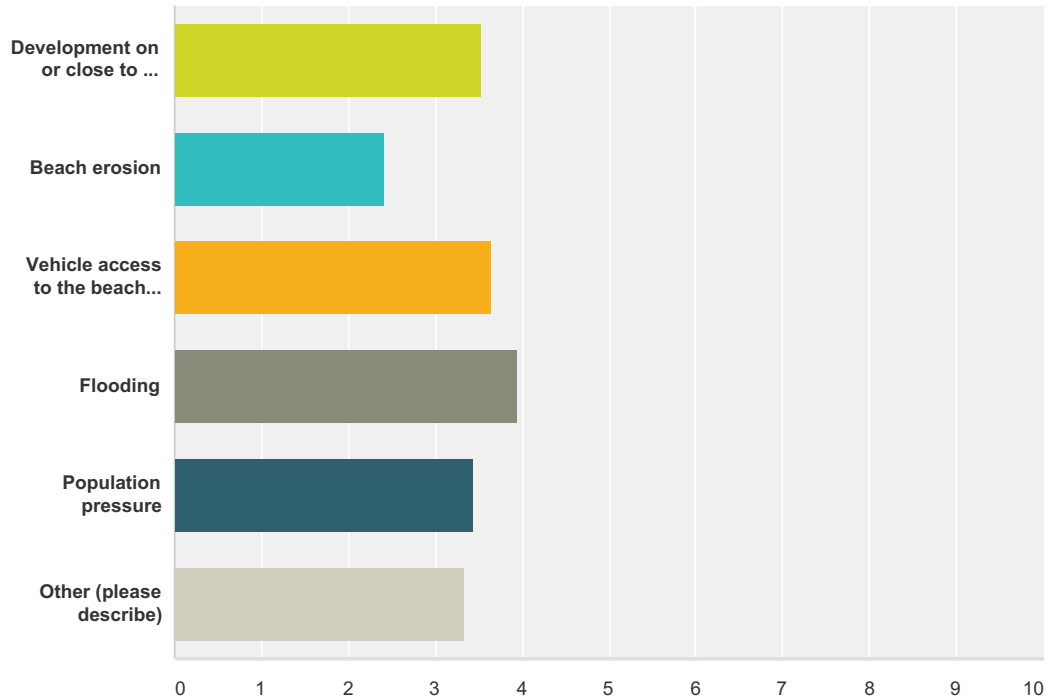
Answered: 24 Skipped: 0



Answer Choices	Responses	
Daily	12.50%	3
Weekly	20.83%	5
Fortnightly	20.83%	5
Monthly	25.00%	6
Yearly	20.83%	5
Never	0.00%	0
Total		24

Q6 Which of these activities currently impact your use of the coastal areas of Peaceful Bay? (Please rank the threats from 1 to 5 with 1 being a great threat and 5 being no threat)

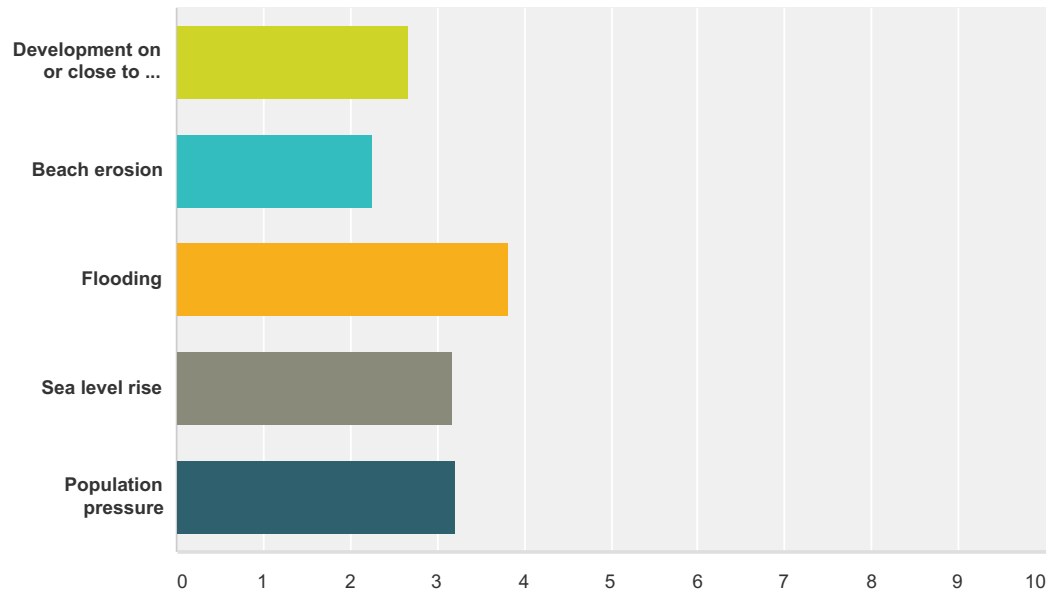
Answered: 23 Skipped: 1



	1	2	3	4	5	Total	Weighted Average
Development on or close to the beach	13.04% 3	17.39% 4	4.35% 1	34.78% 8	30.43% 7	23	3.52
Beach erosion	39.13% 9	8.70% 2	30.43% 7	13.04% 3	8.70% 2	23	2.43
Vehicle access to the beach and dunes (4WD's, motorbikes)	13.04% 3	13.04% 3	8.70% 2	26.09% 6	39.13% 9	23	3.65
Flooding	4.76% 1	9.52% 2	19.05% 4	19.05% 4	47.62% 10	21	3.95
Population pressure	9.09% 2	18.18% 4	18.18% 4	27.27% 6	27.27% 6	22	3.45
Other (please describe)	33.33% 2	0.00% 0	16.67% 1	0.00% 0	50.00% 3	6	3.33

Q7 Which threats/activities do you think are likely to impact the coastal areas of Peaceful Bay in the future? (Please rank the threats from 1 to 5 with 1 being a great threat and 5 being no threat)

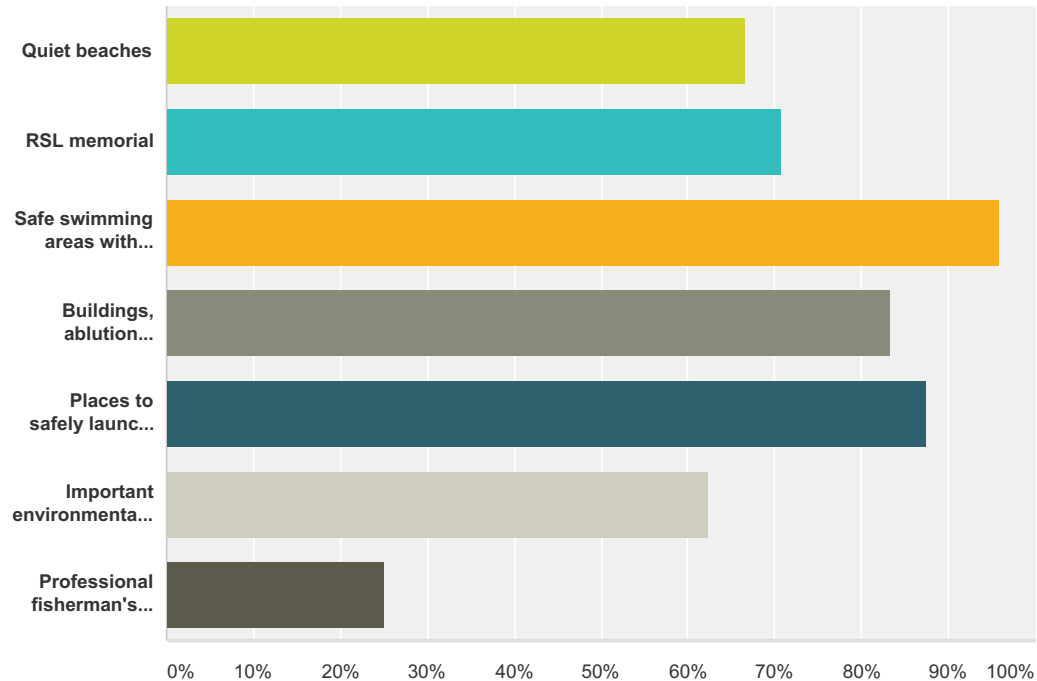
Answered: 24 Skipped: 0



	1	2	3	4	5	Total	Weighted Average
Development on or close to the beach	29.17% 7	16.67% 4	25.00% 6	16.67% 4	12.50% 3	24	2.67
Beach erosion	37.50% 9	20.83% 5	25.00% 6	12.50% 3	4.17% 1	24	2.25
Flooding	4.35% 1	8.70% 2	26.09% 6	21.74% 5	39.13% 9	23	3.83
Sea level rise	4.35% 1	21.74% 5	34.78% 8	30.43% 7	8.70% 2	23	3.17
Population pressure	13.04% 3	26.09% 6	17.39% 4	13.04% 3	30.43% 7	23	3.22

Q8 Which of these uses or assets do you think should be safeguarded so they continue to be available at the Peaceful Bay beach and foreshore? (Please tick all relevant)

Answered: 24 Skipped: 0



Answer Choices	Responses
Quiet beaches	66.67% 16
RSL memorial	70.83% 17
Safe swimming areas with seasonal patrols and swimming lessons	95.83% 23
Buildings, ablution blocks, parking and playgrounds	83.33% 20
Places to safely launch recreational boats	87.50% 21
Important environmental sites and plant and animal communities	62.50% 15
Professional fisherman's shack/lease area	25.00% 6
Total Respondents: 24	

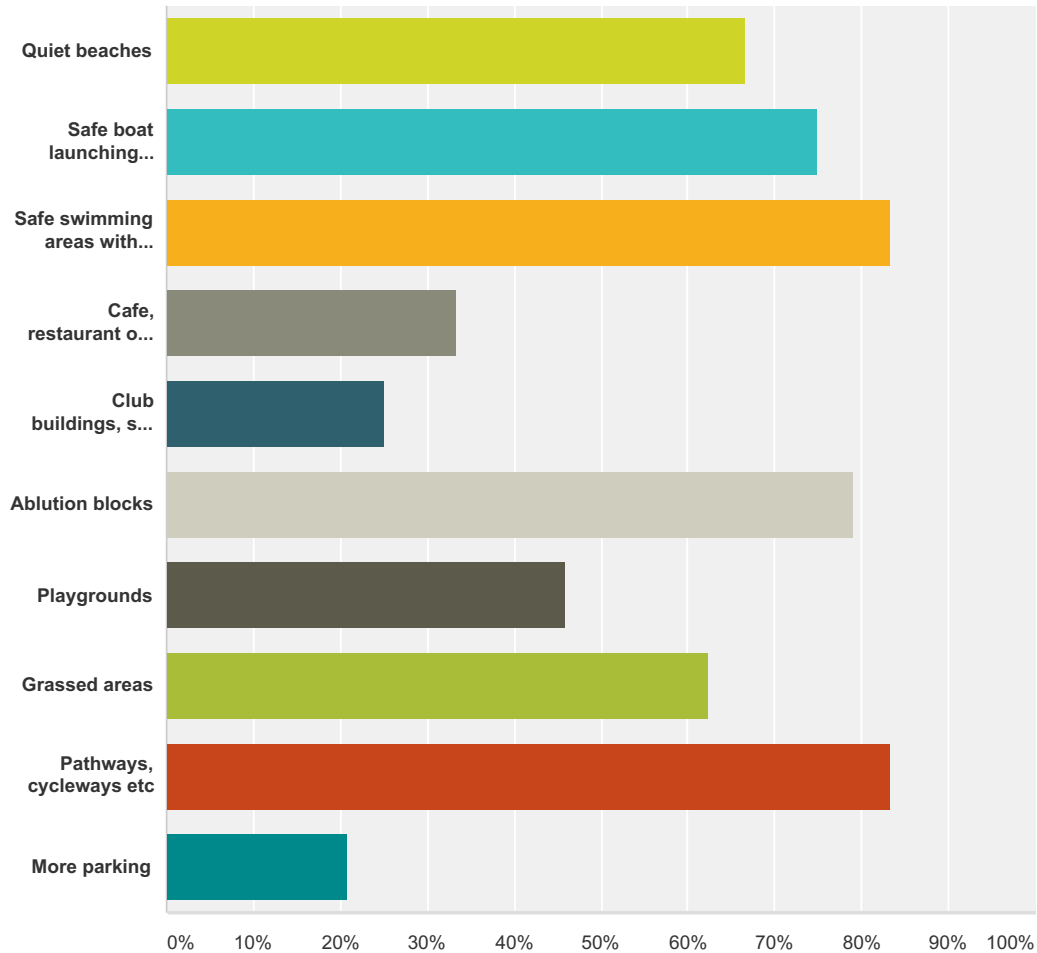
#	Other (please specify)	Date
1	Fishermans shack should be upgraded or moved to a more industrial type site	6/2/2017 4:27 PM
2	RSL memorial should be shifted to Tingleddale Hall.	6/2/2017 1:24 PM
3	Maintain access to estuary along beach	5/16/2017 9:32 PM
4	Dog walking and horse riding	5/16/2017 8:51 PM

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5	With regard to No.3 - What seasonal patrols? With regard to Nos 2&7 if these assets erode away the road into Peaceful Bay will be at great risk..	5/16/2017 8:11 PM
6	Vehicle access to beach and inlet	5/16/2017 1:37 PM

Q9 What facilities, uses or assets would you like to see at the Peaceful Bay beach and foreshore over the next 10 years? (Please tick all relevant)

Answered: 24 Skipped: 0



Answer Choices	Responses
Quiet beaches	66.67% 16
Safe boat launching facilities and/or upgrades to existing facilities	75.00% 18
Safe swimming areas with seasonal patrols and swimming lessons	83.33% 20
Cafe, restaurant or kiosk	33.33% 8
Club buildings, surf lifesaving club	25.00% 6
Ablution blocks	79.17% 19
Playgrounds	45.83% 11
Grassed areas	62.50% 15
Pathways, cycleways etc	83.33% 20

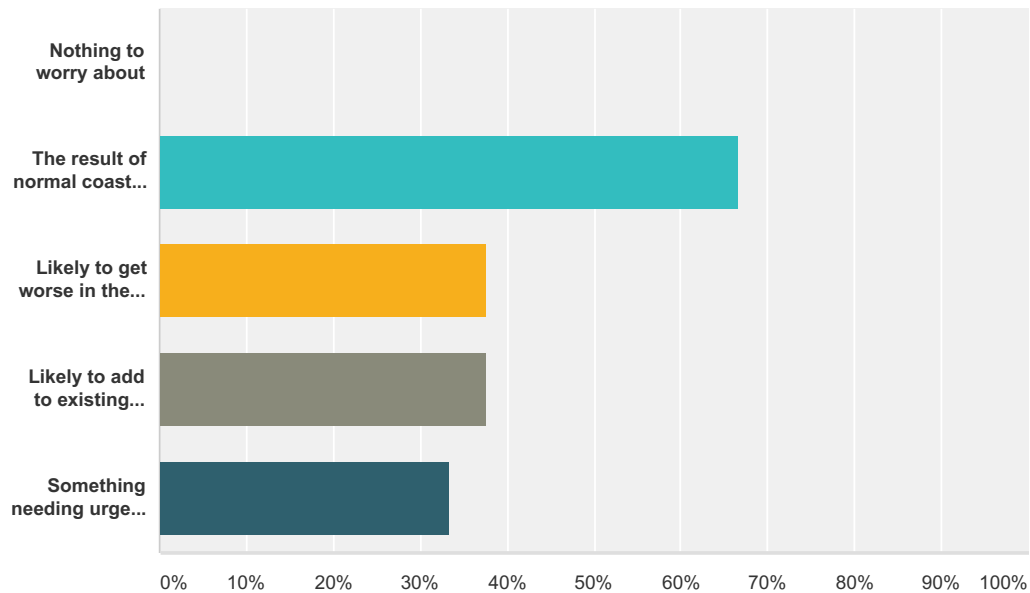
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More parking	20.83%	5
Total Respondents: 24		

#	Other (please specify)	Date
1	Protect native vegetation and avoid fire.	6/22/2017 1:51 PM
2	Large boat service jetty and marina	6/2/2017 1:24 PM
3	Not more of most, just retain what is there. Club building as planned as a combined facility, not more individual buildings.	5/16/2017 11:56 AM
4	Bbq areas	5/16/2017 9:01 AM

Q10 Do you think erosion of the coast at Peaceful Bay is (Please tick all relevant)

Answered: 24 Skipped: 0

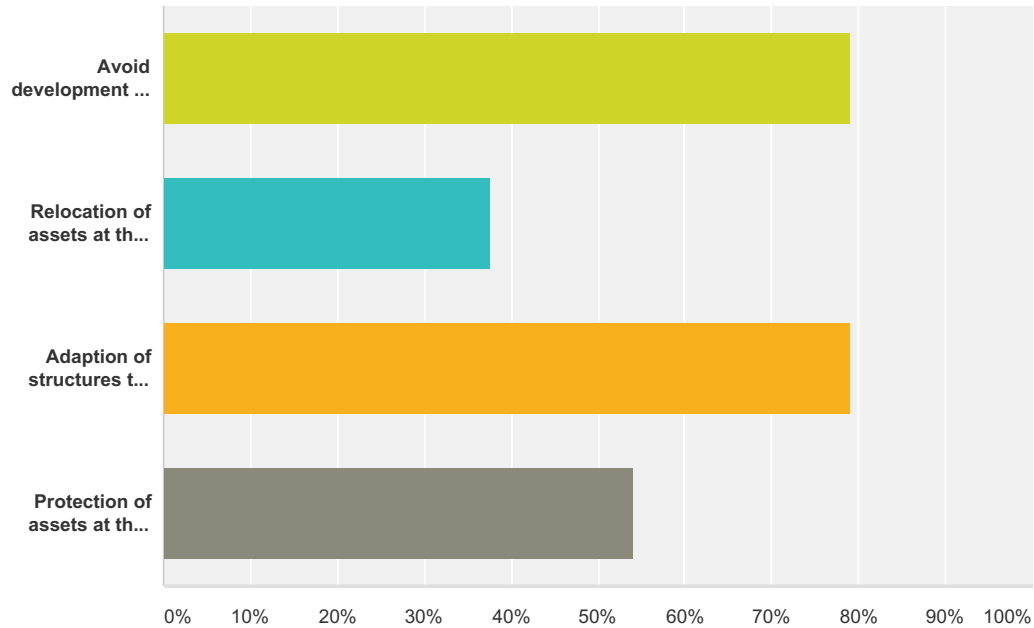


Answer Choices	Responses
Nothing to worry about	0.00% 0
The result of normal coastal processes	66.67% 16
Likely to get worse in the future	37.50% 9
Likely to add to existing damage	37.50% 9
Something needing urgent attention by the Shire	33.33% 8
Total Respondents: 24	

#	Other (please specify)	Date
1	Needs to be monitored	6/2/2017 4:27 PM
2	Problem could be fixed easily and inexpensively.	6/2/2017 1:24 PM
3	To protect the RSL site only	5/16/2017 1:37 PM
4	I have been a regular resident and visitor to Peaceful Bay for 60 + years. The introduction of marram grass had a huge impact on the beach and interfered with normal sand movement, particularly in Foul Bay and on the swimming beach headland. Valuable anecdotal information will come from long term residents/users and fishermen. Vehicles should not be permitted anywhere near the southern headland of the swimming beach. Barriers should be introduced to stop people taking quad bikes along the swimming beach to the headland.	5/13/2017 8:59 AM

Q11 What options would you like the Shire to consider to adapt to coastal erosion over the next 50 years (Please tick all relevant)

Answered: 24 Skipped: 0



Answer Choices	Responses	
Avoid development in areas of potential future coastal erosion	79.17%	19
Relocation of assets at the coast exposed to erosion (ie planned or managed retreat)	37.50%	9
Adaption of structures to accommodate erosion (eg beach access stairs)	79.17%	19
Protection of assets at the coast exposed to erosion	54.17%	13
Total Respondents: 24		

Q12 Is there anything else you would like to add about the value of Peaceful Bay beach and foreshore?

Answered: 11 Skipped: 13

#	Responses	Date
1	Peaceful Bay is an icon of this region and of immense value to the young and old. Development must not damage this beautiful beach. The Denmark Council must avoid the policy of DPaW whereby tourist icons are developed and managed as an income asset with entry fees. It's obscene! Peaceful Bay is where I learnt to swim in the early 1960s. Tom's Rock was a goal to swim around and diver from. It's a beautiful place. The beach to the east with vehicle access and Salmon Camp could easily become the Denmark's Community's boat launching asset with careful construction in a fashion that did not alter the character of this beach in an aggressive manner. Peaceful Bay must not be impacted by this development at all I believe. Good luck with your valuable work.	6/22/2017 1:51 PM
2	Town and caravan park close to protected beaches. Need disabled acces to beach	6/2/2017 4:27 PM
3	Denmark Shire should install a marina similar to the one at Augusta. You could have cruise ships anchoring in the Lee of point Irwin. Tendering its passengers ashore to visit the Tree Walk and Tourist Spots throughout the shire. Imagine the economic value this would bring to the local economy.	6/2/2017 1:24 PM
4	reduction in vehicle access to sensitive dune areas	5/21/2017 3:25 PM
5	The finger jetty makes it safer to launch boats in the bay. However, the lack of depth in the water and shallow, flat beach makes retrieval of larger boats difficult. A better form of launching facility would assist and encourage visitors to the bay, that would only enhance the businesses in the area. Boat launching facilities, for anything larger than a dinghy, are appalling in the Shire of Denmark.	5/17/2017 6:46 AM
6	When the erosion is part of nature humans need to leave it alone. When it is the result of humans, esp during high usage times, it needs to be more strongly regulated. Ie. People showing no respect for the place they are visiting, driving way too fast on the beach and leaving rubbish. I don't think the dunes right on the beach necessarily need protection as these will erode/wash away with winter swells and high tides anyway.	5/16/2017 8:51 PM
7	The value is the beach and foreshore itself and structures and developments should be avoided anywhere near these natural assets.	5/16/2017 8:11 PM
8	As long as easy beach access remains available for vehicles and maintained boardwalks/steps, it will remain a more natural attraction which is its best asset.	5/16/2017 1:37 PM
9	While protection of assets is desirable, (Point 11) I do not believe groins are advisable. They only shift the problem to elsewhere and can even make it worse.	5/16/2017 11:56 AM
10	i feel the welfare of the beach and surrounds should be held in higher regard than the comfort or convience of humans. No further development ie clubs, cafes etc. I feel money should be spent on preserving the beauty of Peaceful and to minimise the impact of erosion.	5/16/2017 7:33 AM
11	The fisherman's huts are part of the history of Peaceful Bay and should be retained. Long drop toilets would be an advantage near the surf rescue building. Rubbish bins should be provided for people who collect marine debris, with appropriate signage. Removal of marram grass is now impossible but serves as a good warning that human interference can have massive impact.	5/13/2017 8:59 AM



Coastal Hazards Issues Paper



OCEAN BEACH and PEACEFUL BAY Shire of Denmark

The Shire of Denmark is undertaking a Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) for Ocean Beach and Peaceful Bay. The CHRMAP will influence the development of 10-year Concept Plans for the beach and foreshore at both sites. This ISSUES PAPER outlines the results of the initial coastal hazard assessment associated with beach erosion and long term coastal change.

Feedback on the planning and management of coastal assets at Peaceful Bay and Ocean Beach is being sought via a community survey.



SYNOPSIS

The WA State Coastal Planning Policy notes that coastal hazard risk management and adaptation planning (CHRMAP) should be undertaken in areas at risk of being affected by coastal hazards over a 100-year planning timeframe (WAPC 2013).

This is a risk based approach to coastal adaptation planning that requires local governments in Western Australia to consider the following adaptation hierarchy:

- *Avoid* new development in areas subject to impacted by coastal processes.
- *Managed Retreat* - removing assets subject to intolerable risk of damage.
- *Accommodation* - adapting assets to suitably address the identified risks.
- *Coastal Protection* works to protect vital assets not suitable for other actions through construction of groynes, seawalls and other works.

The present study focuses on those portions of the Ocean Beach and Peaceful Bay coastlines with the highest value assets. This includes built assets (i.e. coastal infrastructure, buildings) and natural assets (i.e. the sandy beach, coastal dunes).

This issues paper outlines the results of the coastal hazard assessment and key management and adaptation issues that will be considered in the CHRMAP. Ultimately, as part of the CHRMAP process, 10-year Concept Plans will be developed for the Ocean Beach and Peaceful Bay beach and foreshore.

Coastal Hazards

A hazard assessment of the sites has been undertaken to develop allowances for potential erosion due to coastal processes. This required assessment of the current risk of storm erosion (S1), historic shoreline movement trends (S2) and future sea level rise (S3). S1 and S2 allowances have been developed from modeling and historic analysis, while the S3 allowance for sea level rise is based on values identified in the State Coastal Planning Policy (SPP2.6). The concept for the assessment of coastal processes allowances under SPP2.6, including the required factor of safety (FOS) from the horizontal setback datum (HSD), is shown in Figure 1.

Allowances for coastal process have been assessed for the 20, 50 and 100-year planning timeframes at Ocean Beach and Peaceful Bay. Maps have been developed identifying broad areas where consideration is required of the potential impact of coastal processes on existing structures, or planned future development.

This analysis will allow the management and future planning of this highly valued public coastal environment, which is a dynamic system subject to natural cycles of erosion and recovery, to be undertaken in a sustainable manner. Management options may include adaptation of structures, appropriate siting of new public amenities and improved coastal monitoring.



Figure 1: Concept for the assessment of coastal processes allowances under SPP2.6 as applied to Gracetown Beach for Augusta Margaret River CHRMAP.



Ocean Beach

Ocean Beach is an east facing high-energy sandy beach popular for swimming, surfing and boating; and has been subject to coastal erosion in the late 1990's, 2013 and 2016. Coastal infrastructure and beach access is provided along a 400m section at the southern end of the beach, between the granite rock outcrops and the entrance to the seasonally open Wilson Inlet. This is the main recreational ocean beach for the Town of Denmark and is used for commercial and club based activities. Redevelopment of the Surf Life Saving Club is proposed at some time in the future.



Figure 2: Ocean Beach During Reconnaissance Site Inspection (June 2016)

Allowance for Coastal Processes

To identify historic storms with high water levels or high waves, 11 years of wave records and 29 years of water level records were assessed from Albany, the closest available records. Cross-shore beach erosion modeling for a 1 in 100yr event was undertaken using the USACE's SBEACH one-line model at a typical beach profile along Ocean Beach. The initial (pre-storm) and final (post-storm) beach profiles output from the model are shown in Figure 3. The assumed allowance for Acute Storm Erosion (S1) was 16 meters.

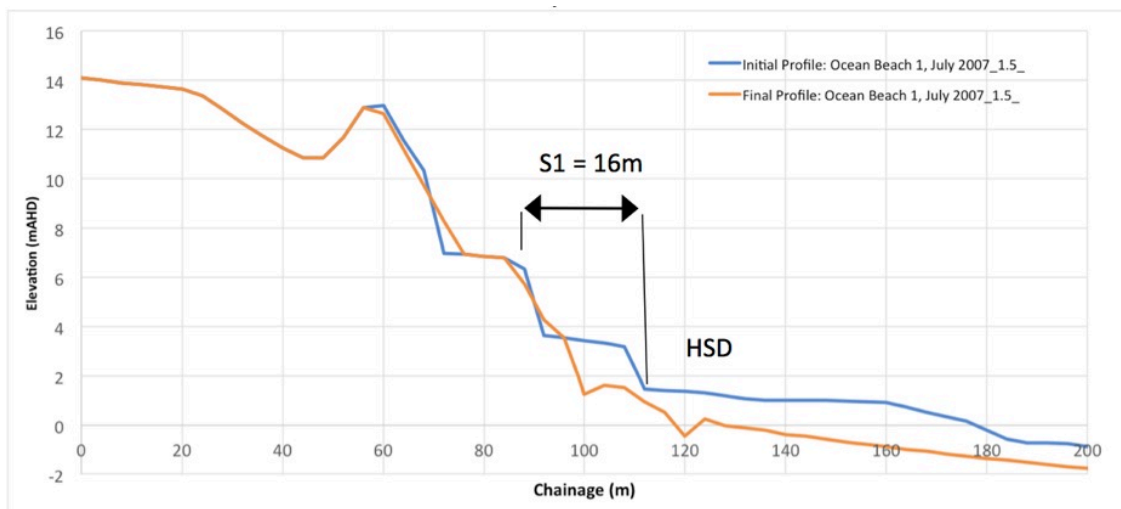


Figure 3: SBEACH erosion model for 100-year average return interval storm.

Note: HSD = Horizontal Setback Datum

The historic shoreline movement trends at Ocean Beach have been assessed based on aerial imagery provided by the Shire from 2002, 2006, 2010, 2014 & 2016 (Figure 4). The following was noted based on the assessment of 4 profiles:

- The vegetation line has eroded about 7 meters in the profile south of the Denmark Surf Life Saving Club (Denmark SLSC) club since 2002. The nature of this erosion may be episodic, and



there is capacity for the dunes to recover between events, however historically this represents a net erosion trend in the order of 0.5m/year.

- Net erosion has not occurred at the Denmark SLSC due to the timber seawall.
- The beach to the north near the entrance has been relatively stable due to rock controls along the back of the beach limiting the landward extent of erosion.

The assumed allowance over a 100-year planning period for Historic Shoreline Movement Trends (S2) was 50 meters. The policy also requires an additional factor of safety of 20m for the 100-year planning period.

The allowance erosion due to future sea level rise (S3) is based on the requirements of State Planning Policy 2.6 for a sandy coast of 90 meters (100 times the adopted sea level rise value of 0.9m over a 100-year timeframe).

The allowances for Coastal Processes at Ocean Beach for the 20, 50 and 100 year planning periods (S1 + S2 + S3), including the required factor of safety, are summarised in Table 1.

Table 1 – Ocean Beach Allowances for Coastal Processes

Planning Timeframe	10 year	50 year	100 year
Coastal Processes Allowances (m)	20	85	175

Key issues for consideration in the risk management and adaptation phase of the CHRMAP for Ocean Beach include:

- The design and present condition of the timber seawall and its capacity to provide longer-term protection. This wall provides important protection to the old Denmark SLSC building.
- Ocean Beach has a number of structures located relatively high on the seaward face of steep dunes. The risk of reduced foundation capacity for these structures following an erosion event, due to slope stability issues, requires consideration.
- Beach access infrastructure is presently subject to ocean forces. Adaptation of these assets may be required in order to maintain a high level of public beach access.
- Future Denmark SLSC development requires careful consideration of coastal processes.
- The presence or otherwise of buried rock.
- The interplay between Wilson Inlet and the beach.



Figure 4: Ocean Beach during a storm in September 2016 and Peaceful Bay Beach Access Stairs



Figure 5: Historic Aerial Imagery for Ocean Beach



Peaceful Bay

Peaceful Bay is a smaller settlement west of the Town of Denmark with a lower energy sandy beach. A small sheltered pocket beach provides a relatively calm swimming beach and beach launching for recreational vessels, while there is a longer eroding sandy beach to the north.

The coastline north of the Peaceful Bay boat launching area, in Foul Bay, has eroded approximately 15 m between 2002 and 2014, resulting in the retreat of sheds from a Fishermen's lease area. If the current rate of erosion continues, the Shire is concerned about future threats to Peaceful Bay Road, which is an access route for the townsite.



Figure 6: Sandy Beaches at Peaceful Bay (L) and Foul Bay to the North of the Boat Launching Area (R) During Reconnaissance Site Inspection (June 2016)

Allowances for Coastal Processes

The Shire provided site photos from historic storm erosion events. Whilst scarping is apparent in the swimming beach foredunes at Peaceful Bay following storms, higher and more persistent erosion scarps are apparent along the beach to the north of the boat ramp within Foul Bay.

Cross Shore Erosion Modelling

Cross-shore beach erosion modeling was undertaken using the USACE's SBEACH 2D model and an adjusted July 2007 storm event as per Ocean Beach. At Peaceful Bay two typical beach profiles were generated, one at the main swimming beach for Peaceful Bay and one at the beach north of the boat launching area (Foul Bay). The modelled allowances for Acute Storm Erosion (S1) are larger at Peaceful Bay than Ocean Beach due to the high responsiveness of relatively sheltered beaches with lower lying dunes to rare high water level and high wave storm events.

The historic shoreline movement trends have been assessed based on aerial imagery provided by the Shire from 2002, 2006, 2014 & 2016. The following was noted based on the assessment of 5 profiles:

- The swimming beach in Peaceful Bay has been relatively stable since 2002 due to rock headlands providing a stable shoreline.
- The vegetation line has eroded between 16 and 24 meters at Foul Bay, to the north of the boat launching area, since 2002. Erosion and/or removal of a number of structures is evident in the aerial photography. Whilst erosion is expected to be associated with storms, and there is capacity for the dunes to recover between events, a net erosion trend in the order of 1.4m/yr was observed. Progressive realignment of the shoreline and net loss of sediment may be occurring and requires consideration in the risk analysis phase.



As at Ocean Beach, the allowance erosion due to future sea level rise (S3) at Peaceful Bay is based on the requirements of State Planning Policy 2.6 for a sandy coast of 90 meters (100 times the adopted sea level rise value of 0.9m over a 100-year timeframe). The policy also requires an additional safety factor of 20m for the 100-year planning period.

The allowances for Coastal Processes at Peaceful Bay for the 20, 50 and 100 year planning periods (S1 + S2 + S3), including the required factor of safety, are summarised in Table 2.

Table 2 – Peaceful Bay - Allowances for Coastal Processes

	Peaceful Bay			Foul Bay		
Planning Period	10 year	50 year	100 year	10 year	50 year	100 year
Coastal Processes Allowances (m)	30	90	155	40	140	275

Key issues at Peaceful Bay that will be considered in the CHRMAP include:

- The nature of storm events that cause erosion at Peaceful Bay, and the capacity of these beaches to recover between erosive cycles.
- Beach access infrastructure is presently subject to ocean forces, and the design and adaptation of these structures is required to maintain a high level of public beach access.
- The observed erosion trend north of the boat ramp within Foul bay is significant and requires further consideration of potential causes and adaptation.
- The potential implications in longer term planning periods for the Peaceful Bay Road, Caravan Park and coastal residents require consideration.



Figure 7: Peaceful Bay – Erosion Near Fisherman's Lease Area (Supplied by Shire)

Where to from here?

The coastal hazard assessment will be used for the identification and assessment of risks to coastal assets, and the consideration of sustainable adaptation options. The Shire of Denmark will be undertaking consultation with stakeholders and the wider community through the CHRMAP process. The study includes consultation through a stakeholder workshop and an online survey (www.surveymonkey.com/r/DenmarkCHRMAP). Hard copies of the survey will also be available from the Shire of Denmark offices.

The results of the feedback and further analysis will feed into recommendations for the future management of the assets and coastline at Ocean Beach and Peaceful Bay. Ultimately, as part of the CHRMAP process, 10-year Concept Plans will be developed for the Ocean Beach and Peaceful Bay beach and foreshore.

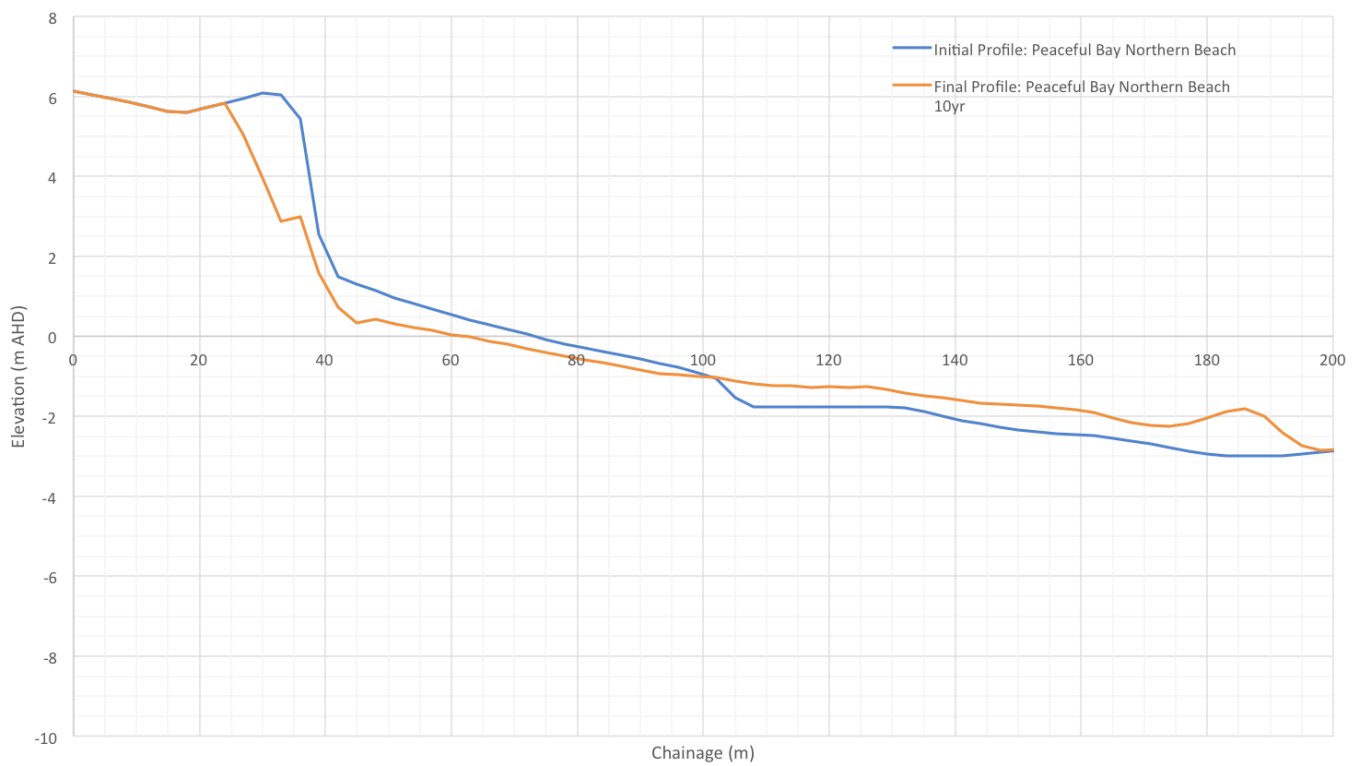


Figure 8 Peaceful Bay Aerial Imagery

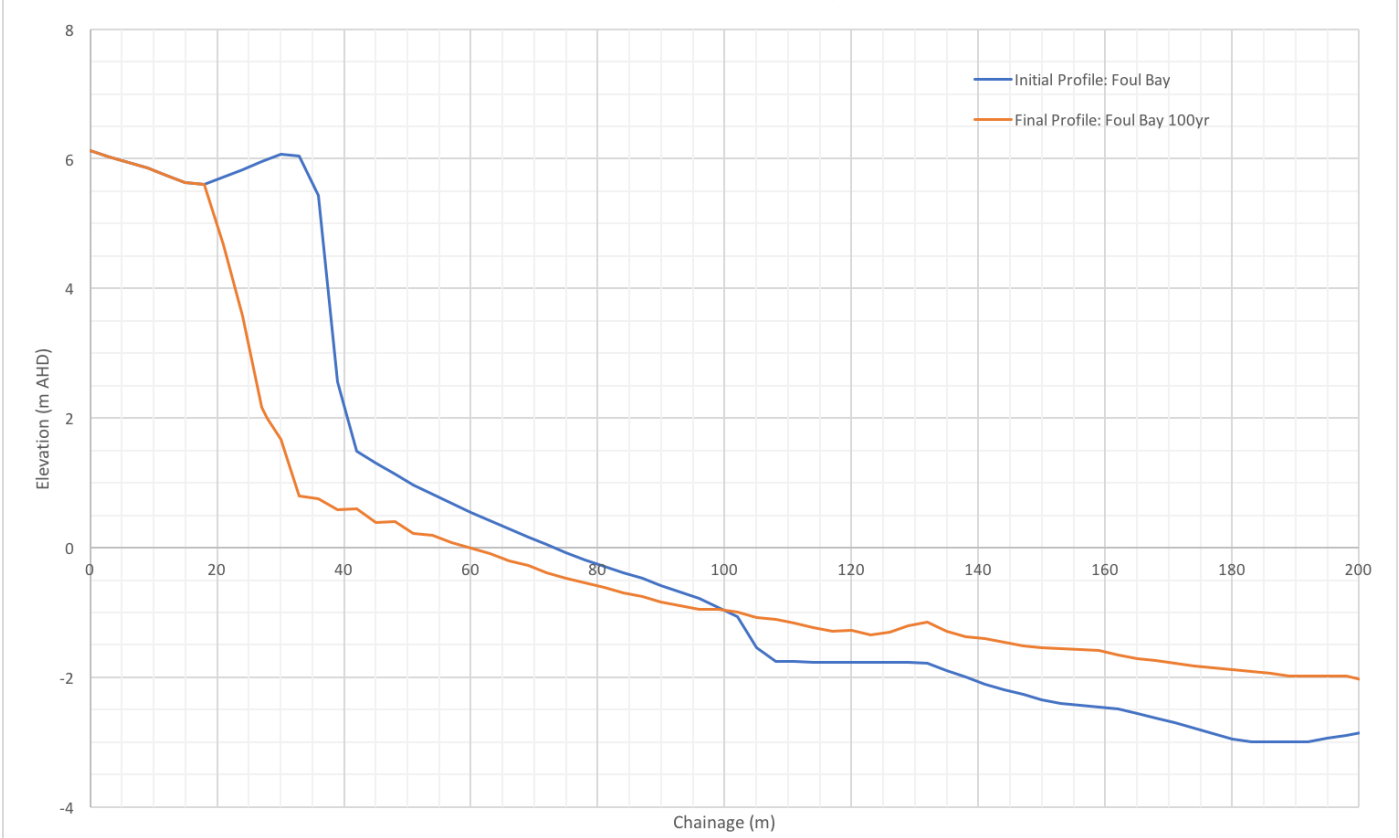


Attachment E Storm Erosion Numerical Modelling (SBEACH)

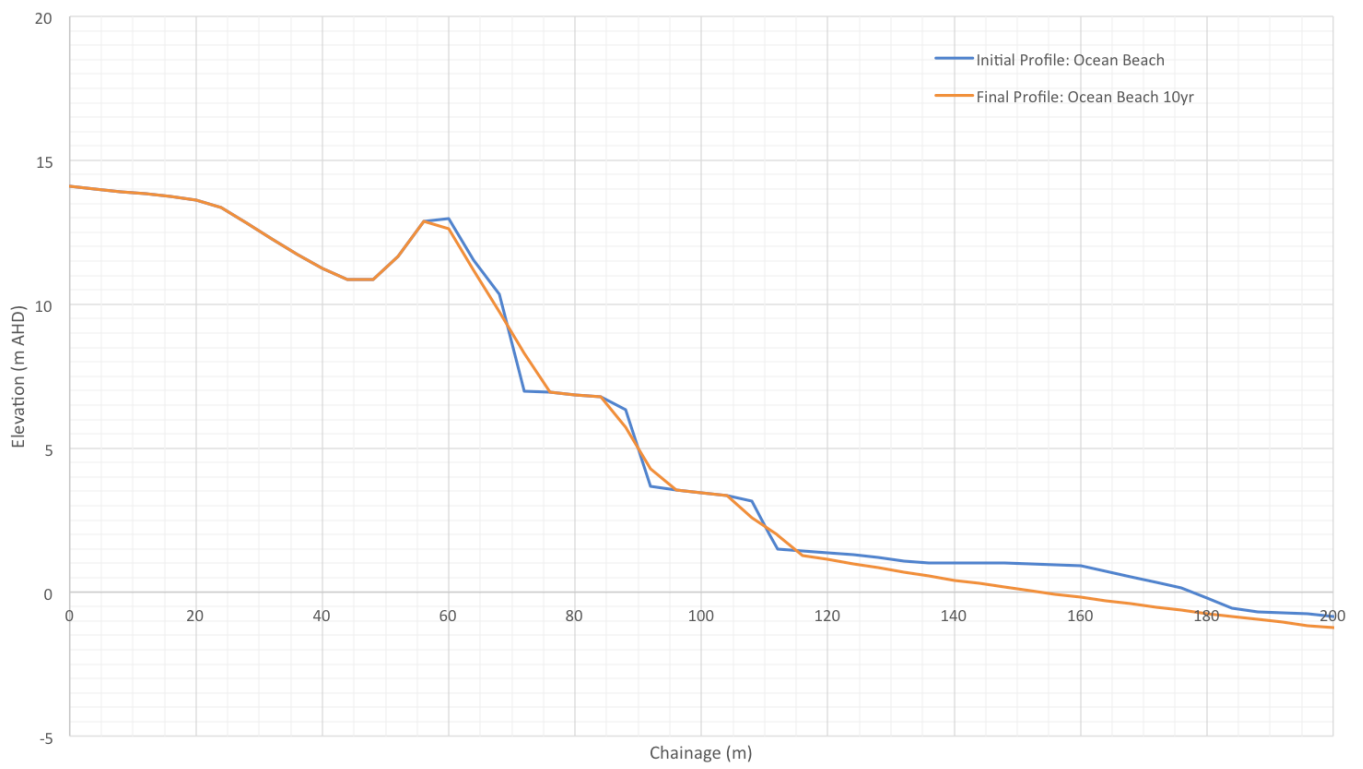
Peaceful Bay Northern Beach SBEACH 10yr Output



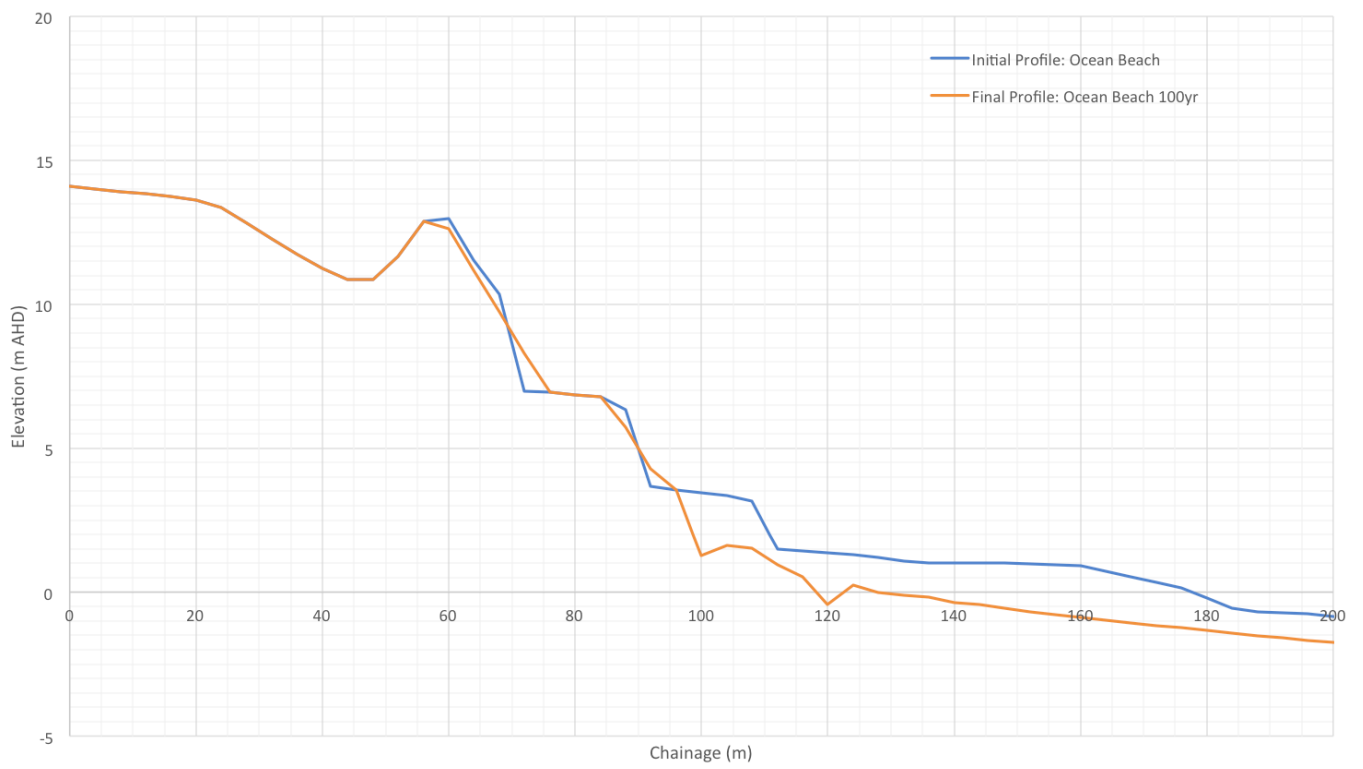
Foul Bay SBEACH 100yr Output



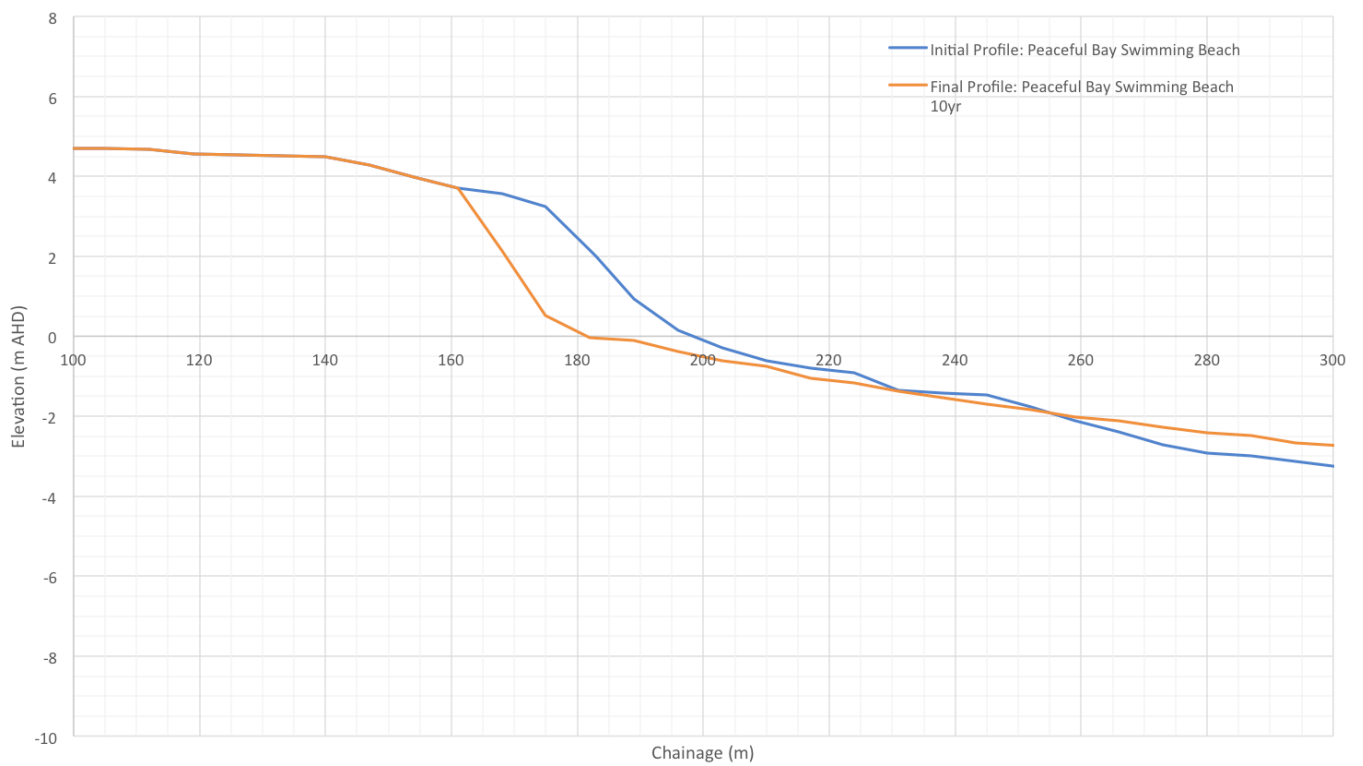
Ocean Beach SBEACH 10yr Output



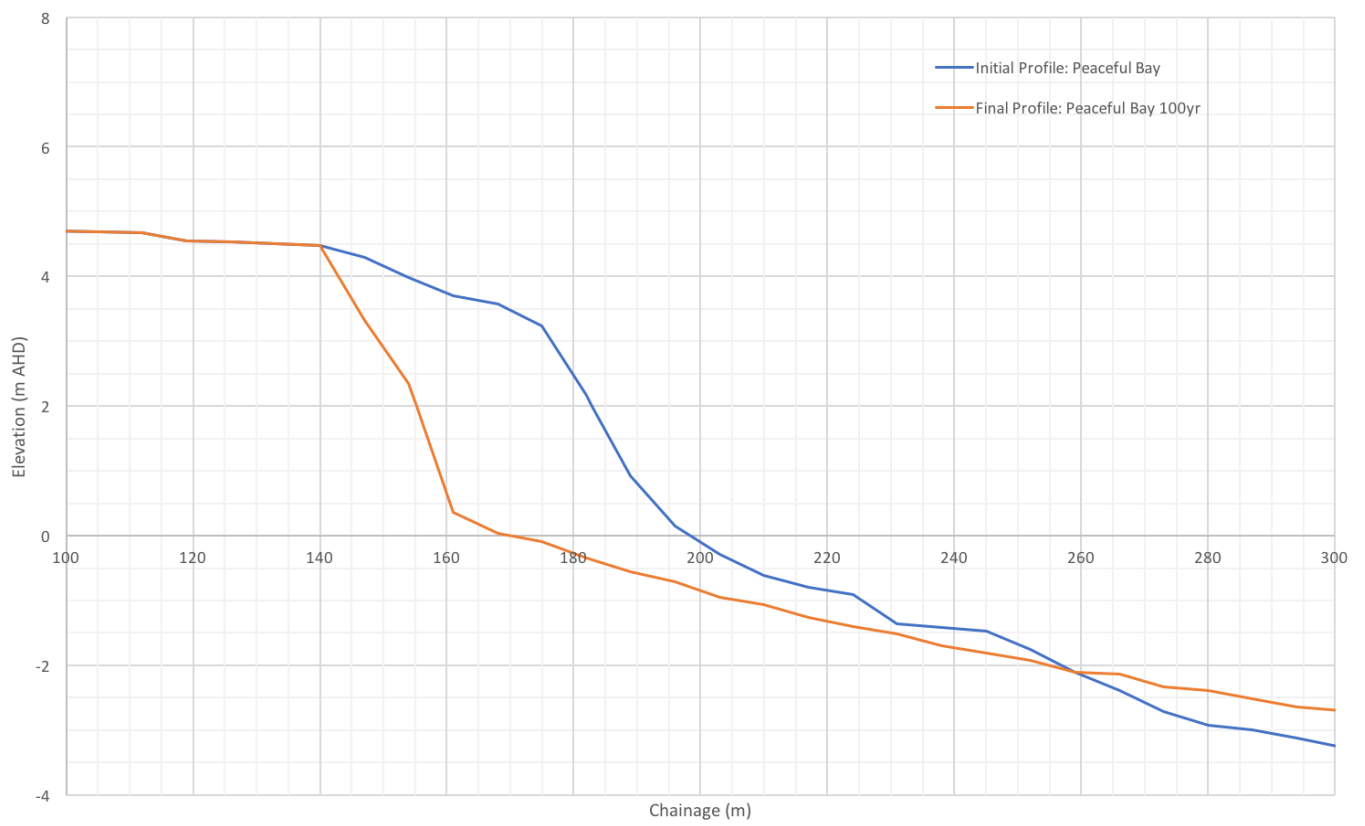
Ocean Beach SBEACH 100yr Output



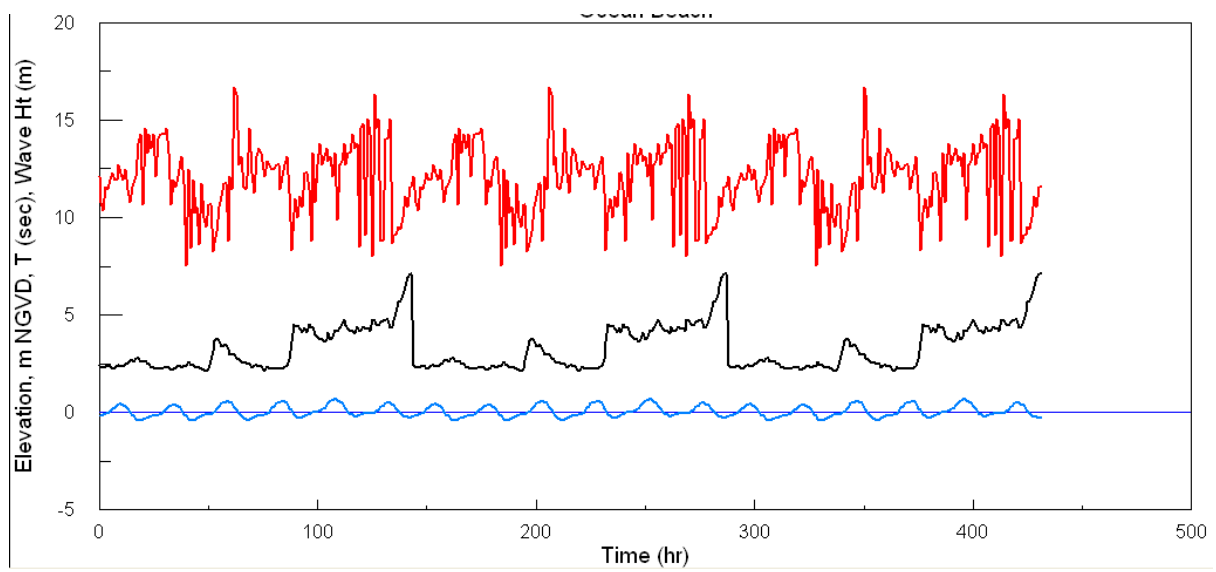
Peaceful Bay (Swimming Beach) SBEACH 10yr Output



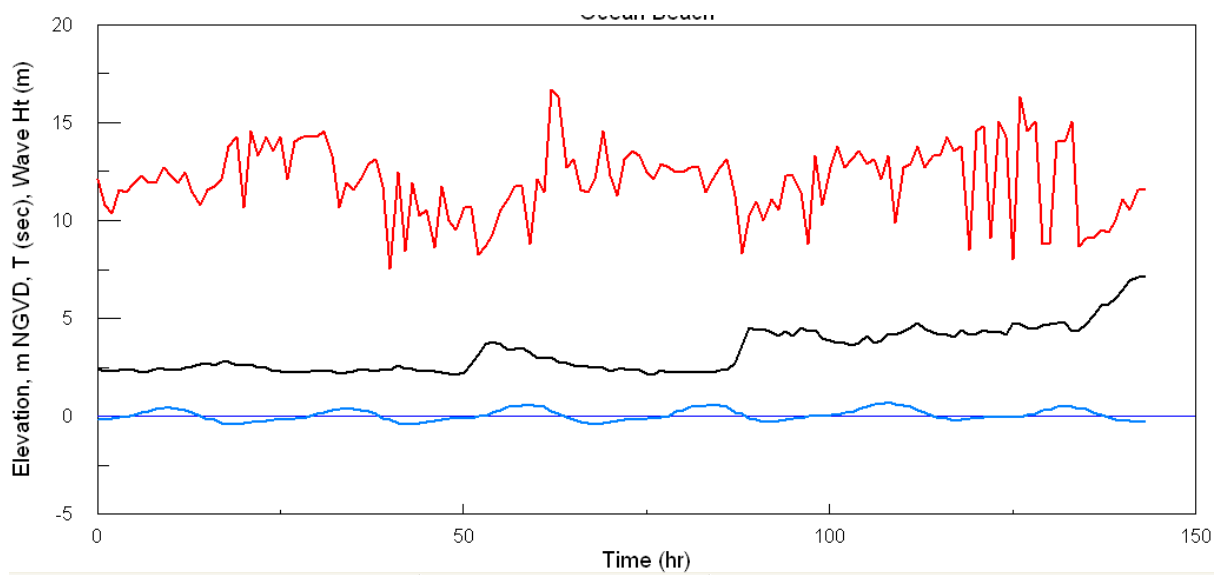
Peaceful Bay SBEACH 100yr Output



Storm July 2007_1.5



Storm July 2007_1_1.5



Seashore Engineering



Seashore Engineering Pty Ltd
www.seaeng.com.au
9757 9992 (SW Office) email: admin@seaeng.com.au
ACN: 69 155 753 361