Redevelopment of Porthcawl Waterfront

CHAPTER 11 – Coastal Processes

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Written by –

ABPmer for Ove Arup and Partners (Arup)

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11.1. Introduction

Background

11.1.1. The following Chapter has been prepared by ABPmer.

11.1.2. This Chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development, as described in Volume 1, Chapter 4 of this ES, in terms of Coastal Processes.

Site Location and Description

11.1.3. The Proposed Development sits within Sandy Bay, an approximately 700 m wide south south-west (SSW) facing coastal embayment located between Port Talbot and Ogmore-on-sea. The Bay is surrounded by a mixture of commercial and residential development, with Porthcawl town to the immediate north and west of the Bay, and a large holiday caravan park at Trecco Bay to the east. An overview of the study area is provided in Plate 111.1.1.

11.1.4. Sandy Bay consists of a mixture of hard defence structures and natural frontages that have been repaired and reinforced over many decades. These can be broadly summarised in seven different sections (Plate 111.1.2).

11.1.5. The Porthcawl Harbour Boating Club sits directly in the lee of the main breakwater with a defence facing angle of 102 degrees. The defence is a steeply back sloping near vertical wall, with a vertical flood wall at the crest at a height of 6.66 mODN.

11.1.6. The eastern breakwater to Porthcawl Marina, extending due north inside the Western Breakwater for around 100 m. This is a steeply back sloping near vertical all, with a vertical parapet at the crest (7.50 mODN) and facing angle of 88 degrees.

11.1.7. The southeastern promenade to Porthcawl connects to the Eastern Breakwater. This is a steeply back sloping near vertical wall, with a vertical parapet at the crest (8.15 mODN) and facing angle of 116 degrees.

11.1.8. The eastern promenade to Porthcawl, a 400 m stretch of seawall that runs north-to-south between the harbour immediately to the north of the marina, and the amusement park. This was enhanced in 2023 following the construction of Welsh Government funded enhancements.

11.1.9. The central section of the bay, which incorporates the Proposed Development, is backed by Coney Beach Amusement Park. This is defended by various private seawalls and revetments, including steeply sloping quarried stone and cement structures with a grass

topped crest at an elevation of ~ 7.99 mODN, concrete stepped revetment style defence with a crest elevation of ~ 8.66 mODN, and a smooth concrete slipway (just south of Mackworth Road) with a crest level of ~ 7.35 mODN. Facing angles of these structures are around 182 degrees. These extend due east along the upper beach of Sandy Bay for around 350-400 m, merging into the relic dune system to the east.

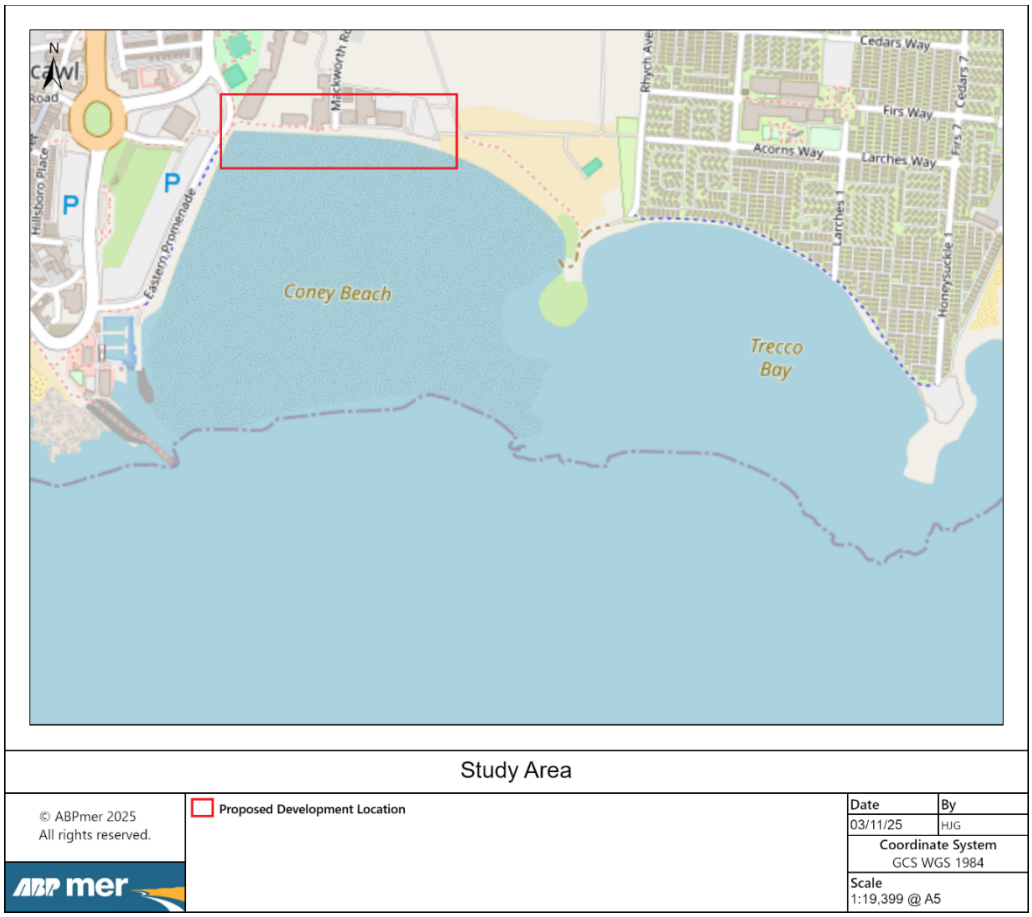


Plate 111.1.1 Study Area showing the location of the Coastal Defence element of the Proposed Development

Plate 111.1.2 Aerial photography of Porthcawl and Sandy Bay (ABPmer, 2017)

Proposed Development

11.1.10. The proposed development consists of a variety of elements, including (but not limited to) additional homes, commercial and leisure floorspace, enhancement of the harbour environment. The development will be protected by new coastal defences which are the subject of this chapter. The coastal defence element of the Proposed Development is a new concrete terraced revetment and upgraded slipway extending approximately 220 m along the frontage, as shown in

11.1.11. Plate 111.1.3. The revetment will be constructed to a crest level of 10 mODN (higher than existing promenade and the Masterplan development behind will tie into this raised level).

11.1.12. The structures generally do not encroach into the beach further than the existing defences and the proposed revetment slope of 1:2 is generally similar to the existing defences. The terracing also reduces the potential for localised scour and erosion.

11.1.13. The toe of the new defence will be slightly further offshore (within a few meters) compared to what is already there in order to protect against drawdown. However much of the toe will be buried by the beach, making the general 'above ground' footprint similar to existing.

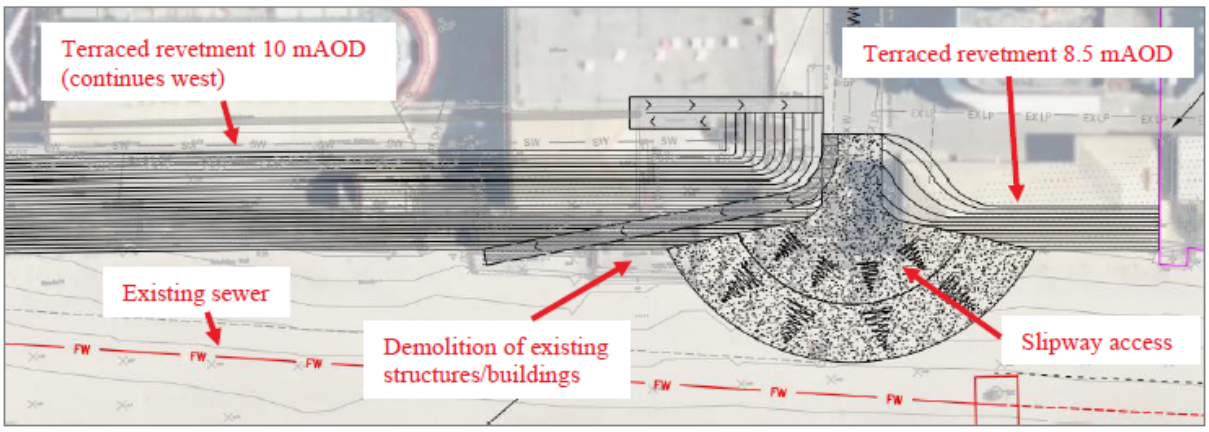


Plate 111.1.3 Extract of sketch SK-003 with key features annotated (from the Construction Methodology Note presented in Appendix 11.1)

Legislation and Policy Framework

11.1.14. The assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. These are summarised below.

11.1.15. The area sits within the Lavernock Point to St Anne's Head Shoreline Management Plan (SMP) Area 7. The SMP long term plan for Area 7 is to "continue to manage the risk of coastal erosion and flooding to Porthcawl, whilst allowing natural evolution of the undeveloped coastline. Existing defences along the developed frontage of Porthcawl will be maintained and upgraded, subject to the availability of public funding for coastal erosion and flood risk management" (Halcrow, 2012).

11.1.16. 'The plan within the specific policy unit containing Sandy Bay is as follows:

- Unit 7.3: Rhych Point to Porthcawl Point (Sandy Bay). The policy is hold the line by maintaining and upgrading existing defence structures, including extending defences over the relict dunes along the eastern shore of Sandy Bay. Impacts to the wider

shoreline are expected to be minimal as the Bay is bounded by the Western Breakwater and the resistant headland at Rhych Point (Halcrow, 2012)

11.1.17. **Marine and Coastal Access Act, 2009** - The Marine and Coastal Access Act 2009 (MCAA) provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment.

11.1.18. **Coast Protection Act, 1949 –** provides a framework for works to protect the coast from erosion and encroachment by the sea. It requires a consent regime for activities that might impact shoreline protection and allows private individuals to protect their own property.

11.1.19. **Marine Works (EIA) Regulations, 2007** - The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011, which came into force on 6 April 2011 and implemented the EU EIA Directive 2011/92/EU.

11.1.20. **Water Framework Directive (England and Wales) Regulations, 2003** - The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (WFD Regs), which implement the European Water Framework Directive (WFD). The objectives of the WFD are to enhance the status, and prevent further deterioration of aquatic ecosystems, promote the sustainable use of water, reduce pollution of water, and ensure progressive reduction of groundwater pollution.

11.1.21. **Replacement Bridgend Local Development Plan – SP4** - This section of the development plan outlines how "all development proposals must make a positive contribution towards tackling the causes of and adapting to the impacts of Climate Change". Of particular relevance to this chapter is the need to direct development away from flood risk areas and avoid development that increases the risk of flood risk and coastal erosion.

11.2. Assessment Methodology

11.2.1. The assessment considers the effect of the coastal defence element of the Proposed Development against the existing baseline, using available qualitative data from the study area. The chapter has utilised a previous coastal process study undertaken to support the management of coastal flooding and erosion in Sandy Bay for Bridgend County Borough Council (ABPmer, 2017). Existing and historical data has been analysed, and the qualitative assessment has utilised expert geomorphological judgement.

11.2.2. The Assessment Matrix used to define impact significance for this chapter assessment is presented in Table 11.4

Table 11.4 Typical Assessment Matrix

Sensitivity	**Magnitude of Impact**				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No Change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No Change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No Change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No Change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very High	No Change	Minor	Moderate or Major	Major or Substantial	Substantial

11.2.3. The 'source-pathway-receptor' model has been used to identify and assess the potential magnitude, sensitivity and significance of predicted change to a series of coastal process pathways and receptors.

11.2.4. With specific reference to the coastal processes assessment, presented in this chapter, the following are considered 'pathways':

- Waves
- Hydrodynamics (flows and water levels)
- Sediment transport

11.2.5. Alongside this, the local Porthcawl Beach is identified as a coastal process receptor and is described further within the baseline section below.

11.2.6. In this way (outside of the assessment of the beach receptor), the assessment presented in the following sections considers the magnitude of change on the coastal processes'

pathways, which then allows the significance of any associated 'receptor' impacts to be subsequently assessed within other topic chapters, particularly Ecology and Flood Risk/Drainage.

11.2.7. Consequently, this chapter takes a variable approach to the assessment, considering the magnitude of *change* for coastal process pathways and the magnitude of *impact* (using the matrix in Table 11.4) for the local Porthcawl Beach receptor.

11.3. Baseline Conditions

Coastal description and morphology

11.3.1. The fundamental geomorphological character of South Wales coast, including Sandy Bay, is controlled by resistant rock outcrops. The outcrops give rise to a series of headlands, sections of cliffed coast with intertidal shore platforms, and intervening Bays backed by sandy beaches and dunes (ABPmer, 2017). Natural processes occurring within Sandy Bay have been modified due to the construction of the Eastern Promenade seawall to the west of the Bay, as well as an approximately 180 m long Western Breakwater south-eastwards from Porthcawl Point, providing protection from waves into the west side of the bay.

11.3.2. Sandy Bay is a small intertidal embayment infilled by a wide, shallow (1:50) gradient sandy beach with bed levels over 1.7 mODN, in relation to a MSL of 0 mODN, near the upper beach in front of the central section. This shallow beach results in an extensive breaker zone. The intertidal consists predominantly of sand with gravel deposits located high on the foreshore. The area behind the beach forms part of a dune system that extends 1 to 3 km inland but has been heavily modified to the west side of the bay behind man-made sea defences. This dune system consists mainly of dunes and sand sheets, with localised development of fore dune ridges and hummock dunes (ABPmer, 2017).

11.3.3. A comparison between near present and historical (2006) LiDAR data, shows that the beach has been very stable over the past circa 20 years as illustrated in Plate 11., which shows very little change across the Sandy Bay frontage. This is further evidenced in Plate 11.6, which shows very little change in Profile 8b7.3_012 between 1998 (earliest available historical dataset) and 2025.

11.3.4. Net littoral drift was found to be predominantly eastward, particularly to the east side of the Bay.

11.3.5. Consequently, and with reference to the assessment approach described above, the local beach is considered to be stable and have a 'low' sensitivity to change.

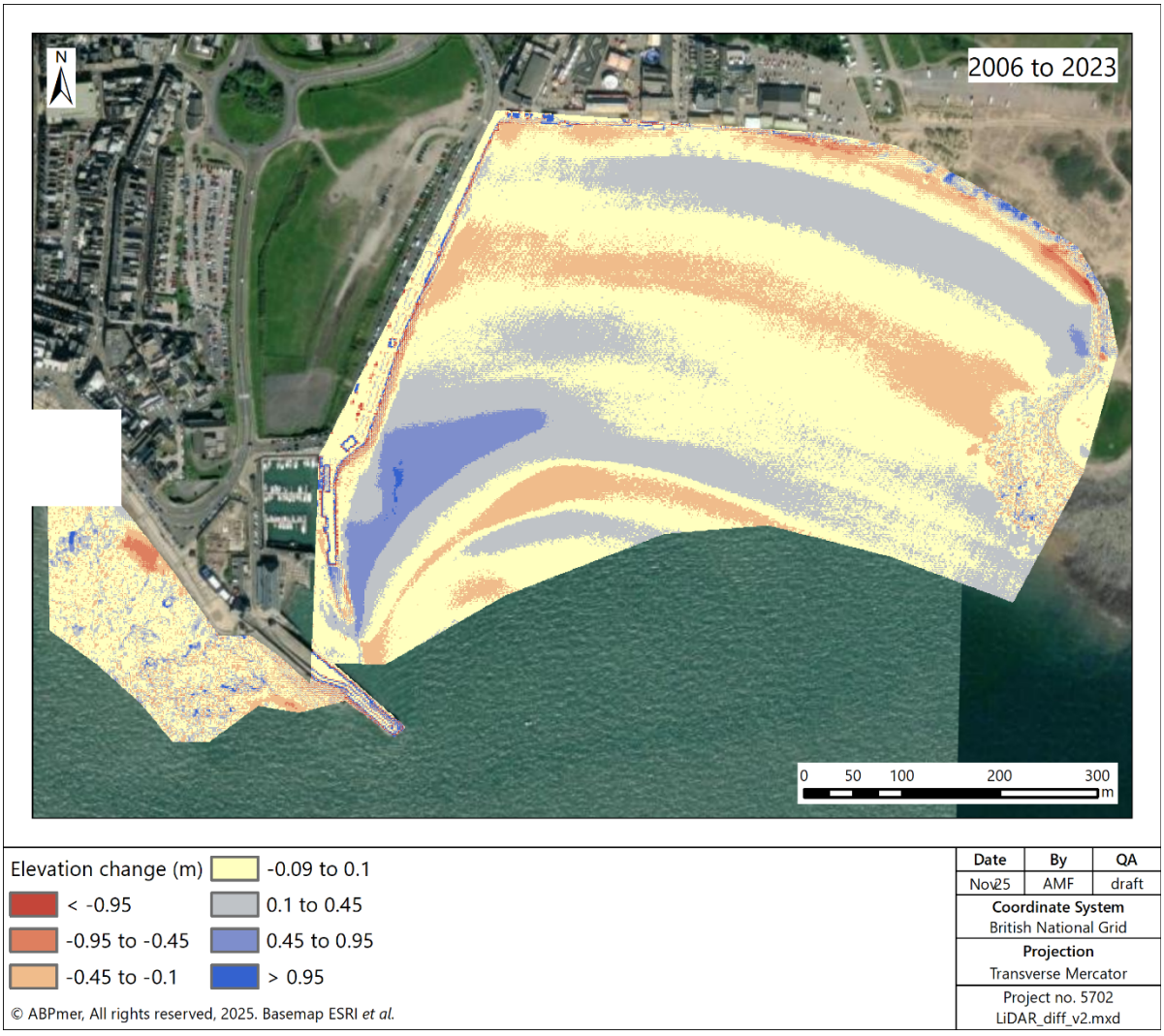
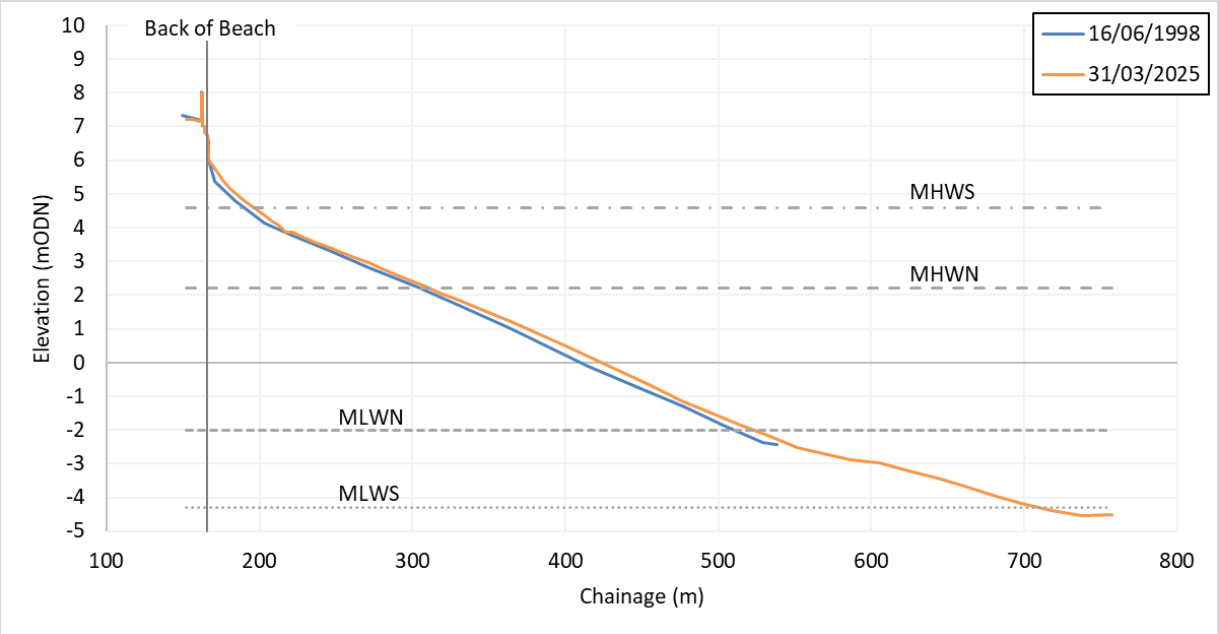


Plate 11.5 Beach elevation change between 2006 and 2023 composite LiDAR



Source: Wales Coastal Monitoring Centre

Plate 11.6 1998 and 2025 beach profile – Profile 8b7.3_012

Water levels

11.3.6. The study area is within the Bristol Channel, which is within a hyper-tidal environment, with a spring tidal range in excess of 6 m. This is due to the behaviour of the tidal wave originating in the North Atlantic and the funnelling effect of the channel, which in turn modifies the behaviour of the tidal wave. Within the study area, the tidal range is nearly 9 m during spring tides, reducing to over 4 m during neap tides (Table 11.1), which is characteristic for coastal locations within the Outer Bristol Channel.

11.3.7. The hyper-tidal range at Porthcawl and shelving intertidal zone means that the existing sea defences on the west of Sandy Bay and immediately shore-side of the amusement park are only exposed to the incident wave climate for periods of the tidal cycle (Plate 11.7). Whilst the MHWS level extends along much of the Eastern Promenade seawall (to the west of the Bay), MSL and MHWN level only reach up to 50% of its overall length; therefore much of the defences will only be exposed to waves either under extreme weather events occurring on a spring tide, or lower levels enhanced by surge events.

Table 11.1 Tidal characteristics at Porthcawl

Location	Reference Still Water Level							Mean Range (m)	
	HAT	MHWS	MHWN	MSL	MLWN	MLWS	LAT	Spring	Neap
Porthcawl (mCD)	11.0	9.9	4.5	5.3	3.3	1.0	0.1	8.9	4.2
Porthcawl (mODN)	5.7	4.6	2.2	0.0	-2.0	-4.3	-5.2		

Source: 2025 Admiralty Tide Tables

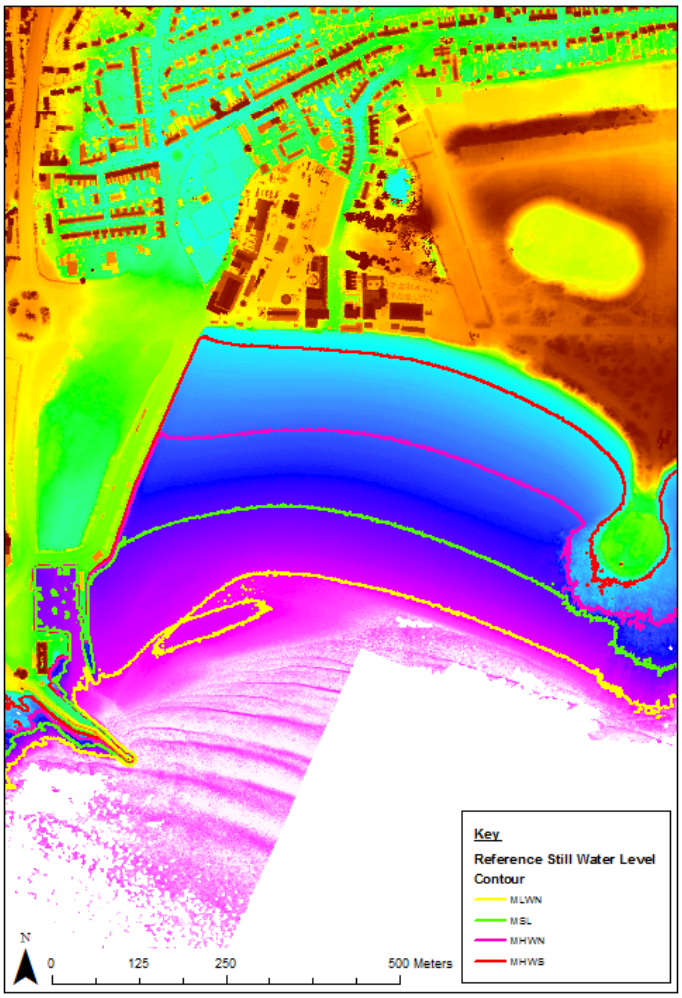


Plate 11.7 Water level contours for Porthcawl (mODN) overlaid onto 1 m DSM LiDAR (ABPmer, 2017)

11.3.8. The Environment Agency coastal flood boundary dataset (Environment Agency, 2018) provides an assessment of extreme water levels offshore of Sandy Bay, which are summarised in Table 11.2. These provide the extreme still water levels associated with different return periods ranging from 1 in 1 year to 1 in 1,000 years. The UKCP18, 2007-2100 RCP8.5 dataset has been used to calculate the sea level rise from the CFBD18 base year of 2017 to the 2026 and 2126 epochs. This has followed the latest Welsh

Government (2022) recommendations. For epochs beyond 2100, the guidelines recommend using allowances from UKCP18, 2007-2101 RCP8.5 dataset, with the average increment for the last 5 years (2094 to 2099) being used to extrapolate beyond 2100. The results of these calculations are provided in

11.3.9. Table 11.3 for the 70th and 95th percentile RCP8.5 cases. It should be noted that the Environment Agency states that these levels are considered accurate only to one decimal place. Generally, it is the coincident occurrence of extreme surge heights with high water levels that is considered to bring about extreme water levels within the study region.

Table 11.2. Extreme water levels for base year of 2017 (Environment Agency CFBD, 2018) (EA Location Chainage 462)

Return Period (Years)	Still Water Level (mODN)
1:1	5.66
1:10	6.01
1:20	6.11
1:50	6.25
1:75	6.35
1:100	6.37
1:200	6.50
1:1,000	6.91

Source: Environment Agency, 2018

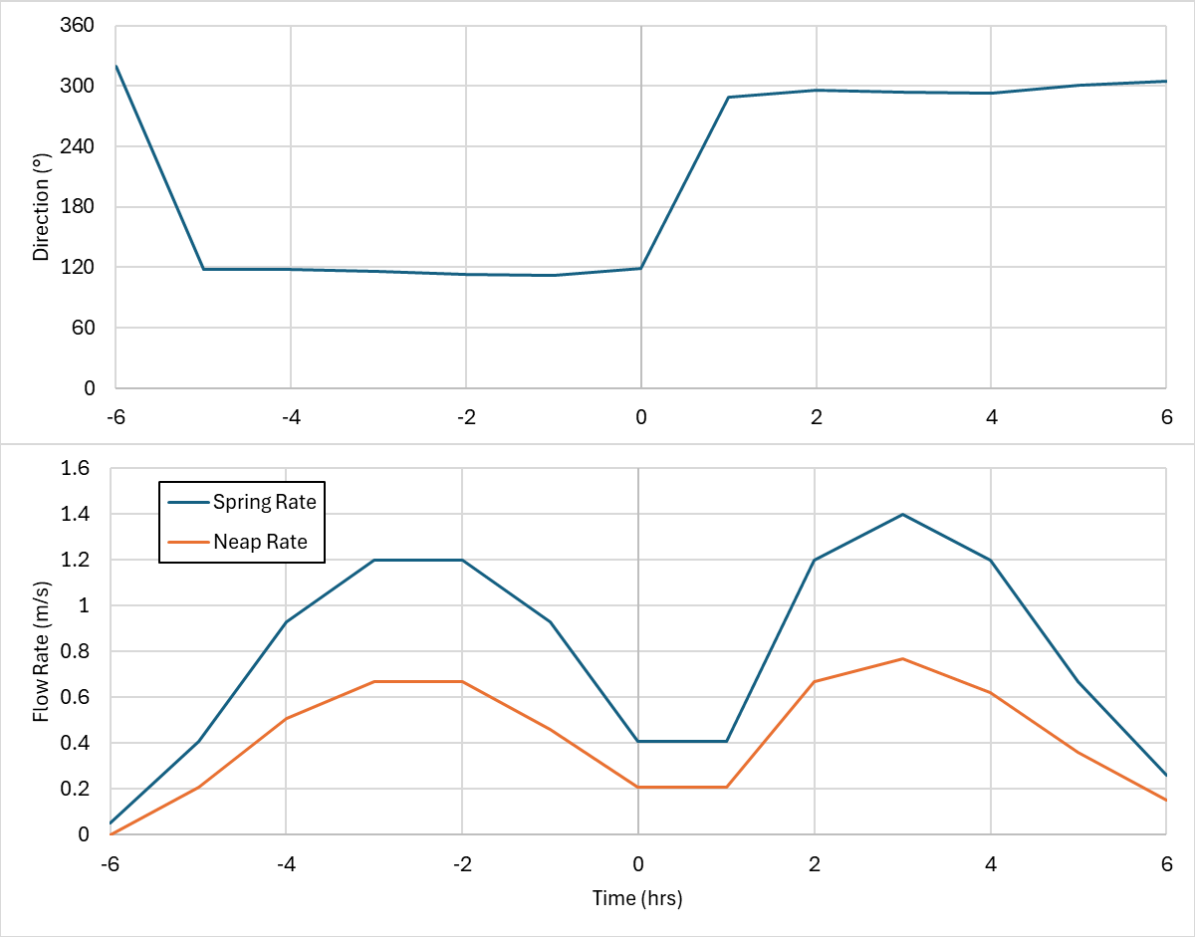
Table 11.3 Sea level rise guidance values (m) based on UKCP18 RCP8.5

Period	70th Percentile	95th Percentile
2017 to 2026	0.05	0.06
2017 to 2126	1.10	1.49

Source: UK Climate Projections, 2018

Currents

11.3.10. The tidal regime within the Bristol Channel is characterised by strong tidal flows, on an east-west axis, as a result of the large tidal range and channel morphology. The current speeds vary spatially both along and across the coastline in line with channels, sandbanks and intertidal flats. In proximity to Porthcawl, information on Admiralty charts (Plate 11.8) indicates strong near easterly and westerly flows on the flood and ebb respectively. On the flood, flows can be around 1.2 m/s, whilst ebb flows are generally higher at approximately 2.4 m/s.



Source: UKHO, 2025

Plate 11.8 Tidal stream data approximately 3 km due south of Porthcawl

Waves

11.3.11. On a regional scale, the Bristol Channel is exposed to both long period swell waves generated in the Atlantic and shorter period wind-waves generated locally, which are limited by wind speed and fetch length. The largest and most frequent waves which approach the study area are from a west south-west (WSW) direction. During periods of low water and neap tides, waves are modified by the local bathymetry, as are long period westerly waves in water depths less than 20 m.

11.3.12. More locally to Sandy Bay waves are either limited in their fetch length (easterly) or are likely to be dissipated via the presence of offshore sandbanks. The defences around the Bay are subject to a sheltered wave climate, and the intertidal zone surrounding Porthcawl with the raised shore platform has a refraction effect on waves entering the nearshore. These waves are dissipated over the intertidal area of the Bay, with reductions in average significant wave heights to less than 1 m. There is further sheltering and

refraction effects as a result of the Western Breakwater, with wave heights of less than 0.4 m at the frontage toe locations within the Bay (ABPmer, 2017). Average significant wave heights generally increase in value from west to east.

11.3.13. Wave modelling undertaken by ABPmer suggests that, taking into account SLR, wave heights at the toe of the structure could increase by up to 50% and 70% under a 70th and 95th percentile SLR respectively by 2126 (ABPmer, 2025).

11.4. Assessment of potential Effects, Mitigation Measures and Residual Effects

Potential Effects During Construction

11.4.1. The greatest effect on the identified coastal processes pathways and receptors will be as a result of the completed development. Whilst detailed construction methodology is not yet available, the construction effects will only be temporary (whilst construction is underway) and will likely be predominantly land based. The draft construction methodology (as provided in Appendix 11.1) notes that no materials will be delivered by sea and no working at sea is required. In addition, all materials and plant will be removed from the beach at the end of each tidal shift, and the beach will be reinstated to a similar level as prior to commencement on completion of the works. Furthermore, the scheme does not include any dredging element, so dredge/disposal impacts (which would normally be assessed during the construction stage) are not relevant to this study.

11.4.2. As a result of the above, none of the coastal process pathways or receptors have been assessed for the construction phase.

Potential Effects During Operation

11.4.3. For the operation (i.e. the completed scheme post-construction) of the Proposed Development, the following elements have been assessed:

- Potential changes to local wave conditions;
- Potential changes to hydrodynamic regime (flow speed and direction);
- Associated local changes to the sediment transport (and hence morphology) pathways as a result of localised changes to the driving hydrodynamic forcing; and
- The potential impact on the local Porthcawl Beach receptor.

11.4.4. As noted above, a consideration in the construction methodology and design of the Proposed Development is to minimise the impact on coastal processes. This is achieved by keeping all major changes landward of the existing defences and keeping the toe of the new defences in line with what is already there. This approach has been used to inform the assessment of potential effects.

Magnitude of change to wave conditions

11.4.5. Placing infrastructure in the intertidal/subtidal region has the potential to change the local wave conditions, which in turn can affect associated sediment transport.

11.4.6. As the Proposed Development is within the existing footprint of the defences, it is predicted that wave patterns will be unchanged from the existing baseline conditions.

11.4.7. As the Proposed Development coastal defences are a concrete terraced revetment, the relative reflectivity of the structure will change from the current defences. However, this difference is expected to be minimal.

11.4.8. Therefore, the predicted magnitude of change to wave conditions is assessed as negligible.

Magnitude of change to flow conditions

11.4.9. As with wave conditions, placing infrastructure in the intertidal/subtidal also has the potential to change flow conditions, affecting the associated sediment transport.

11.4.10. The toe of the revetment (where the sheet piles meet the concrete revetment below existing beach level) will be at 4 mODN and MHWS is 4.6 mODN, whilst MHWN is 2.2 mODN. Therefore, the very base of the toe of the revetment will only be subject to tides during mean springs.

11.4.11. Considering the level of the beach in relation of the toe of the Proposed Development, alongside the fact that it is within the existing footprint of the defences, it is predicted that wave patterns will be unchanged from existing baseline conditions.

11.4.12. With the addition of sea level rise, it is predicted that more of the revetment will be exposed to tides. However, taking into account the highest SLR prediction from Table 11.2 (1.49 m), not every tide will be reaching the revetment, with MHWN levels still being below current MHWS levels.

11.4.13. Therefore, the predicted magnitude of change to wave conditions is assessed as negligible.

Magnitude of change to sediment transport

11.4.14. Changes in wave conditions and hydrodynamic forcing has the potential to impact sediments and patterns of erosion and accretion. However, due to the fact that the impacts of the Proposed Development on waves and hydrodynamics are predicted to be negligible, it is anticipated that there will not be any associated changes to sediment transport pathways.

Magnitude of impact on the beach

11.4.15. As discussed in Section 11.0, the morphology of Sandy Bay is stable. The draft construction methodology states that any significant variations in beach level will be managed and reinstated. This, along with the fact that the predicted magnitude of change on waves, hydrodynamics and sediment transport has been assessed as negligible, it is expected that the beach will be unchanged from existing baseline conditions.

11.4.16. The sensitivity of the beach as a receptor is considered low. With the changes to the wave, hydrodynamic and sediment transport processes predicted to be negligible, the predicted impact on the beach is assessed as negligible.

Mitigation and Enhancement Measures

11.4.17. A Construction Environmental Management Plan will be developed for the construction phase, with the following environmental mitigations being considered, with particular focus on coastal processes:

- No works to be carried out below the tide level to minimise suspension of sediments in the water column.
- Regular visual monitoring during construction to determine any visual changes to the marine environment.
- Where there is excavation of beach material, excavation arisings to remain on the beach and be placed nearby the excavation.
- Work in small sections and in sequence to minimise the extent of partially complete works exposed to tide and wave action risk and to mitigate flood and erosion risk.
- Throughout the scheme construction, any significant variation in beach level caused by plant movements are to be managed and reinstated to maintain safe access.

11.4.18. Operation is likely to involve regular beach monitoring (e.g. Welsh Coastal Monitoring Programme) and inspection of structures along the frontage to identify if any remedial actions are required.

11.4.19. This is consistent with the maintenance regime for the previous coastal defence works in the area. With the existing Sandy Bay Maintenance Strategy, for the Eastern Promenade wall visual inspection and monitoring of the beach levels and exposure of the toe of the wall has been recommended at regular intervals. There is also an existing Dune Monitoring and Management Plan for the relict dunes which recommends sediment monitoring.

11.4.20. In the context of sea level rise, it is expected that the revetment structure will be lower in the tidal cycle. As such, the current construction methodology states that there will be opportunity for environmental enhancements such as surface texturing or adding features to create more favourable habitat and mitigate against coastal squeeze.

Residual Effects

11.4.21. It is anticipated that any residual effects as a result of the Proposed Development are likely to be within the natural variability of the study area.

Cumulative Effects

11.4.22. Cumulative effects have been scoped out of this assessment.

11.5. Conclusions

11.5.1. The assessment has considered the effects of the Proposed Development on the hydrodynamics, waves and sediment processes of Sandy Bay. This coastal processes assessment has used baseline understanding and expert knowledge in order to determine the potential effects.

11.5.2. The coastal processes assessment has concluded that the effects on the flow and wave regime, as well as sediment processes are negligible and unchanged from the existing baseline conditions.

11.5.3. The impact on the beach is assessed as negligible.

11.6. References

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