The Sizewell C Project

9.13 Sizewell C Coastal Defences Design Report

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GLOSSARY

ALARP	As Low As Reasonably Practicable
AOD	Above Ordnance Datum
BECC	British Energy Climate Change
BLF	Beach Landing Facility
BOD	Basis of Design
CD	Chart Datum
CM	Credible Maximum
CMC	Controlled Modulus Column
CoW	Cut-off Wall
CPMMP	Coastal Processes Monitoring and Mitigation Plan
DCO	Development Consent Order
EA	Environment Agency
EMIT	Examination, Maintenance, Inspection and Testing
ExA	Examining Authority
FRA	Flood Risk Assessment
HCDF	Hard Coastal Defence Feature
HPC	Hinkley Point C
IAEA	International Atomic Energy Agency
MBIF	Marine Bulk Import Facility
MCA	Main Construction Area
MHWS	Mean High Water Springs
MSF	Main Safety Function
OD	Ordnance Datum (Newlyn)
ONR	Office for Nuclear Regulation
PLSF	Plant Level Safety Function
PRoW	Public Right of Way
RCP	Representative Concentration Pathway
RF	Reasonably Foreseeable
SCDF	Soft Coastal Defence Feature
SLR	Sea Level Rise
SSSI	Site of Special Scientific Interest
SZB	Sizewell B Nuclear Licensed Site
SZC	Proposed Sizewell C Nuclear Licensed Site
UKCP	United Kingdom Climate Projections

1 INTRODUCTION

1.1.1 This technical report describes the engineering design of the proposed SZC sea defences which has been developed by the SZC Co. engineering team in collaboration with Cefas, the project landscape architects, rights of way specialists, and ecologists to enable the delivery of an integrated coastal defence feature that reflects the existing and future coastal characteristics.

1.1.2 SZC Co. is cognisant that Sizewell beach and the adjacent coastline is used and enjoyed by many and the character and amenity experience is particularly important. The design of the SZC coastal defences is underpinned by a full appreciation of the character of this part of the Suffolk Coast and Heaths AONB and the Suffolk Heritage Coast, which are expressed in the Design Principles outlined in the Design and Access Statement submitted at Deadline 5. They will inform the ongoing refinement of the design and are secured in Requirement 12B of the draft Development Consent Order [REP7-007]. High level information on the landscape design of the sea defence is included where relevant, although the primary focus of this report is on the technical engineering design of the coastal defences.

1.1.3 In January 2021, SZC Co. made an application [AS-181] to the Planning Inspectorate to amend the DCO submission made in May 2020 to build and operate a nuclear power station on the coast at Sizewell ('the Sizewell C Project'). One of the changes requested related to the design of the sea defences (hard coastal defence feature; HCDF) where the crest would be higher and extend further seaward (to the east). A second change in relation to the sea defences was the replacement of a rock armour temporary sea-defence during construction with a sheet-piled temporary defence.

1.1.4 During post-submission engagement carried out by SZC Co. with East Suffolk Council (ESC), together with other stakeholders including the Environment Agency (EA), Marine Management Organisation (MMO), Natural England (NE), Royal Society for the Protection of Birds (RSPB) and National Trust (NT), requests have been made for further design detail to be provided, including scaled plans and sections, and evidence that the seaward extent of the HCDF has been limited as much as possible. A number of other stakeholders had also raised lack of design detail as an issue in their Section 56 relevant representations for the original May 2020 DCO submission, although the final design is reserved for submission and approval under DCO Requirement 12B.

1.1.5 In light of the response by stakeholders, in the preliminary hearings, the ExA requested 'Design details and plans for Hard Coastal Defence Feature (HCDF)', to be provided to the examination at Deadline 2 on 2nd June. The

'Sizewell C Coastal Defences Design Report' was prepared in response to that information request and was not for approval [REP2-116].

1.1.6 This document has now been updated for Deadline 8, incorporating details of further design review and optimisations. The principal outcomes of those optimisations is to reduce the seaward extent of the toe of the HCDF, a paring-back of the HCDF alignment at the BLF/ Northern Mound area, and elimination of the sheet piled temporary HCDF around the Northern Mound.

1.1.7 Additional questions were raised in subsequent representations from Interested Parties, and by the Examining Authority. Separate responses have already been provided to these questions (see [REP2-100], particularly Questions Bio.1.30, FR.1.0 and FR1.30) but where relevant those responses are reflected in this update of the Coastal Defences Design Report.

1.1.8 All levels given in this Technical Note are designed, finished levels inclusive of future settlement effects.

1.1.9 Typical cross-sections provided in this document (Figure 3-2, Figure 3-5, etc.) are taken at an approximate Northing of 264015m. This is representative of the typical north-south 'run' of the Sea Defences along the Sizewell C frontage. The beach profiles presented in cross sections are taken from Channel Coastal Observatory data at February 2020[1]. Larger-scale sections are presented at Appendix A (A.1, A.2, etc.).

[1] https://coastalmonitoring.org/

2 DCO APPLICATION, CHANGE SUBMISSION AND OPTIMISATION

2.1.1 This Section describes the sequence of developments in the design solution for the Sea Defences during the DCO process, from the initial DCO application in May 2020 to Deadline 8 in September 2021.

2.2 May 2020 DCO Application

2.2.1 The principal technical design parameters supporting the DCO application were:

- The design life of the structure was 80 years (up to 2110).
- Climate change parameters based on using UKCP09.
- Structure to be earthquake-resistant (seismic design).

2.2.2 Other design parameters including the design basis storm event are defined by ONR and EA guidance and have remained unchanged. The sea defence design was also cognisant of the Design Principles outlined in the Design and Access Statement that was updated at Deadline 5 (REP5-070).

2.2.3 The construction methodology for the sea defence was set out in **ES Volume 2, Chapter 3 Description of Construction** [APP-184]. The permanent parameters for the sea defence were set out in the **ES Volume 2, Chapter 3 Description of Permanent Development** [APP-180]. These documents comprised the parameters for the sea defences.

2.2.4 A summary of the engineering design basis as then proposed is provided below:

- A Temporary Sea Defence comprising a rock revetment to a level of +7.0m OD with an earth bund on top providing screening up to +10.0m OD.
- A Soft Coast Defence feature (SCDF) shown on the drawings as infill on the existing beach crest to tie in with the existing and retained defences.
- A Permanent Sea Defence, comprising a rock-armoured revetment sea defence with crest level (excluding landscaping) +10.2m OD.
- An adaptive sea defence with crest level (excluding landscaping) of +14.2m OD.

2.2.5 Figure 2-2 and Figure 2-3 show the typical cross-sections of Temporary and Permanent Sea Defences current at that time. A larger scale cross-section of the Permanent Sea Defence is provided at Appendix A.1.

Figure 2-1 - Temporary Sea Defence, Typical Cross-section Underpinning May 2020 DCO Submission

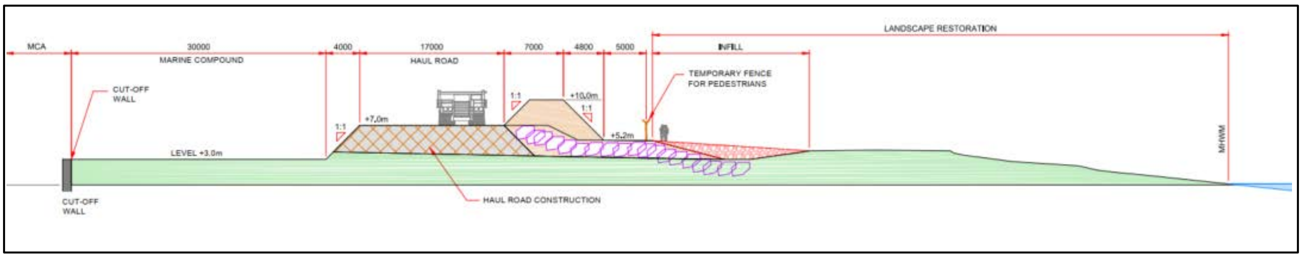
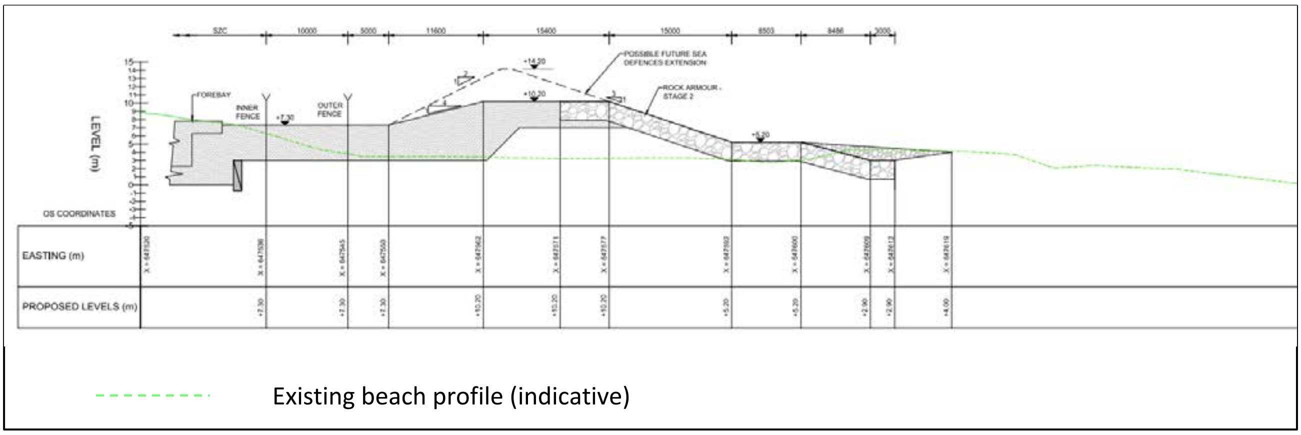


Figure 2-2 - Permanent Sea Defence, Typical Cross-section Underpinning May 2020 DCO Submission



2.3 January 2021 Change Submission [AS-181]

2.3.1 The principal design parameters are:

- The design life of the structure is 110 years (up to 2140 – extended to accommodate change in spent fuel storage strategy)
- Climate change parameters based on using UKCP18.
- Structure to be earthquake-resistant (seismic qualification).

2.3.2 The above changes increased the extreme 1 in 10,000yr design Still Water Level from 5.95m OD to 7.02m OD. The design Still Water Level is defined as the estimated present-day extreme water level including surge, derived from a statistical analysis, plus the climate change increase in mean sea level and surge to the year 2140.

2.3.3 The modified sea defence design comprised the following elements:

- A temporary sea defence during construction comprising a steel sheetpile wall to a level of +7.3m OD.
- A permanent hard coastal defence feature (HCDF) comprising a rock armour revetment to a level +12.6m OD (excluding landscape).
- Up to 2m thickness of substrate over the revetment to allow for visual integration and habitat creation on the seaward slope giving a maximum total height of +14.6m OD. Wqxq1
- An adaptive sea defence height of +16.4m OD excluding landscaping, with a maximum height of +18.0m OD including landscaping.
- A soft coastal defence feature (SCDF) of pebbles and cobbles to a level of +6.4m OD.
- Toe level of HCDF set at 0.0m OD, beneath SCDF.

2.4 Design Optimisation to September 2021

2.4.1 Further design development has taken place and the outcome of the design review is:

- Reduction in width of the whole line of the HCDF along the Sizewell C frontage by 5m to align the toe with Eastings 647615.
- Pare-back of the HCDF by 15m at the permanent BLF/ Northern Mound area to align the toe with Eastings 647615.
- Elimination of sheet piled temporary HCDF along the northern edge of the Northern Mound in favour of an optimised construction sequence.
- Further development of SZC SCDF blending into the SZB defences.

2.4.2 All of the above fall within the same parameters that have been assessed within the Environmental Statement (ES) and ES addenda, and the other relevant assessments, that would be secured under the DCO.

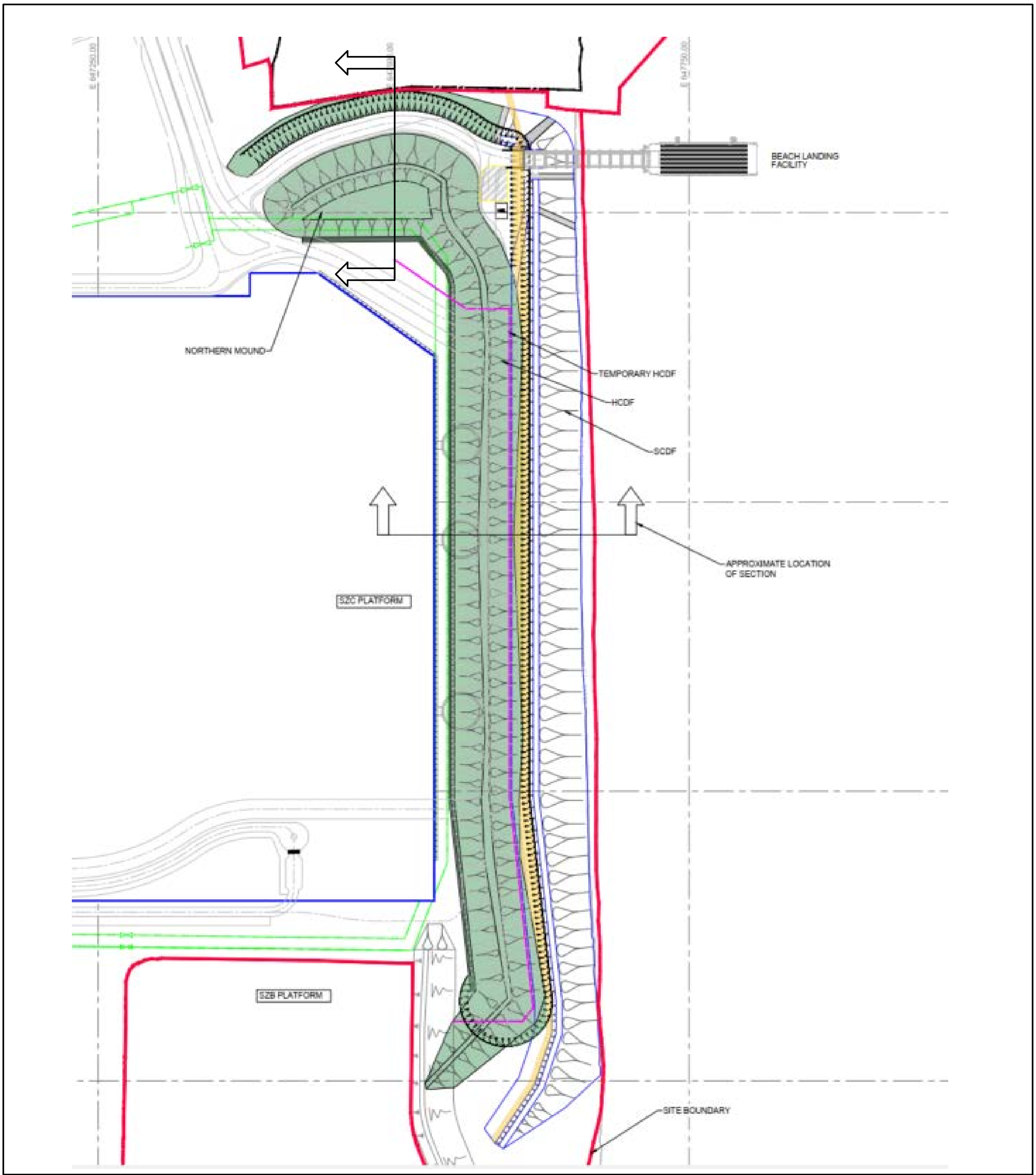
3 DESIGN DESCRIPTION

3.1.1 This section describes the design current at the time of preparing this document, at Deadline 8 (24 September 2021). This will continue to be work in progress until the design is submitted for formal approval following the grant of DCO consent.

3.2 General

3.2.1 The plan of the proposed Sea Defences is shown in Figure 3-1. The pink line shows the proposed temporary sheet-pile sea defence. This would be present during construction and will then be replaced by the permanent sea defences that would be in place throughout the operational life of the power station and during decommissioning until 2140. The black lines show the permanent HCDF. The green shading denotes landscape treatment of the HCDF and yellow shading the footpath corridor accommodating the England Coast Path. The slope indicators bounded by blue line are the proposed SCDF.

Figure 3-1 - Sea Defence Layout

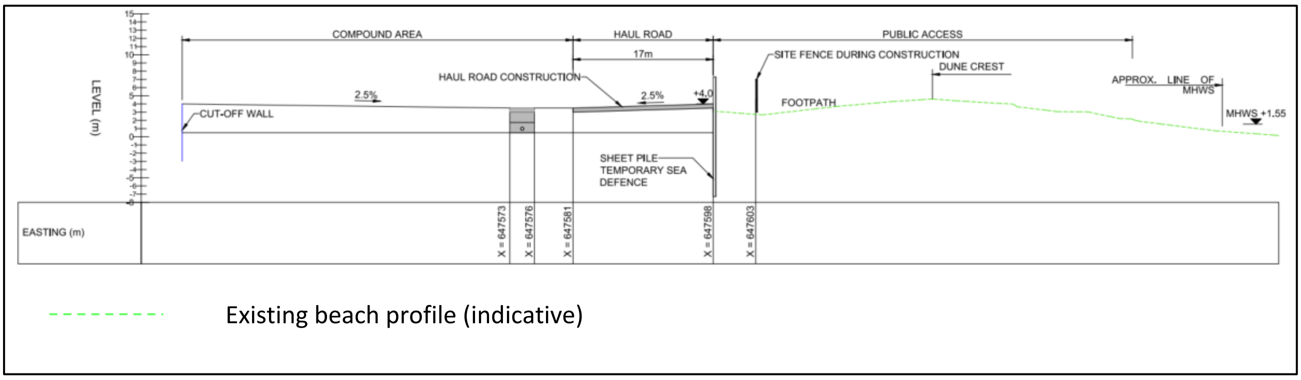


3.3 Temporary Hard Coastal Defence Feature

3.3.1 A temporary sea defence is proposed to protect the existing SZB nuclear power station and the proposed Sizewell C Main Construction Area (MCA) excavation from coastal flooding during the construction phase. This would take the form of a sheetpiled wall, with crest height +7.3mOD, overlapping the existing SZB sea defences at the south, running northwards to form the perimeter of the SZC MCA, and tieing-in with the Northern Mound. The alignment is represented by the pink line in Figure 3-1.

3.3.2 This design was introduced in the January 2021 change submission to increase working space within the SZC MCA. The typical cross-section of this temporary sea defence along the eastern flank of the MCA is shown on Figure 3-2 and in larger scale at Appendix A.2.

Figure 3-2 - Temporary HCDF, Typical Cross-Section



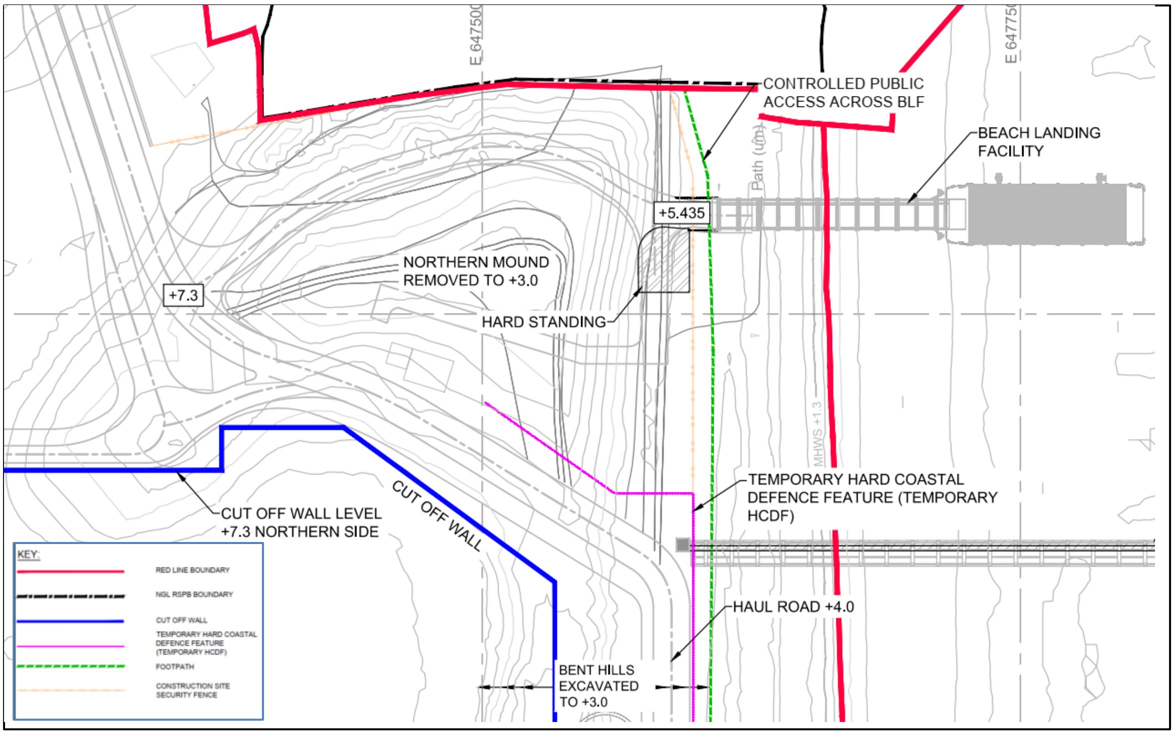
3.3.3 The temporary HCDF would be installed as one of the earliest construction activities, prior to the removal of the existing ridge ("Bent Hills") which provides a part of the existing SZB Sea Defences.

3.3.4 The sheetpiled temporary HCDF alignment will terminate at the southern edge of the Northern Mound, tying in to the reconstructed Northern Mound to maintain protection to the MCA excavation.

3.3.5 The Northern Mound would be removed, ground improvement installed beneath its footprint, and then reconstructed as an early activity prior to the MCA excavation being advanced. The reconstructed Northern Mound will form the northern extent of the temporary HCDF, tying in to the elevated ground of the SSSI crossing.

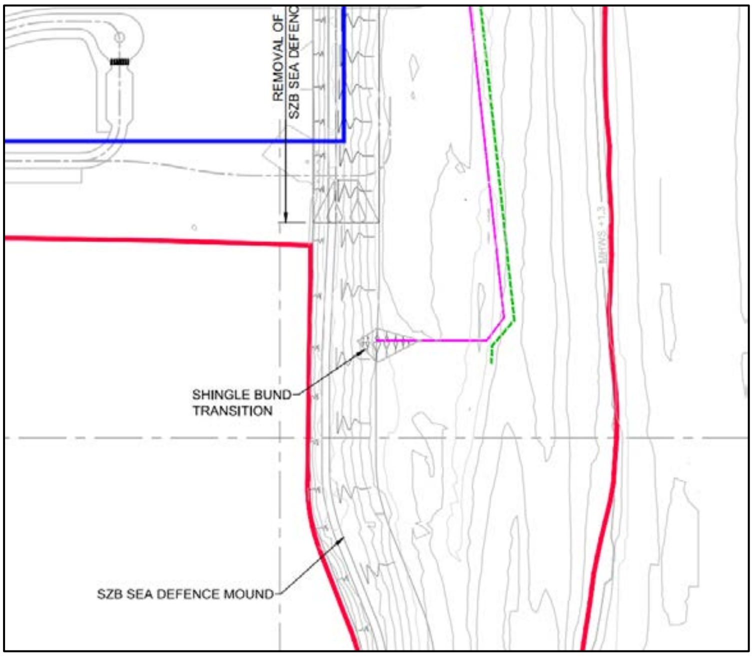
3.3.6 Figure 3-3 shows the configuration of the sheetpiled Temporary HCDF in this area.

Figure 3-3 - Temporary HCDF, Configuration at BLF/ Northern Mound



3.3.7 At the southern end of the site the temporary HCDF sheetpile will tie in with the SZB sea defence, refer to Figure 3-4.

Figure 3-4 - Temporary HCDF, Configuration at SZB

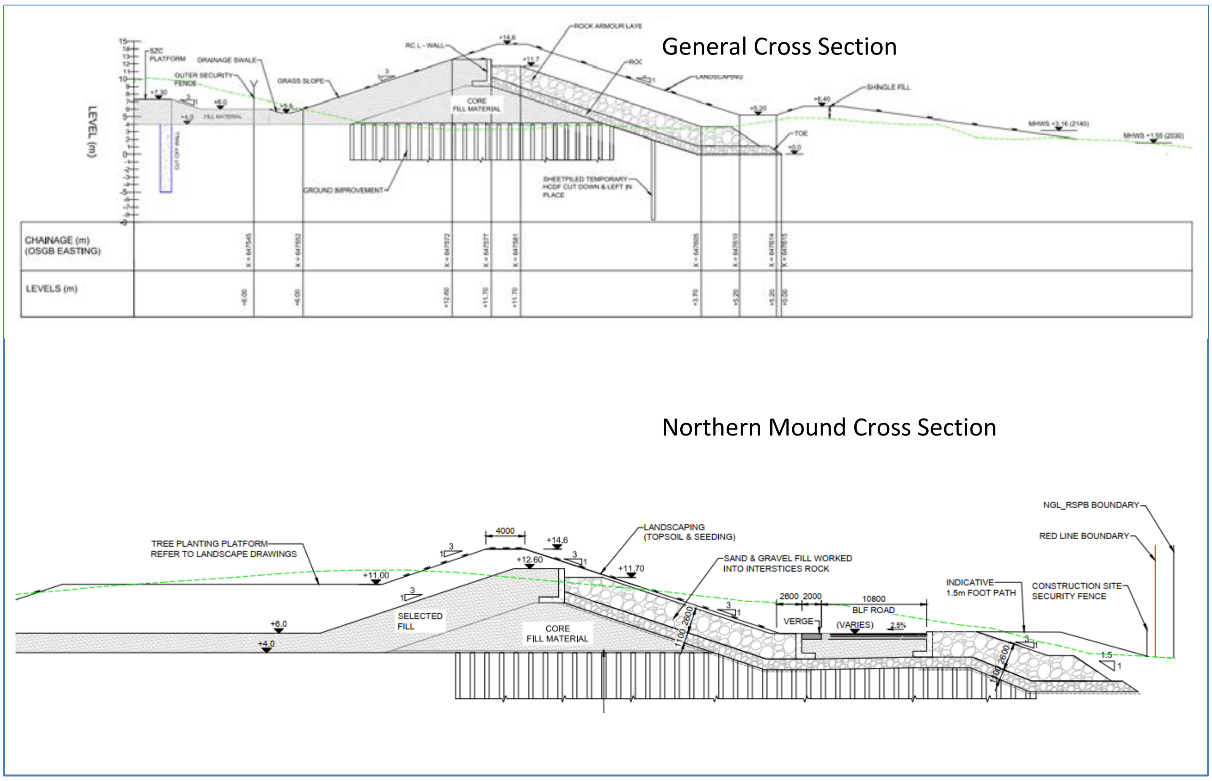


3.4 Permanent Sea Defence

3.4.1 The Permanent Sea Defence comprises two distinct, but functionally and spatially interconnected, elements; the permanent HCDF and the Soft Coastal Defence Feature (SCDF). There is also provision for an Adaptive Design of the Permanent Sea Defence to be implemented should future circumstances dictate the need for greater levels of protection than currently adopted. The Adaptive Design will only be implemented if mean sea level rise exceeds the reasonably foreseeable design value during the operational life of the structures from approximately 2030 to 2140 (see Section 3.11.5 *et seq*. for further details of trigger criteria for the implementation of the Adaptive Design).

3.4.2 A typical cross section of the Permanent Sea Defence is presented at Figure 3-5. A larger scale section is provided at A.3. The water levels shown are at the end of design life (2140), including for sea level rise according to RCP8.5, 95%-ile. MHWS in 2030 (start of operations) is also shown for comparison. The green line is the 2014 measured beach profile.

Figure 3-5 – Permanent Sea Defence, Typical Cross-section and Northern Mound



3.4.3 The seaward toe of the sea defence extends approximately 3m further east (seaward) than in the original DCO submission. This change in seaward extent between the current design and the May 2020 version is driven by the change in crest level of the Permanent Sea Defence (+10.2mOD in May 2020 submission, increasing to +12.6mOD in the change submission) and the minimum 5m standoff to the outer SZC site fence that fixes the landward (western) boundary. This security standoff represents a minimum value that was already assumed in the May 2020 DCO application in order to minimise the SZC footprint. The increase in crest height is due to the increase in climate change allowance between UKCP09 and UKCP18 and the extended design life of the sea defence.

3.4.4 The design considers a number of constraints and interfaces, including:

- The Beach Landing Facilities (Permanent and Temporary BLF)
- The cut-off wall design and construction (anchors)
- Tunnel routes under the sea defence
- Permanent security fence
- Public Right of Way (PRoW)
- Northern transition (Northern Mound)
- Southern transition (SZB sea defences)
- Drainage design of platform
- Landscaping treatment and profiles
- Habitat creation
- Minimising seaward extent of HCDF commensurate with engineering function.

3.4.5 **Basis of Design**

3.4.6 Table 3-1 summarises the design basis storm event conditions for both Reasonably Foreseeable (RF) and Credible Maximum (CM) scenarios.

3.4.7 The RF climate change scenario is the design basis for the Permanent Sea Defence. RF is a conservative estimate of future climate change as it uses the highest climate change scenario (RCP 8.5 95%tile).

3.4.8 The Credible Maximum (CM) has been taken as the H++ scenario defined in UKCP09 (not updated for UKCP18). It provides an estimate of sea level rise beyond the likely range but within physical plausibility. The CM case is the design case for the Adaptive Design which is described in more detail at Section 3.11.

3.4.9 Both scenarios must cater for the 1 in 10 000 year design basis storm event, and be tested against the 1 in 100 000 year beyond-design-basis event to identify any "cliff edge" effects that would also need to be designed against.

Table 3-1 - Design Parameters

Climate Change/ Timescale	Design Cases (Design Basis)	Design Case: Cliff Edge (Beyond Design Basis)
Reasonably Foreseeable (RF) 2110-2140	1 in 10,000 year return period storm event (95%ile) UKCP18, RCP8.5 – 95%ile SLR Long-term coastal erosion of 0 – 20m Hydraulic roughness 0.5 Storminess Wave Height Increase 10% Existing protection from offshore banks	1 in 100,000 year return period storm event (50%ile) UKCP18, RCP8.5 – 95%ile SLR Long-term coastal erosion of 0 – 20m Hydraulic roughness 0.5 Storminess Wave Height Increase 10% Existing protection from offshore banks
Credible Maximum (CM) 2110 -2140	1 in 10,000 year return period storm event (95%ile) H++ sea level rise – BECC Upper Long-term coastal erosion of 20m to 40m Hydraulic roughness 0.5 Storminess Wave Height Increase 10% Offshore banks lowered in height	1 in 100,000 year return period storm event (50%ile) H++ sea level rise – BECC Upper Long-term coastal erosion of 20m to 40m Hydraulic roughness 0.5 Storminess Wave Height Increase 10% Offshore banks lowered in height

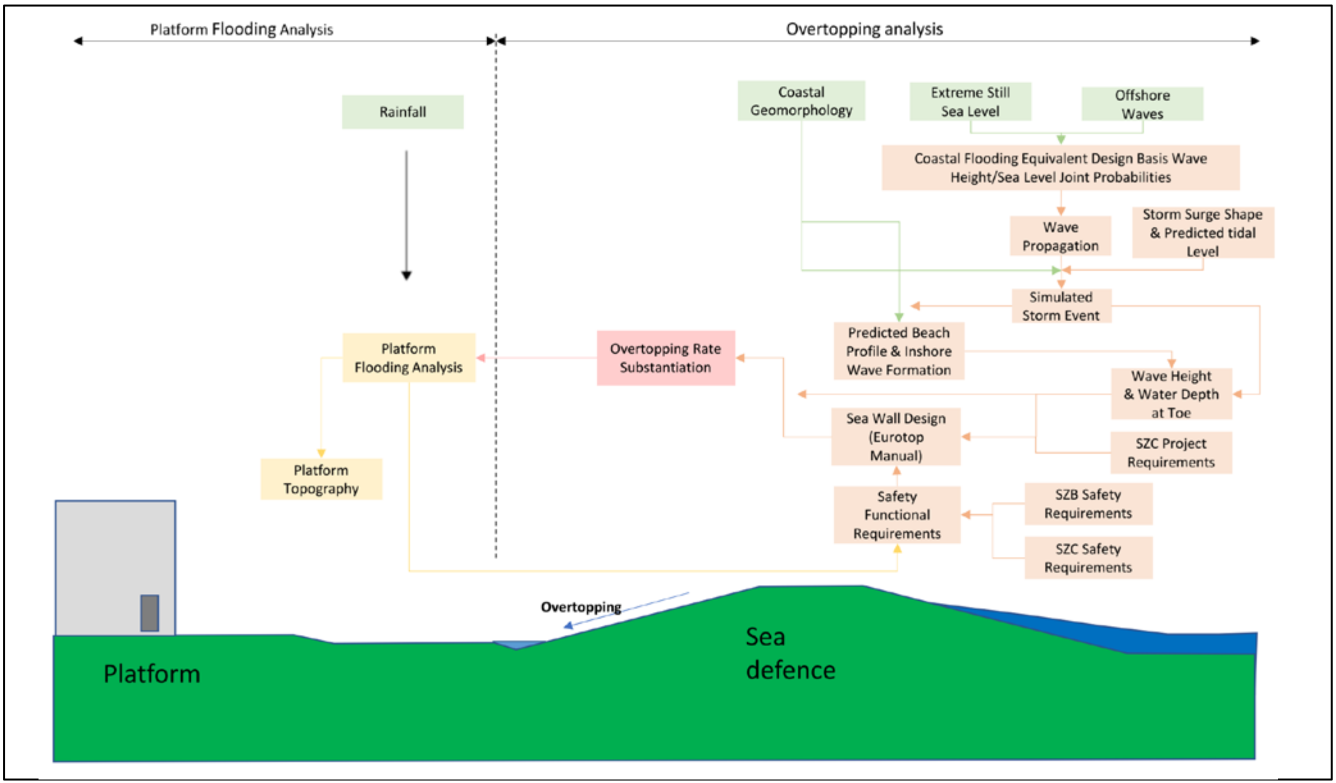
3.4.10 **Design Methodology**

3.4.11 The key inshore design parameters for the sea defence are:

- Wave height and still water level pairs at the toe at the toe of the HCDF.
- Associated wave direction and period

3.4.12 These parameters are derived from a combination of numerical wave and beach modelling to take account of environmental considerations including coastal geomorphological processes responsible for coastal change. Figure 3-6 shows the process used to obtain these inshore design parameters. The inshore parameters were then used to calculate the overtopping of the sea defence and the stability of the rock armour slope.

Figure 3-6 - Design Methodology



3.5 Hard Coastal Defence Feature (HCDF)

3.5.1 The engineered structure of the HCDF comprises a rock revetment with a double armour layer of 6 to 10 tonne quarried armour stone rock over a rock underlayer, granular core and ground improvements (where needed). A landscape treatment would be applied to the surface of the HCDF.

3.5.2 The primary physical elements of the HCDF design cross section include: crest height, slope angle, rock size, toe level, core fill material specification, and foundation design. Table 3-2 lists the physical design parameters that affect the form and level.

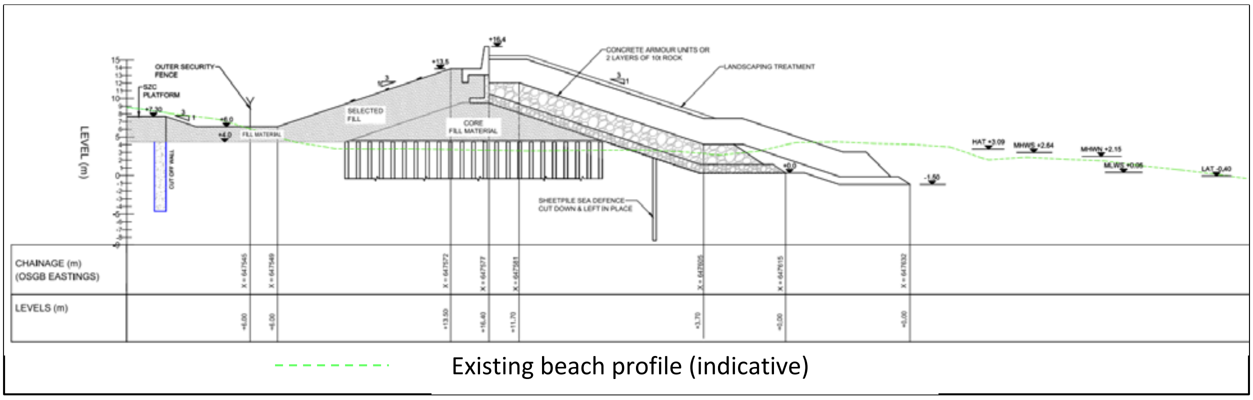
Table 3-2 - Physical Design Parameters

Physical Parameter	Design parameters	Comments
Armour Size	-Wave height and period -Storm duration -Structure porosity	It is desirable to use standard grading 6-10t rock as this is largest readily available size. A concrete armour solution is frequently considered when a

Physical Parameter	Design parameters	Comments
	-Structure Slope angle	larger rock size is required. A concrete armour solution is not required for the HCDF but may be required for the Adaptive Design.
Crest Height	Overtopping volume which is dependent on: -Slope roughness -Wave height and water level combination -Structure slope angle	Crest height is set to achieve a peak allowable overtopping rate. This is specified at 2 l/s/m for the design basis event. This limit was found to be acceptable in the context of flood risk to the station platform and also stability of the HCDF backslope.
Slope angle	-Internal angle of friction of the core fill material and other layers, which affects the slope stability. -Seismic loading (slope stability)	Slope angle affects other parameters such as scour depth rock stability and overtopping. Steep slopes cause greater wave reflection which causes scour. A 1 in 3 slope has low reflection characteristics.
Toe Level/Scour	- Design Basis Simulated Storm Event - Beach profile/SCDF response to the storm event	The level of the toe is set at below the predicted scour level for the design basis storm event.
Core	-Interface stability under hydraulic loading -Internal stability under seepage pressure -Compressibility and strength requirements	Core material needs to be an engineered fill to be suitable for use.
Foundation	-Underlying soil strata physical properties -Slope stability including under seismic loading	Sea defence may need ground treatment in some locations because of underlying low strength layers of peat/ alluvium

3.5.3 Figure 3-7 shows both the Permanent Sea Defence design and the outline of the Adaptive Design superimposed on it. The HCDF toe is set beneath the SCDF level in both scenarios.

Figure 3-7 - Permanent Sea Defence, Cross-Sections (Baseline and Adaptive)



3.5.4 The erosion of the existing beach and SCDF cross section that would occur during design storm events was simulated using a numerical beach profile evolution model. The simulated storm comprised a 90hr predicted tidal series with superimposed surge shape and storm wave shape using various 1 in 10,000yr joint probability pairs of waves and water levels. The starting beach profile assumed 20m erosion of the proposed renourished shingle crest (SCDF) prior to the storm.

3.5.5 The toe level of the Permanent Sea Defence in the January 2021 DCO change submission is set at a level of 0.0m OD, being 0.5m below the predicted lowest beach level following a 1 in 10 000 year storm event (Table 3-3). This modelling is based on the 2140 climate change parameters (RCP8.5, 95%ile).

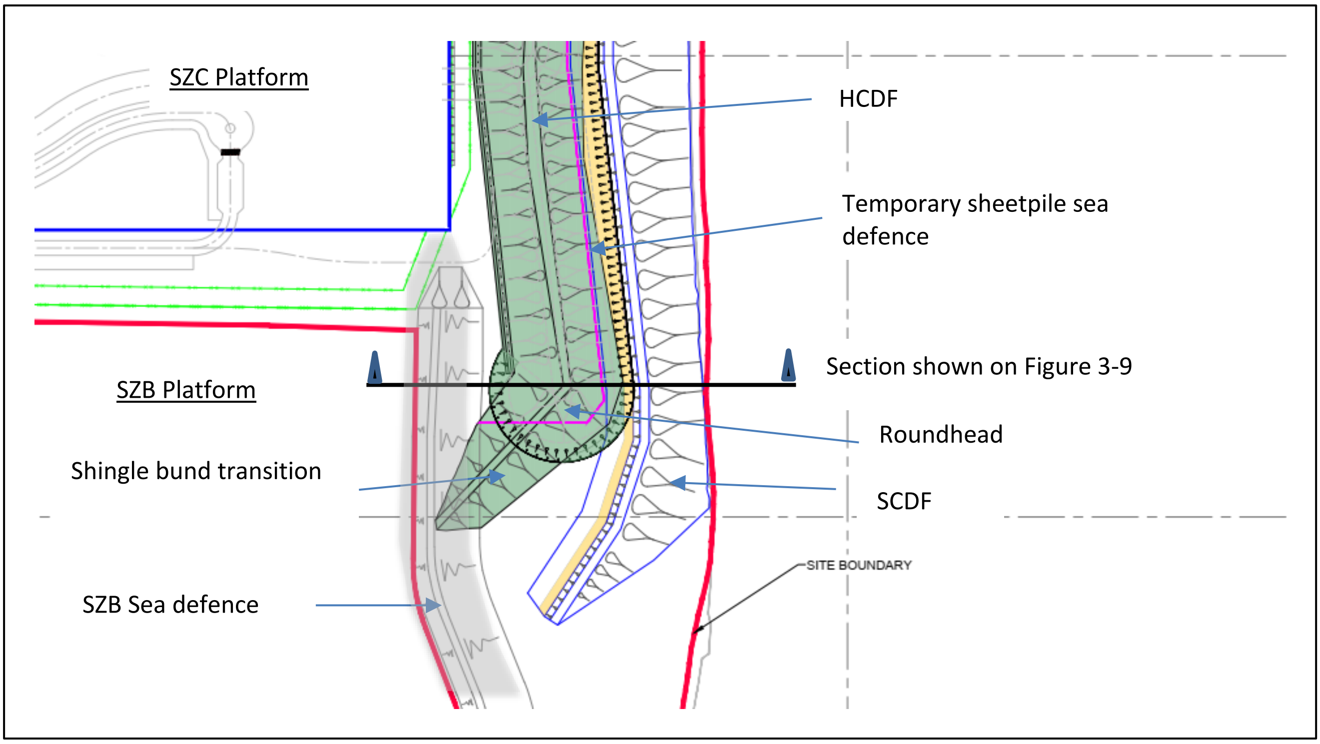
Table 3-3 - Minimum toe level results from model output

1 in 10,000yr Storm **With reasonably foreseeable climate change**	**1 in 100,000yr Storm** **With reasonably foreseeable climate change**
+0.50 mOD	+0.46 mOD

3.6 SZB Interface

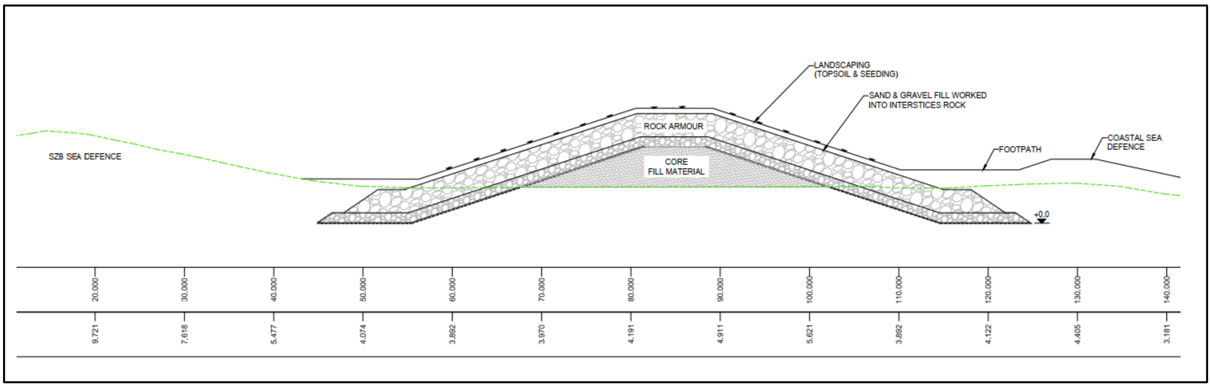
3.6.1 The design of the interface with the SZB defences has been refined since the design phase underpinning the May 2020 DCO submission. The SZC Permanent Sea Defences are to be seismically qualified, whereas it has been confirmed that the existing SZB sea defences are not seismically qualified. It is therefore necessary to separate the two defence structures from one another. The proposed SZC sea defence included in the January 2021 change submission therefore overlaps the SZB defence, as shown in Figure 3-8, rather than merging into it.

Figure 3-8 - SZB Interface – Plan



3.6.2 An indicative cross section of the roundhead feature is shown in Figure 3-9, the location of this section is shown in plan on Figure 3-8. This area of the sea defence is closer to the existing line of MHWS and therefore has a smaller beach volume in front of it than the main run of the sea defence. Numerical modelling indicates that this narrower section of the SCDF has sufficient volume to provide protection against 1 in 10,000yr storm events.

Figure 3-9 - SZB Interface – Roundhead



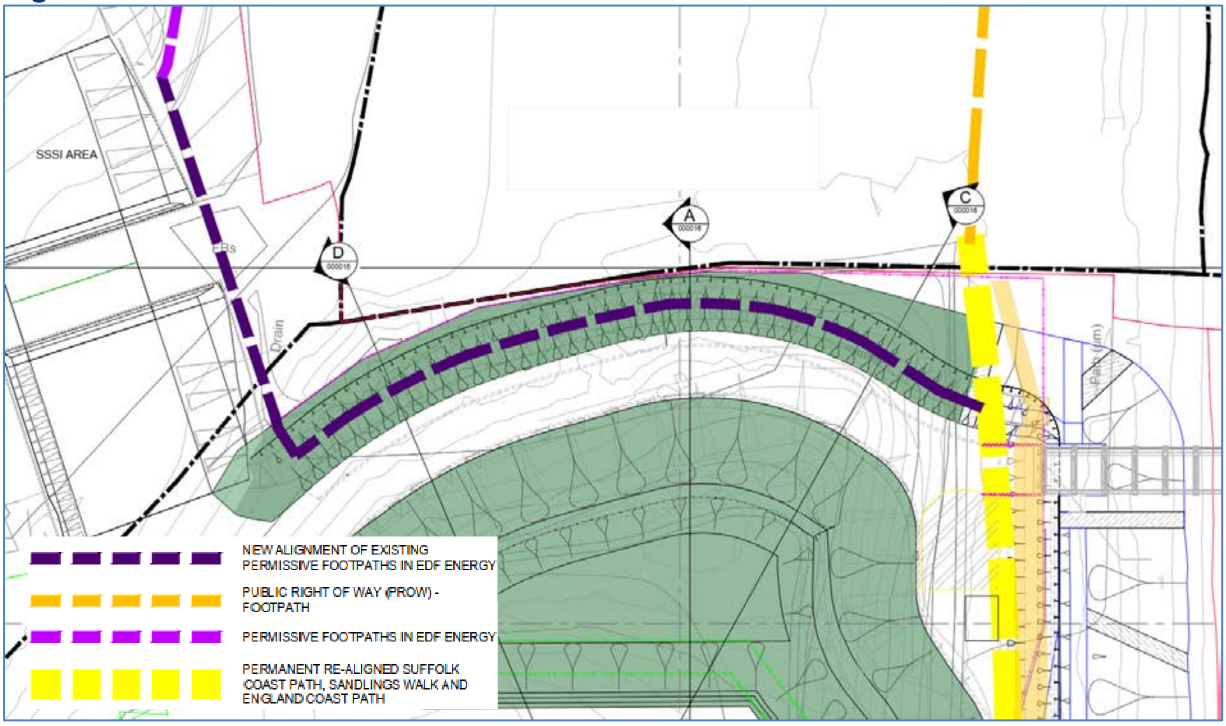
3.7 RSPB Boundary & Public Rights of Way (ProW)

3.7.1 The Public Rights of Way (PRoW) (the Suffolk Coast Path) would be redirected up and down the shoreline as necessary to facilitate construction of the permanent and temporary sea defences. Further information about the Rights of Way and Access Strategy is given in [REP7-023].

3.7.2 Figure 3-10 shows the location of the realigned Coast Path (PRoW) and Sandlings Walk (permissive path).

3.7.3 Sandlings Walk will be aligned around the toe of the reconstructed Northern Mound section to cross the SSSI adjacent to the retained SSSI crossing bridge. The exact route alignment is to be agreed, but sufficient and suitable space exists for the permissive path to be installed entirely within the SZC Co land area and within the Order Limits proposed Order Limits boundary, not relying on RSPB land. The cross sections shown in Figure 3-11 indicate the proposed location of this path.

Figure 3-10 – RSPB Interface & PROW

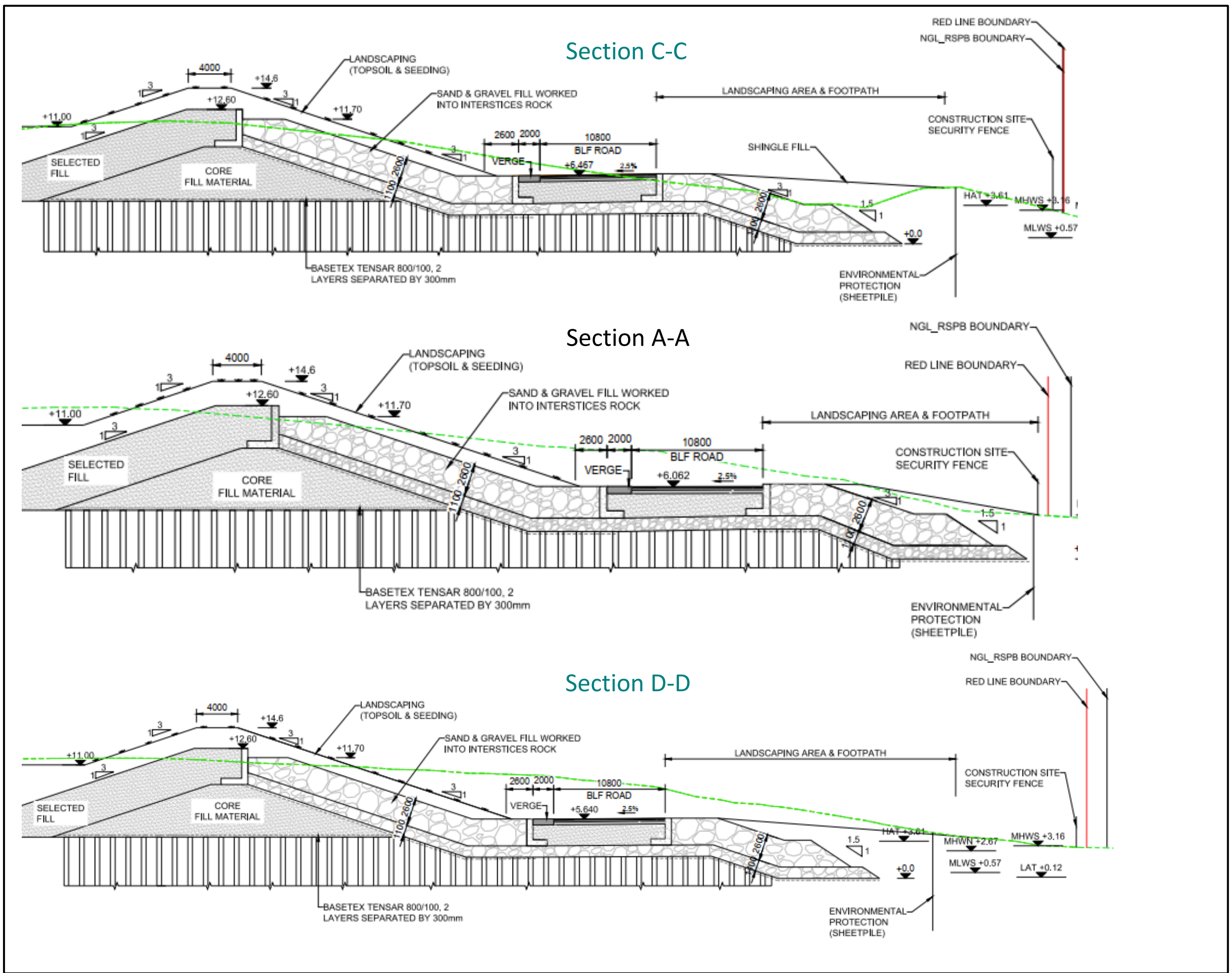


3.7.4 The typical sections in Figure 3-11 show an Environmental Protection sheetpile (EPS) within the SZC site and alongside the RSPB boundary.

The purpose of the EPS is to prevent construction site contamination such as mud/ slurries from reaching the SZC boundary and entering the Minsmere area through overland flow. The EPS will be a low-level feature, and is not expected to extend more than a metre above surrounding ground levels. At the closest section to the RSPB boundary (A-A) it provides a barrier between the construction excavation for the toe and the RSPB land.

3.7.5 The EPS is a temporary feature. The equivalent function could be provided by other means such as surface-mounted pollution control barriers. It is not considered to have any adverse impact on coastal processes. It is not shown on other drawings as it is not a permanent feature. It is included on this drawing to define the treatment of the boundary with RSPB Minsmere.

Figure 3-11 – Typical Sections at RSPB Interface



3.8 Landscape Treatment

3.8.1 The HCDF would have a natural, vegetated appearance similar in character to the Sizewell B sea defence. The outward, public facing slopes of the sea defence would have a typical gradient of 1:3 to aid the establishment of vegetation and match the profile of the existing Sizewell B defences. The engineered structure of the sea defences would be dressed with a soft fill material and planted to integrate the feature into the coastal landscape and provide characteristic habitat.

3.8.2 The landscaped height of the sea defence would vary between +13.2m OD and +14.6 m OD allowing for an additional 0.6m – 2m substrate layer on top of the hard engineered structure. The substrate layer would be constructed to varying depths in order to create undulations in the landform, to naturalise its appearance and create niches for habitat variation.

3.8.3 Substrate placed above the functional crest level of +12.6mOD is not considered to contribute to the claimed performance of the HCDF. However, it is recognised that the presence of this material will in practice provide some beneficial effect.

3.8.4 The seaward facing slope of the defence would be planted with coastal scrub and dune grassland species along the majority of its length and managed in line with the existing Sizewell B sea defence to achieve a similar naturalistic appearance.

3.8.5 Tree planting would be incorporated on the front and back slopes of the sea defence on the Northern Mound. Land to the rear face of the Northern Mound would be raised to a height of approximately +11mOD post construction and is deliberately set lower than the crest of the sea defence to create a sheltered area to provide an enhanced environment to support the establishment of trees given the important viewpoints to the north.

3.8.6 The revised design maintains an approximate 12m wide plateau and footpath corridor along the seaward face of the defence at a minimum height of +5.2mOD, to accommodate the proposed England Coast Path. The design of the sea defence allows for variation in the width and height of the plateau to create a naturalistic landform.

3.8.7 The publicly accessible coastal margin would extend up to the SZC platform security fence and allows for an informal footpath along the crest of the sea defence.

3.8.8 Further details of the landscape proposals for the sea defences are provided in the updated Design and Access Statement submitted at Deadline 5 (REP5-070).

3.9 Drainage Swale

3.9.1 A swale has been indicated in the space between the landward slope of the HCDF and the SZC platform, as shown in Figure 3-5 and Appendix A.3. The swale is included as a beneficial feature, but is not necessary in order to meet drainage requirements. The swale will increase the volume available between the HCDF and the SZC platform for storage, infiltration and guidance of runoff surface and any overtopping water from the HCDF. The inclusion of this swale has no impact on the seaward extent of the HCDF, which is driven by the Adaptive Design configuration.

3.9.2 The swale will not be present in the Adaptive Design configuration. The back slope of the Adaptive Design is set at the 5m minimum offset from the outer fence line and it is this which defines the seaward extent of the HCDF.

3.10 Soft Coastal Defence Feature (SCDF)

3.10.1 Description

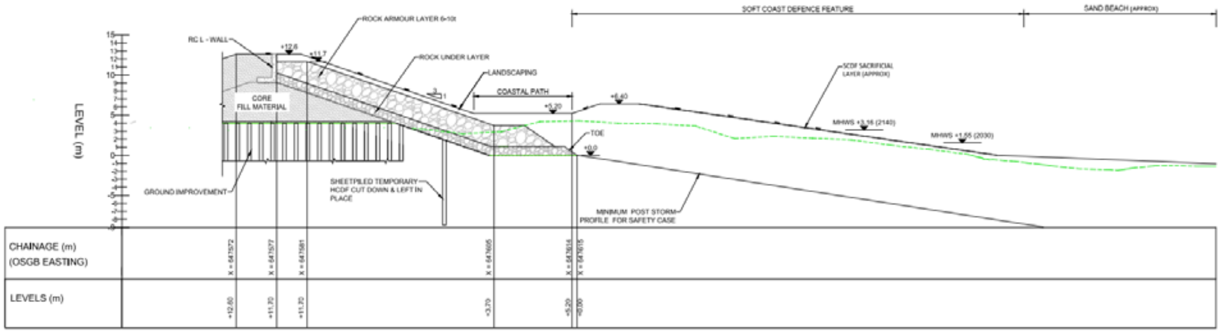
3.10.2 The proposed Soft Coastal Defence Feature (SCDF) refers to the enhanced and maintained upper (shingle) beach at Sizewell. The upper beach is distinct from the sandy mostly sub-tidal beach that extends offshore and includes sand bar features.

3.10.3 The purpose of the SCDF is to maintain the natural alongshore drift of sediments, and to prevent undermining of the HCDF toe. In so doing, by virtue of its physical presence, it will also afford protection from wave attack and be a source of accretion to the downdrift beaches.

3.10.4 The Soft Coastal Defence Feature (SCDF) was referenced in the May 2020 DCO application. Infilling to the beach crest was shown on the supporting drawings (refer to Figure 2-3).

3.10.5 The SCDF is defined by an upper profile that will be created from beach recharge (sacrificial layer) and a lower profile that would be the recharge threshold that the beach profile should always be above, refer to Figure 3-12, Figure 3-13 and Appendix A.4. An initial recharge of the beach during construction will create the upper profile. There will be subsequent periods of recharge during the life of the sea defences, if and when the beach erodes to the extent that triggers the need for recharge. This is described further in section 3.10.18 *et seq*. and 4.2.17 *et seq*.).

Figure 3-12 – SCDF, Upper Maintained Profile and Initial Beach Recharge Profile



Existing beach profile (indicative) – shingle fill above this line is initial beach recharge

3.10.6 **Geomorphology**

3.10.7 As detailed in Volume 2, Chapter 20 (Coastal Geomorphology and Hydrodynamics) of the ES (Book 6) [APP-311], the Sizewell frontage is comparatively stable compared to neighbouring shorelines. However, expert geomorphological assessment contained in Appendix 20A of the ES [APP-312] concluded that, without mitigation, the shore would erode back within a few decades following construction of Sizewell C, risking exposure of the HCDF by 2053-2087. This would occur naturally, irrespective of whether Sizewell C is developed or not. The proposed Soft Coastal Defence Feature (SCDF) would be deliberately sacrificial, releasing sediment into the local sediment system in major storm events that would reduce erosion rates along the SZC frontage. The SCDF would be recharged as necessary in order to maintain the beach. This would prevent the HCDF being exposed over the lifetime of the power station, including decommissioning, avoiding significant impacts on neighbouring shorelines.

3.10.8 **Design of the SCDF**

3.10.9 The behaviour of the SCDF in design basis storm events has been numerically modelled and eroded post-storm profiles derived. The introduction of beach replenishment material (pebbles and cobbles) on the shoreface and backshore (beach crest) will ensure that a beach is maintained seaward of the HCDF.

3.10.10 Numerical modelling of the beach storm response indicates that the toe of the HCDF would not be at risk of being undermined in a design basis 1 in 10,000yr storm event provided it is set at 0.0m OD or lower. This modelling was based on an eroded profile some 20m landward of the proposed/existing profile immediately prior to the storm. These profiles will be subject to further study and modelling work during the detailed design phase and will be based on the most recent survey information.

3.10.11 **Initial creation of SCDF**

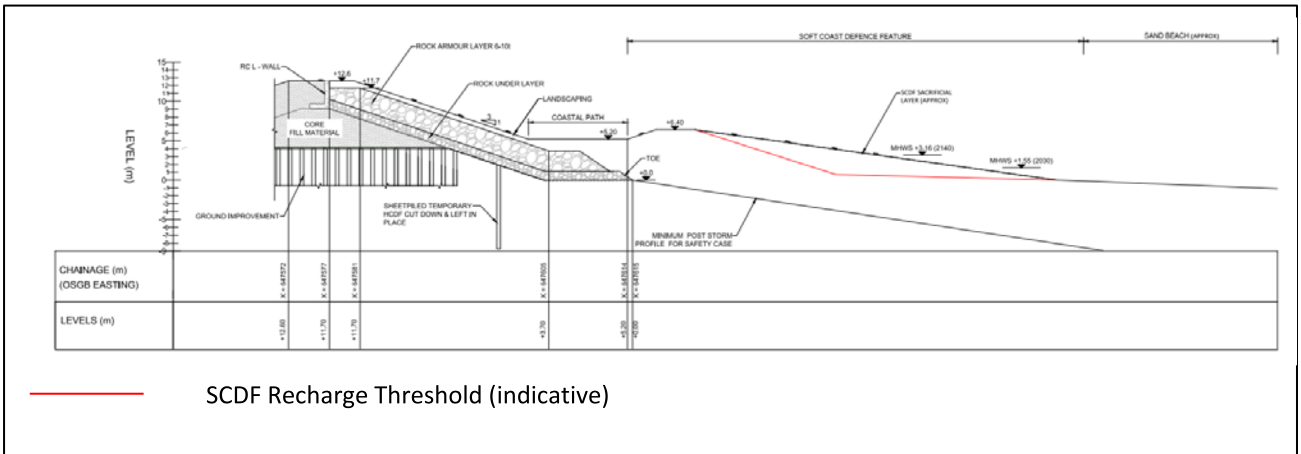
3.10.12 Figure 3-12 and Appendix A.3 show the proposed infilling required to create the SCDF, being the volume between the existing beach (green dashed line) and the proposed beach profile (upper black line). This infilling and shaping of the existing beach would be undertaken immediately following construction of the HCDF.

3.10.13 The SCDF would start at the eastern face of the HCDF, following the approximate alignment of the proposed coast path. Seaward of the coast path, the SCDF would rise to form a bund with an approximate crest level of +6.4m OD, before sloping down gently to merge with the existing beach profile. The exact shape, crest level, and crest width of the SCDF will be determined at detailed design stage following DCO grant.

3.10.14 The infilling will likely use sediment within the same particle size range as the native beach face. Use of pebbles and cobbles towards the coarser end of the size spectrum, would provide enhanced longevity and reduce the frequency of subsequent recharge but for geomorphological, ecological, landscaping reasons the default position is that the SCDF will match the native particle size. BEEMS technical report TR544 [REP7-101], gives further details of the proposed beach recharge material.

3.10.15 Figure 3-13 and Appendix A.4 show the indicative proposed recharge threshold profile.

Figure 3-13 – SCDF, Indicative Recharge Threshold



3.10.16 The recharge threshold profile shown in red on Figure 3-13 and Appendix A.4 is higher than the beach profile required to maintain the safety case for the sea defences such that the toe of the HCDF at +0.0m OD is not undermined in a design basis storm event. Again, the exact shape/volume of this profile will be determined at detailed design stage.

3.10.17 BEEMS technical report TR544 [REP7-101] has proposed that beach recharge would be based on a volumetric approach. The SCDF is conceptually divided into two main components:

- landward safety buffer volume (V_{buffer}), which is not intended to be depleted or frequently exposed but is sufficiently large in itself to avoid HCDF exposure under severe storms,
- seaward sacrificial volume V_{sac}, which would be allowed to erode as far back as V_{buffer} ,before being recharged. The rationale for the safety buffer component is to protect against storms or storm sequences just prior to recharge.

3.10.18 **SCDF and Beach Maintenance**

3.10.19 When the SCDF has eroded to pre-defined ‘trigger’ levels it would be recharged (‘topped up’ with sediment) in order to maintain a protective beach between the HCDF and the sea, as indicated in BEEMS technical report TR544 [REP7-101] & TR545 [REP7-045]. These reports demonstrate that maintaining the beach in this manner is viable over the design life to the end of operational and decommissioning phases.

3.10.20 The Coastal Processes Monitoring and Mitigation Plan (CPMMP) [REP5-059], to be approved under DCO Requirement 7A and Marine Licence Condition 17, details the methods to monitor erosion of the SCDF and will define the levels at which recharge is required.

3.10.21 The CPMMP would be periodically reviewed by the Marine Technical Forum (MTF) which is to be secured and funded through obligations in the draft Deed of Obligation [REP7-040].

3.10.22 **Landscape Treatment**

3.10.23 The existing vegetated shingle and beach habitats would be replicated on the proposed SCDF in accordance with the Preliminary Design and Maintenance Requirements for the Sizewell C Coastal Defence Feature [REP7-101].

3.10.24 Following the initial creation of the SCDF, the supratidal area will be landscaped using retained seedbank material from the initial site preparation.

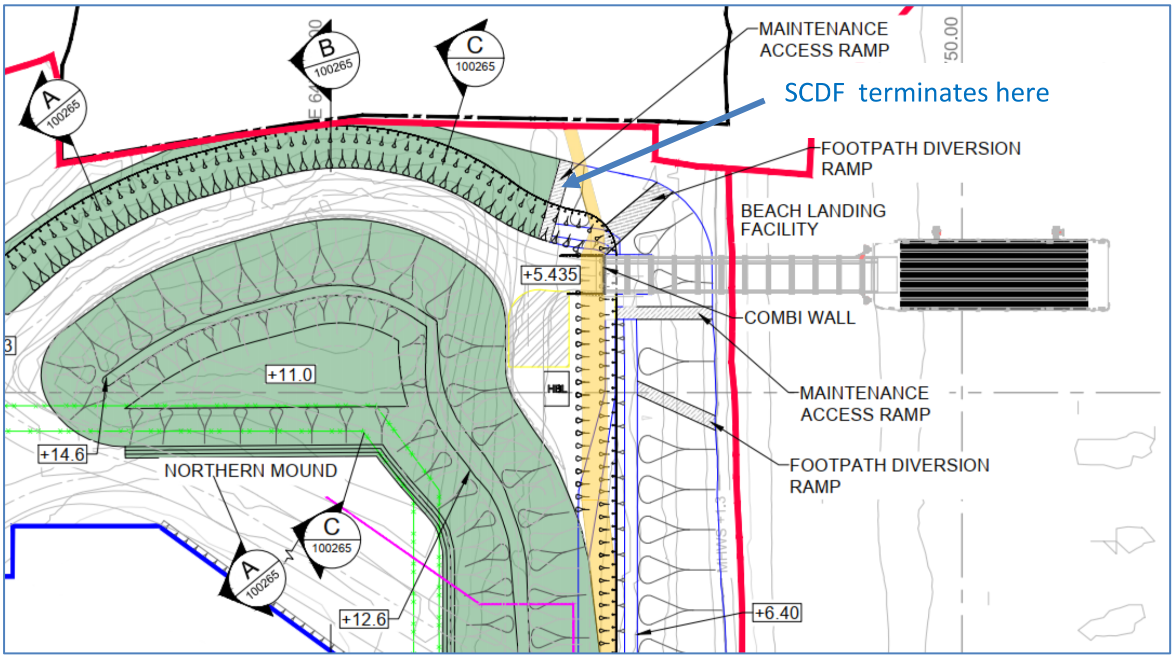
3.10.25 Once the SCDF is established, future recharge of the beach will be infrequent. Recharge is not expected to have any long-term impact on the established habitats and would occur in areas where vegetation is naturally lost, replenishing the sediment there and facilitating potential re-colonisation of the supratidal habitat within the county wildlife site, just as currently happens after a storm event.

3.10.26 Recharge of the SCDF would occur before the beach has eroded to the coast path ensuring that the coastal path remains in place.

3.10.27 **SCDF and BLF interface**

3.10.28 The soft sea defence terminates at the maintenance ramp in the BLF area, as seen in Figure 3-14.

Figure 3-14 – SCDF and BLF interface



3.10.29 The crest of the SCDF will be locally lowered at the BLF location when the BLF is in use, otherwise it will be profiled as elsewhere when the BLF deck is in storage. The maintenance access ramp on the south side of the BLF would be buried by the SCDF but could be uncovered when required for use.

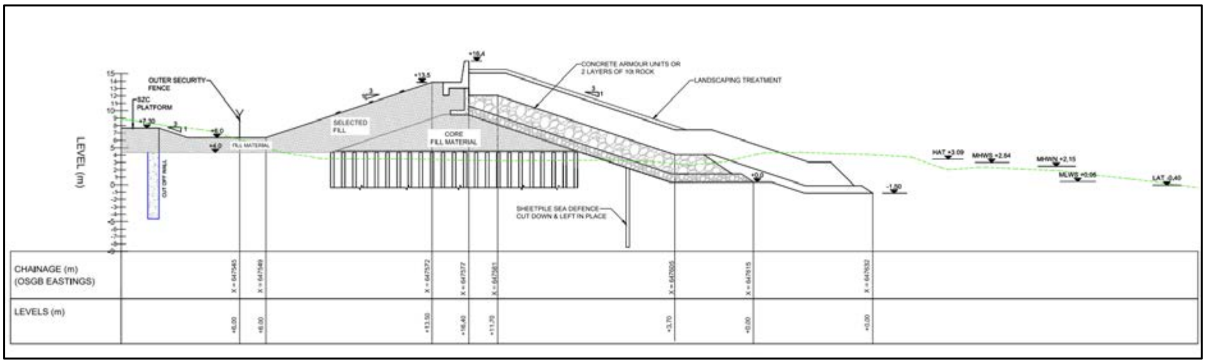
3.11 Adaptive Design

3.11.1 The HCDF is designed to protect Sizewell C from a 1 in 10,000yr storm event with “Reasonably Foreseeable” (RF) climate change effects up to the end of its design life in 2140. Further details of the RF case are given in Sections 3.4.5 *et seq*. The RF sea level rise is taken from UKCP018 RCP8.5 (95%tile) and is, therefore, a conservative estimate. A value of 10% was added to design wave heights and periods.

3.11.2 Owing to the inherently uncertain nature of climate change, it is recognised that the RF climate change scenario may be exceeded, leading to more onerous climate change effects becoming prevalent. ONR and EA guidance therefore requires that the sea defence be capable of adaptation to a Credible Maximum (CM) sea level rise. The CM scenario is defined as the H++ climate change scenario as defined in UKCP09, as UKCP18 refers back to the UKCP09 estimates and does not provide updates estimates (refer to section 3.4.5 *et seq*). The sea defences have therefore been designed to allow for future adaptation to accommodate the CM scenario, should it develop. The modified defences that would be delivered through implementing these future adaptations are termed the “Adaptive Design”.

3.11.3 Figure 3-15 shows the Adaptive Design, with tidal levels shown reflecting RF sea level rise to 2140. A larger-scale section is provided at Appendix A.5. The Adaptive Design of HCDF would retain an SCDF in front of it.

Figure 3-15 - Adaptive Design, Typical Cross-section of HCDF



3.11.4 In the Adaptive Design, concrete armour units would be overlaid on the previously placed rock revetment, and the toe section extended further seaward to a lower level. A toe level of -1.5mOD would be required, i.e. 1.5m deeper compared to when the proposed HCDF is originally built.

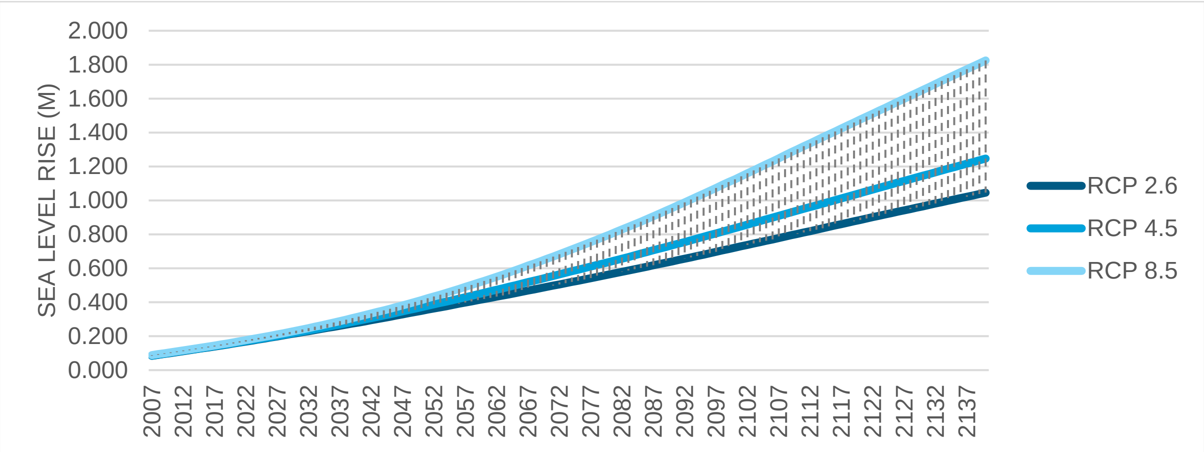
3.11.5 **Trigger Levels for Adaptive Design**

3.11.6 The implementation of measures to enact the Adaptive Design would be driven by progressively observed effects of climate change, specifically mean sea level rise.

3.11.7 The need to implement the Adaptive Design is only expected to occur if mean sea level is forecast to exceed the Reasonably Foreseeable design value (RCP8.5 95%ile). The current UKCP18 RCP 8.5 95%ile sea level rise estimates to 2140 is 1.825m. Figure 3-16 shows the UKCP18 sea level rise estimates. It will be obvious which trajectory is being followed decades before the design value is exceeded, allowing implementation of the Adaptive Design before the threshold is reached.

3.11.8 International and UK Government Climate Change predictions are also expected to be regularly updated and refreshed, and the UKCP18 predictions compared against future predictions.

Figure 3-16 - UKCP18 RCP's (95%-ile)



3.11.9 Paragraph 7.1.37 in the Main Development Site Flood Risk Assessment (MDS FRA) (Doc. Ref 5.2A) [AS-018] confirms that the impacts of climate change on sea level rise would be monitored and assessed at set intervals (e.g. 10 years) to determine the trajectory of the projections (e.g. in terms of sea level rise or increased storminess) and consider whether there is any change from either the currently considered projections or the climate change guidance as applied within the Application. This is in line with the Nuclear Site Licence requirements, whereby an appropriate monitoring programme needs to be in place and that a periodic safety review is undertaken. Monitoring arrangements for this are secured by DCO Requirement 12B.

3.12 Minimising eastward extent

3.12.1 The key driver for minimising the eastward extents of the HCDF is to minimise impacts on coastal processes whilst maintaining an appropriate corridor for amenity and recreation.

3.12.2 Opportunities to reduce the eastward extent of the Permanent Sea Defence fall into two general groups:

- Move the HDCF further inland
- Reduce the overall width of the HCDF

3.12.3 The form and location of Temporary HCDF does not drive the seaward extent of the Permanent HCDF. The adoption of the Temporary Sea Defence has allowed the construction phase plot plan to be optimised, minimising the occupation of the beach and foreshore during this phase and providing an effective screen between construction activities and public access areas.

3.12.4 **Move HCDF further inland?**

3.12.5 The HCDF construction is constrained by the minimum 5m standoff from the outer security fence to the landward toe of the sea defence in the Adaptive Design configuration, refer to Section 3.9, Figure 3-15 and A.5.

3.12.6 The landward toe of the HCDF cannot therefore be moved further west unless the outer perimeter fence also moves to the west. Moving the perimeter fence to the west could only be achieved through either compressing the East-West extents of the SZC platform, or by moving the entire platform further west.

3.12.7 The SZC platform configuration, including offsets between perimeter fencing and internal assets, and between internal assets on the platform, has been optimised to minimise space requirements and to maximise replication with the HPC layout. Further East-West compression of the platform layout is therefore not considered feasible. It is also not considered feasible to relocate the entire SZC platform further west as this would further increase land take from Sizewell Marshes Site of Special Scientific Interest (SSSI) which would not be appropriate.

3.12.8 It is therefore not practicable to modify the operational SZC platform position or configuration, nor the position of the outer security fence relative to the internal platform area to lessen the seaward extent of the sea defences.

3.12.9 Reduce width of HCDF?

3.12.10 A number of options were considered to reduce the overall width of the Permanent Sea Defence, including:

- Increasing gradients
- Reducing crest level
- Reducing crest width

3.12.11 Increasing gradients to minimise the eastward extent was considered, but was discounted for the following reasons:

- A steeper seaward slope would require a higher crest level to achieve the same overtopping performance.
- A steeper seaward slope would require larger rock armour or the use of concrete armour units.
- A slope steeper than 1 in 3 would be difficult to establish grass on and difficult to maintain as motorised machinery could not be used. This applies to both seaward and landward slopes. If a steeper slope were to be adopted for the revetment, landscaping opportunities would be limited. In order to achieve a naturalistic landscaped finish, the landscaped surface would still need to be at a maximum of 1:3 slope. With a higher crest level this would lead to an increased land take towards the beach, even if the buried structure were to become narrower.
- A slope steeper than 1 in 3 would require reinforcement to be stable for seismic loading. This applies front and back.
- A landward slope steeper than 1 in 3 would be less resistant to surface erosion from overtopping water.

3.12.12 A reduction in the Eastern extent of the Permanent Sea Defence could be achieved by adopting a lower crest height. However this was discounted because the crest height is the key functional parameter of the sea defences to reduce the risk of overtopping to acceptable levels.

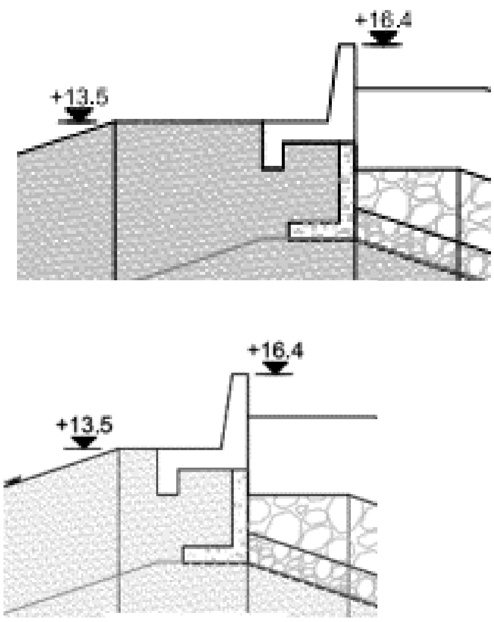
3.12.13 However, a 5m reduction in the width of the crest plateau in the Adaptive Design has been implemented. This reduction in width applies along the entire North-South run of the HCDF and is explained below:

- The horizontal plateau provides a maintenance and inspection access to the crest of the HCDF. The mass of soil behind the crest wall and beneath the surface plateau contributes to the stability of the crest wall, providing stability against sliding and overturning due to water and wave loads from the seaward side. As a secondary effect, the plateau also permits some dissipation of energy from overtopping waves before the overtopping water runs down the rear (west-facing) backslope of the HCDF.

- The reduced width of plateau (4m total including crest wall stem) is considered at the lower limits of operability for inspection and maintenance access. Further reductions are not considered practicable.

- The reduced mass of soil behind the crest wall will reduce the available passive resistance stabilising the crest wall. Resistance can, however, be enhanced by the inclusion of additional engineering measures in the design of the crest wall. These measures might include physical connection (shear keys, bolts, etc.) between the baseline crest wall and the adaptive design crest wall, the inclusion of additional features in the adaptive design crest wall (basal shear keys, etc.) or the inclusion of additional engineering measures within the soil behind the crest wall. This will require further development in the detailed design phase.

Figure 3-17 – Reduced Crest Width (Adaptive Design)



3.12.14 This change does not affect the functional aspects of the baseline design, such as side slopes, core, armour, crest/ toe levels or crest plateau width. The baseline Permanent HCDF will in effect be repositioned 5m landward of its original position shown in the January 2021 submission, with the toe of the HCDF set at Eastings 647615m.

3.12.15 **Alignment at BLF**

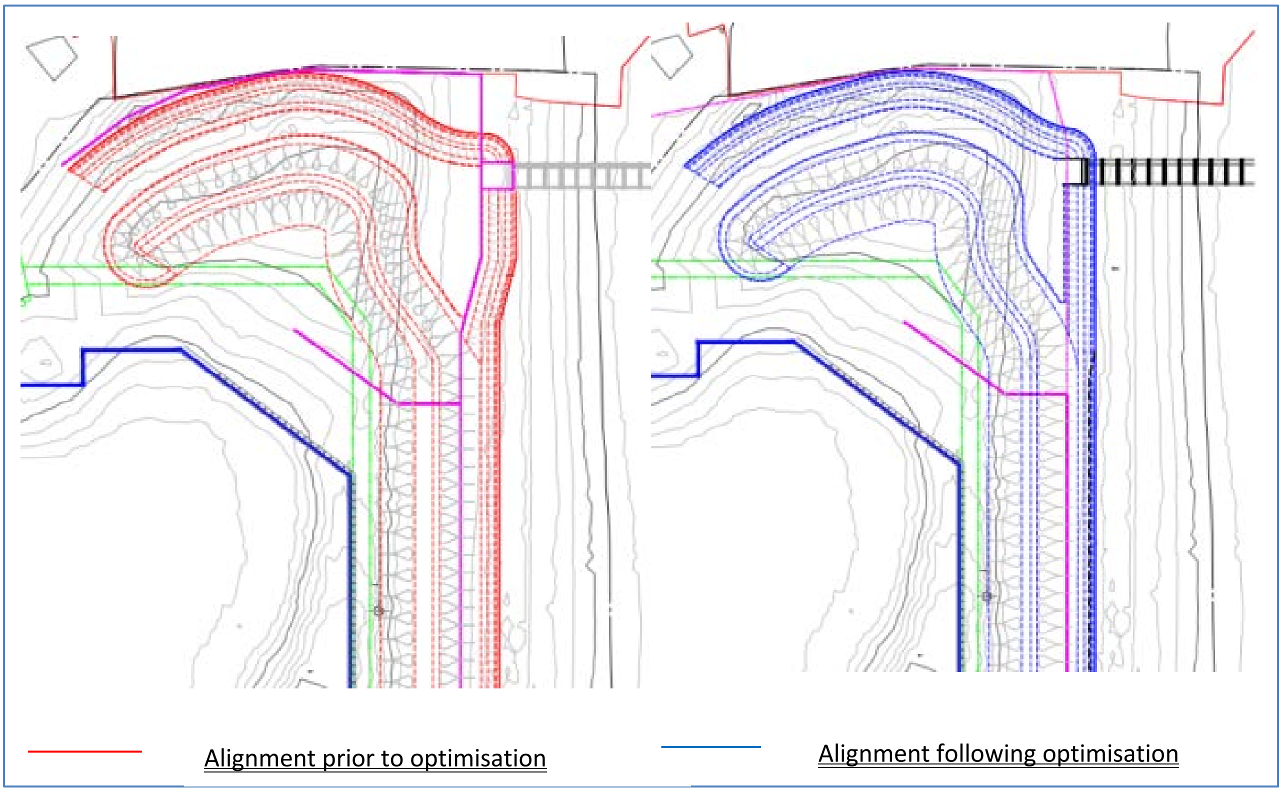
3.12.16 The eastward protrusion in HCDF alignment at the BLF/ Northern mound area shown in the January submission has been eliminated, to provide an HCDF toe alignment which follows the main run.

3.12.17 Figure 3-18 shows the revised alignment of the HCDF (blue) alongside the alignment proposed at the January 2021 Change Submission (red).

3.12.18 This has been achieved through an optimisation of earthworks profiles and operational space within the works area.

3.12.19 The reduction in seaward extent will be 15m, to align the toe in this area with the general line of the toe, at Eastings 647615.

Figure 3-18 – Modified Alignment at BLF Area

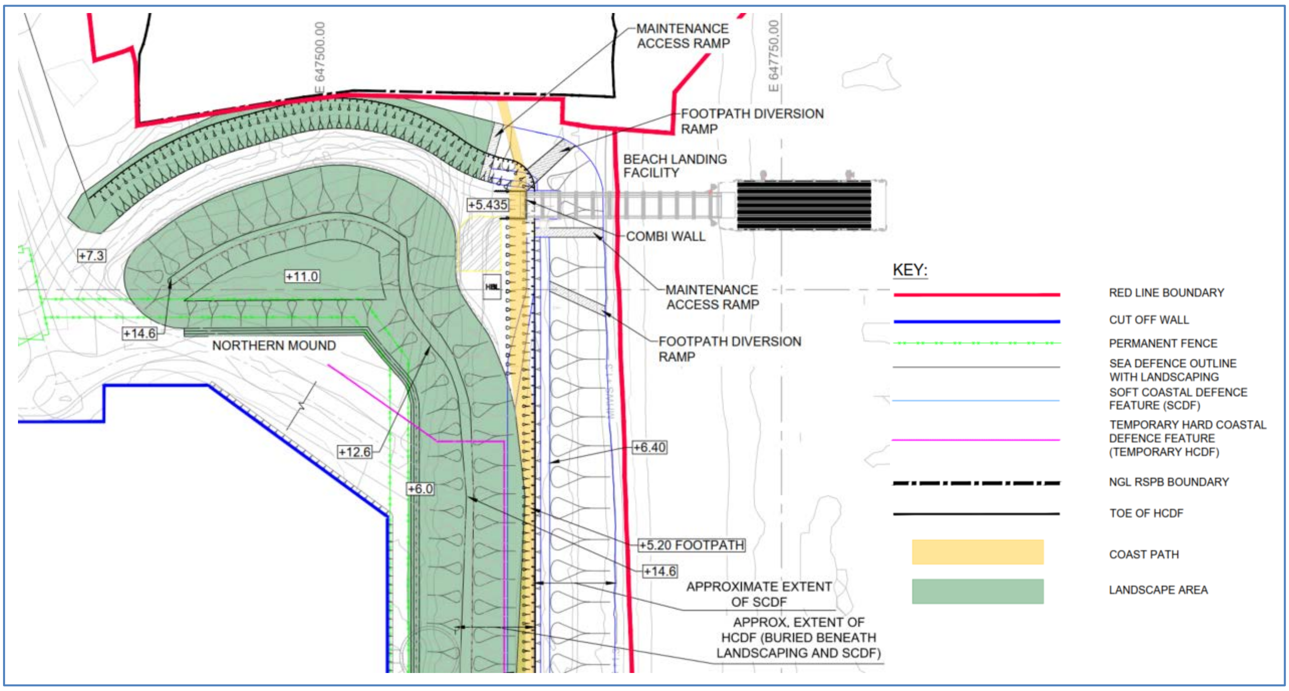


3.12.20 The updated design drawings [REP5-015] also show additional features which were introduced in the January 2021 Change Submission, refer to Figure 3-19. These include:

- Maintenance access ramps: required to maintain the soft sea defence and repair the hard sea defence. These will be permanent structures.

- Coast Path diversion ramps for when the Permanent BLF is in use. These are intended to be a soft feature created using shingle/sand beach material and temporary in nature.

Figure 3-19 – Permanent BLF Interface



3.12.21 **Foundation design**

3.12.22 Appropriate provision for ground strengthening underneath the sea defence is to be considered to provide adequate slope stability and to prevent soil liquefaction. Ground improvement may also be required to limit settlement to an acceptable level. The design includes a 200mm consolidation allowance in the crest height shown on the drawings. A preliminary foundation design using rigid inclusions has been developed that achieves these requirements. The detailed design proposals will be developed using more detailed soils investigation information that has only recently been received.

3.12.23 **Design Summary**

3.12.24 Table 3-4 summarises the principal dimensions and levels of the May 2020 Application, January 2021 Change Submission and further developments within the established parameters up to Deadline 8 (September 2021).

Design details are for the proposed permanent HCDF, prior to the potential implementation of the Adaptive Design.

3.12.25 Figure 3-20 (larger version at Appendix A.1) shows a comparison of the designs at May 2020 and that current at Deadline D8 (September 2021).

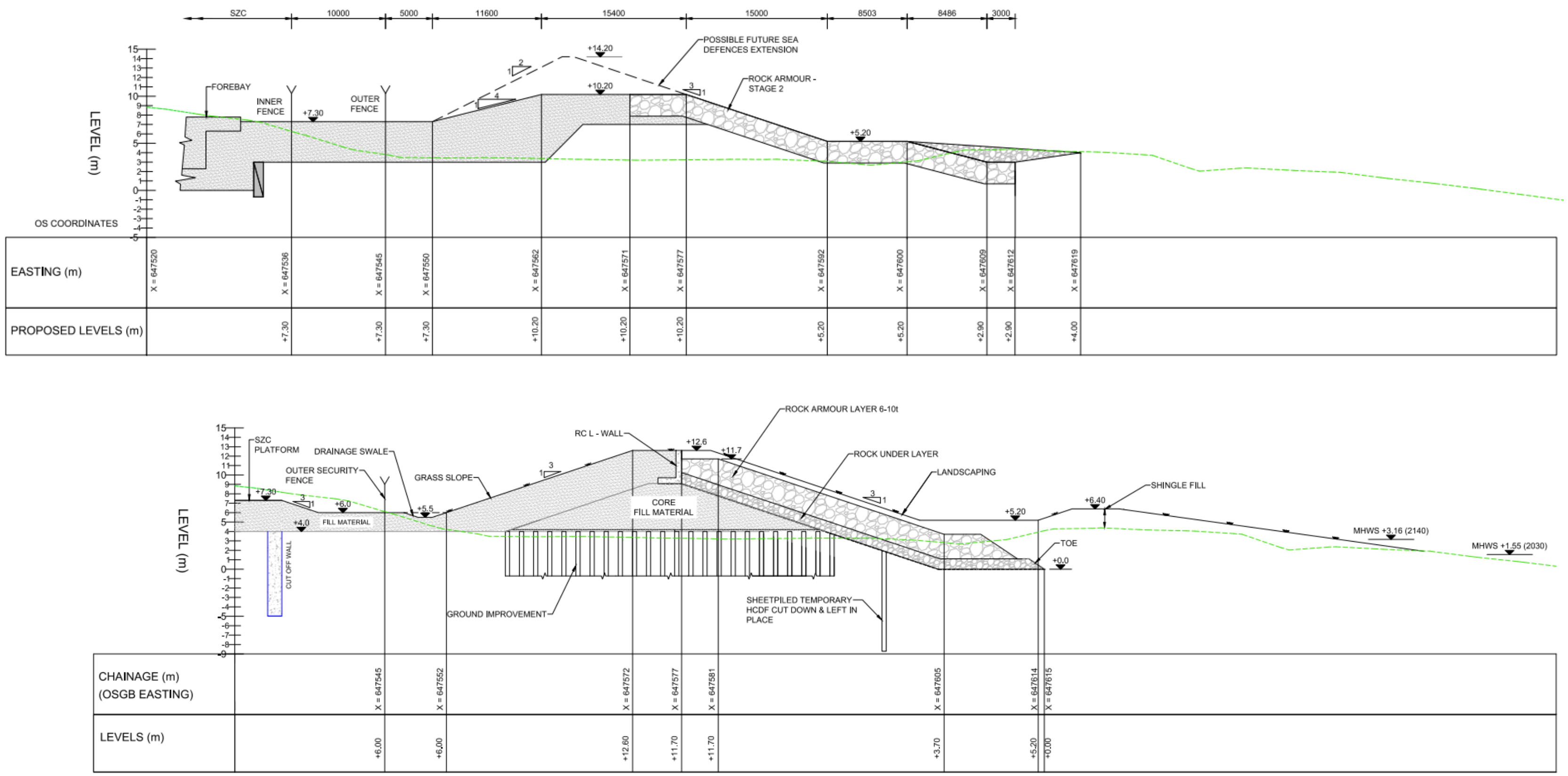
3.12.26 Additional and/or updated details are shown on the design drawings and Figures within this report, including:

- SZB/SZC interface;
- Ground improvement, to strengthen the existing soil and support the HCDF;
- Drainage swale, to capture, convey and attenuate surface water runoff originated from both overtopping and rainfall events; and
- Landscaping, to provide at least 600mm of coverage over the seaward face of the sea defence, to crest levels varying between 13.2 m OD and 14.6m OD.
- Footpath corridor alignment, to tie in with existing PRoW.

Table 3-4 – Summary of Changes to HCDF

Element	May 2020 DCO Submission	January 2021Change Submission	September 2021 Deadline 8 Update
Crest height	10.2m OD	12.6m OD	12.6m OD
Toe level	3.0m OD	0.0m OD	0.0m OD
Seaward toe of Sea Defence (Easting in OSGB)	647612m	647620m	647615m
Landward slope	1:4	1:3	1:3
Seaward Slope	1:3 with berm	1:3 no berm	1:3 no berm
Rock Size	Not stated	6 to 10 tonnes rock	6 to 10 tonnes rock
Land level between CoW and HCDF	7.3m OD	6.0m OD (variable)	6.0m OD (variable)

Figure 3-20 – Typical Cross Sections - May 2020 Submission (upper), September 2021 Deadline 8 update, (lower)



4 CONSTRUCTION AND SEQUENCING

4.1.1 Construction of the Coastal Defences is described in the Construction Method Statement [REP7-281].

4.2 Temporary Sea Defence

4.2.1 Construction of the Temporary Sea Defence may commence as soon as a suitable access is made available to the works area. Plant and materials may initially be delivered to the SZC site via the SZB access to the south, transitioning to access from the north across the temporary SSSI crossing bridge. Access to the foreshore from the MCA area is likely to be created via a limited excavation at the western toe of the Northern Mound and work around to the east.

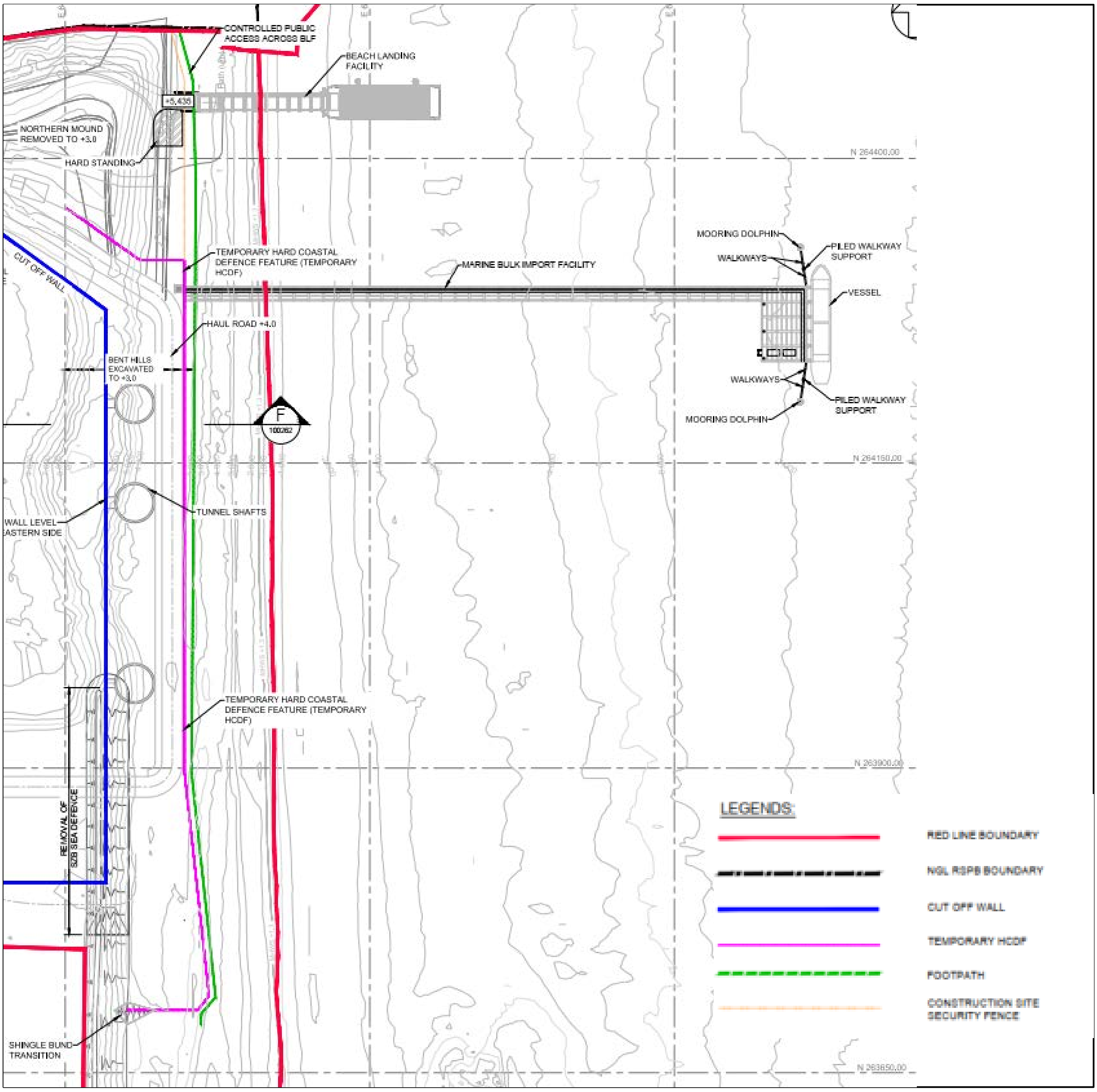
4.2.2 Installation of sheetpiles would be carried out on a number of work fronts, the number of work fronts and installation rigs being selected to support the overall construction programme. Installation would be by methods selected to minimise noise and ground-borne vibration and may require pre-augering in some areas. The southern tie-in to the SZB sea defences would be achieved by installing sheetpiles up to the designed extent, and then infilling the wedge between vertical SZC sheetpiles and inclined face of SZB embankment using shingle fill.

4.2.3 The existing Northern Mound will be removed to permit the installation of ground improvement and reconstruction of the Northern Mound using controlled engineered fill and to incorporate elements of the HCDF. The reconstruction of the Northern Mound to a level of +7.3mOD or higher will provide the temporary HCDF function in this area. The reconstructed Northern Mound will tie in to the completed SSSI crossing embankment at level +7.3mOD to protect the future MCA excavation.

4.2.4 Excavation of the MCA will commence (assuming CoW and other critical predecessors are completed) and also installation of CMCs within the sheet piled perimeter.

4.2.5 The plan view showing the temporary sheetpile sea defence in pink is shown in Figure 4-1. A typical cross-section is shown in Figure 3-2 and at Appendix A.2.

Figure 4-1 - Temporary Sea Defence (Sheet pile) plan



4.3 Permanent Sea Defence (HCDF)

4.3.1 The Permanent Sea Defence will be constructed towards the end of the construction phase, once bulk excavation, filling and main construction activities for SZC are complete.

4.3.2 **SZB Interface**

4.3.3 The SZC Permanent Sea Defence, including the southern termination, would be constructed without intrusive works to the existing SZB Sea Defences. The wedge between the structurally independent SZB and SZC Sea Defence systems would be infilled with shingle or other material prior to landscaping.

4.3.4 The application of the landscape proposals, including the establishment of new planting and landform, would be undertaken at the earliest practicable opportunity following completion of the engineering structure.

4.3.5 Ground Improvement will be required for the eventual Permanent Sea Defences. This would be installed at the early stage in advance of the Temporary Sea Defence, along with other similar Ground Improvement measures concentrated at the northern end of the MCA site.

4.3.6 **Main (Central) Section**

4.3.7 Once the cooling water tunnel works are complete and the construction haul road is no longer required the south run of the reinforced sea defence core can be installed.

4.3.8 Construction of the Permanent Sea Defence would be carried out in stages. As the Permanent Sea Defence is constructed, the Temporary Sea Defences would be removed or cut down to permit the construction of Permanent Sea Defence.

4.3.9 For each section of embankment, excavation would be carried out for the toe of the proposed embankment: the dig is on both the west and the east side of the sheet pile

4.3.10 It has been assumed that the operation to excavate and place the different layers comprising the embankment will be carried out in short manageable sections to prevent undue exposure of the unprotected core.

4.3.11 **Northern Mound**

4.3.12 Within the Northern Mound area, the core of the Permanent Sea Defence would be raised to approximately +8mOD level, and new Permanent BLF access road constructed (levels vary +5m to +7.3m).

4.3.13 The surface of the new defence core must be protected against erosion and weathering using a concrete canvas or similar durable barrier.

4.3.14 With the erosion protection in place, the Northern Mound will provide effective protection to the MCA excavation. The sheet pile wall would be breached to allow access to construct the land-side piles for the Permanent BLF. At this stage, the sheet pile wall would still be the primary defence against attack/ degradation by wave energy in severe storm conditions.

4.3.15 Once the Permanent BLF is complete and operational, the remaining under-rock and rock armour would be imported to complete the Permanent Sea Defence to design levels in the northern mound area.

4.3.16 Once the rock armour is in place from the SSSI to the re-entrant corner on the east of the MCA, the sheet piles in the Northern Mound corner can be removed as the permanent defences would be functional.

4.3.17 **Soft Coast Defence Feature (SCDF)**

4.3.18 Following construction of HCDF, the SCDF profile would be formed using dredged imported shingle material and any suitable site won material. A trailer suction hopper dredger would dredge material from an existing licenced offshore extraction site and then moor offshore SZC. The shingle would then be pumped ashore using a pipeline and moved into the profile using bulldozers.

4.3.19 Any future recharge of the beach during the design life of the sea defences would use a similar methodology as the initial creation.

4.4 Adaptive Design

4.4.1 The Adaptive Design has been developed to provide a simple means of increasing the crest height of the Permanent Sea Defence if required to respond to observed climate change effects exceeding the design basis. Construction of the Adaptive Design would involve placing additional armour, a wave wall and landscaping on the top of the Permanent Sea Defence, reaching a crest level of 16.4m OD.

4.4.2 The core and associated foundations required to support the Adaptive Design would be installed as part of the initial Permanent Sea Defence construction and would not require further intrusive work at a later stage.

4.4.3 The Adaptive Design would be implemented by placing an overlay of rock armour or concrete units over the originally placed revetment. The embankment and toe would be extended outwards and downwards as part of the Adaptive Design implementation. These Works would include excavation within the beach/ SCDF to permit the extension and lowering of the HCDF toe, and the transport and placing of armourstone units to form the new revetment. Placement of the toe armour would be within the tidal zone.

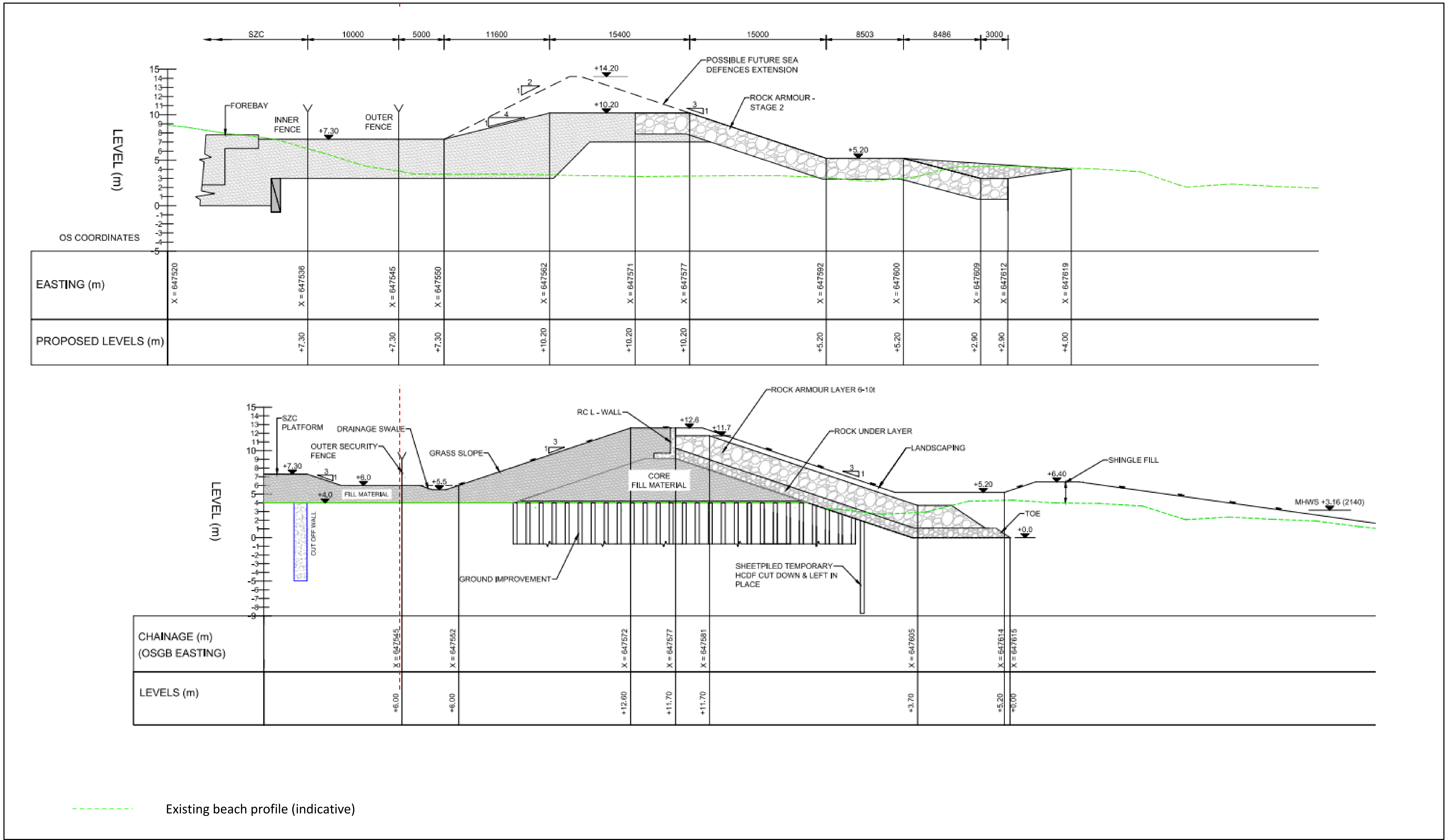
4.4.4 Additional armour may be imported via the Permanent BLF, which would be retained throughout the life of SZC. Additional fill material could also be imported via the Permanent BLF or by road and hauled along the foreshore.

4.4.5 The precise construction methods, timing and sequencing by which this would be implemented will depend on the SZC and SZB configuration at the time. The design has been developed to be simple to implement, and does not require unusual or unique plant, materials, methods or access arrangements.

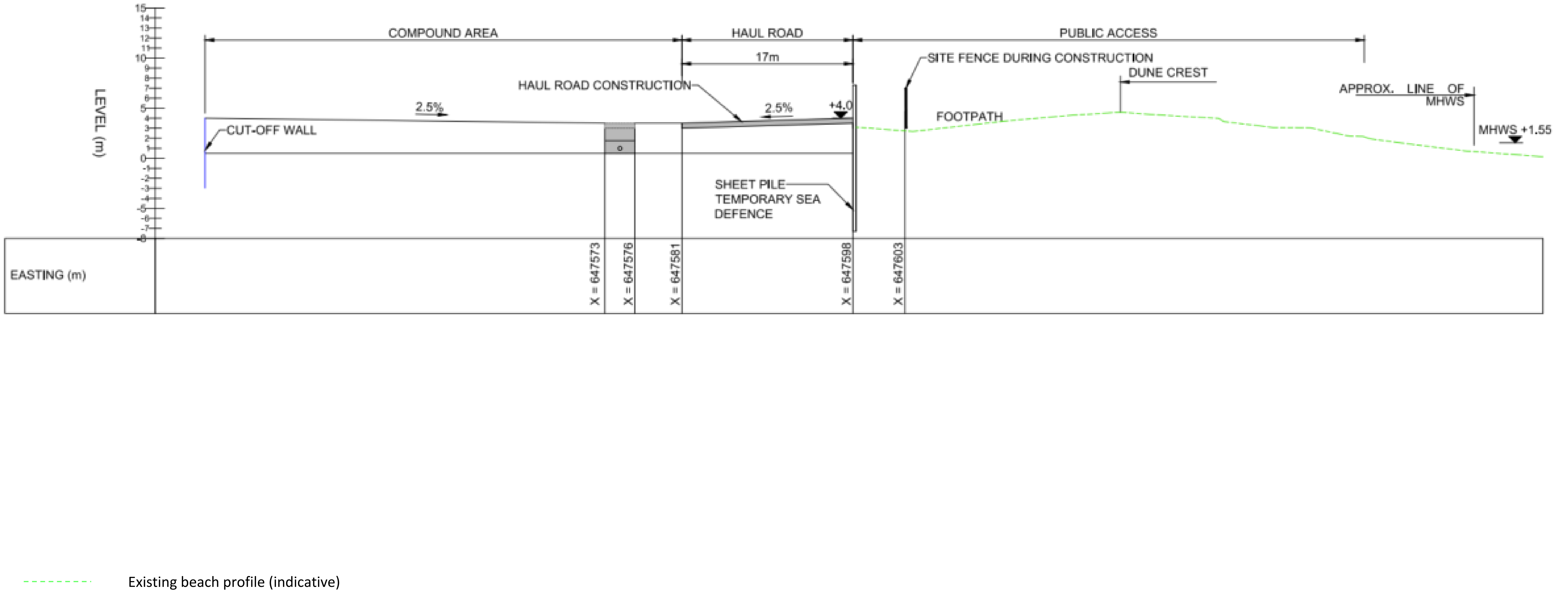
APPENDIX A: TYPICAL CROSS SECTIONS

This Appendix contains larger-scale versions of figures presented elsewhere in the report, to provide improved legibility of details.

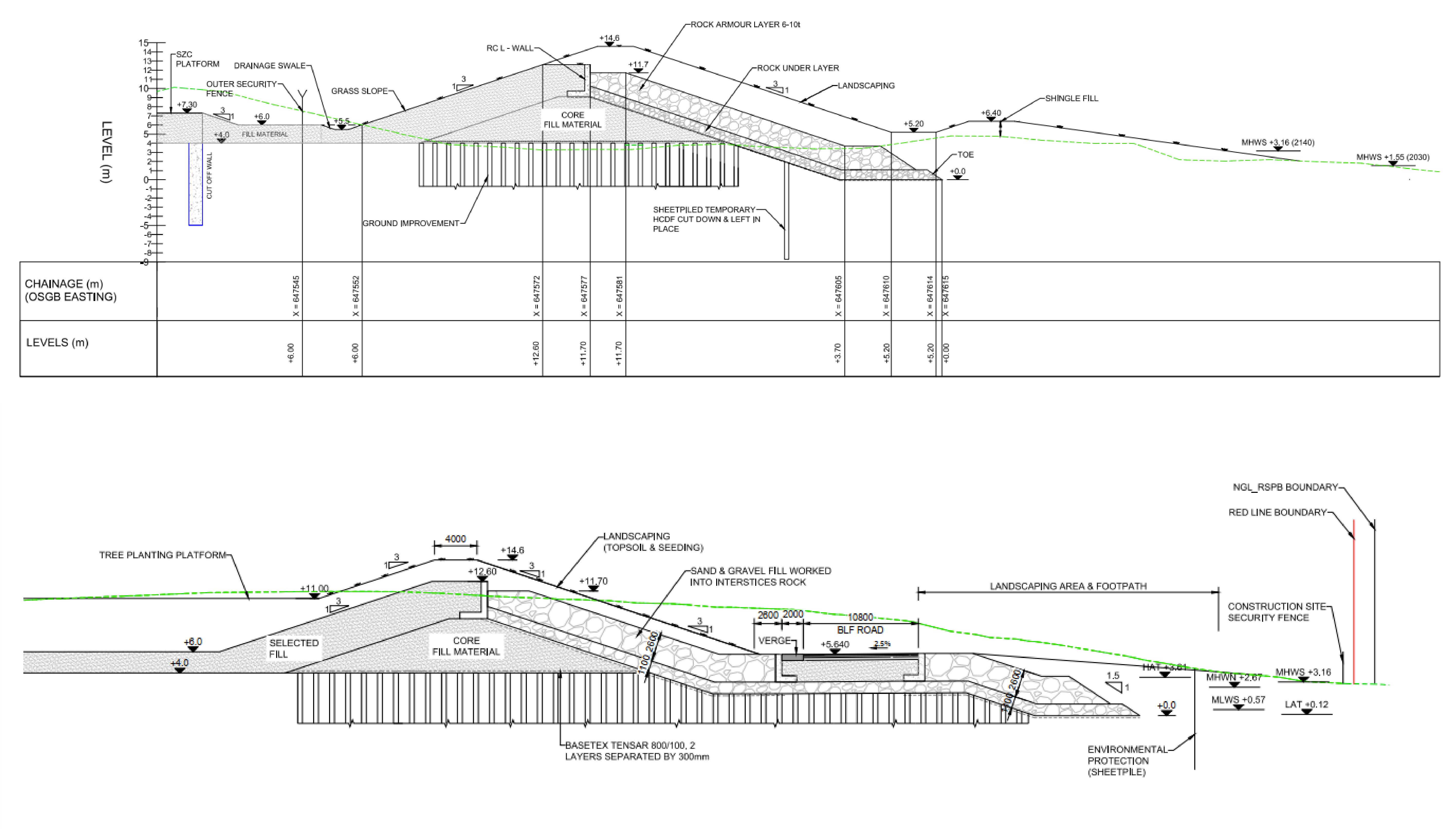
A.1. Typical Cross Sections - May 2020 Submission (upper), September 2021 Deadline 8 update (lower) - Figure 3-20



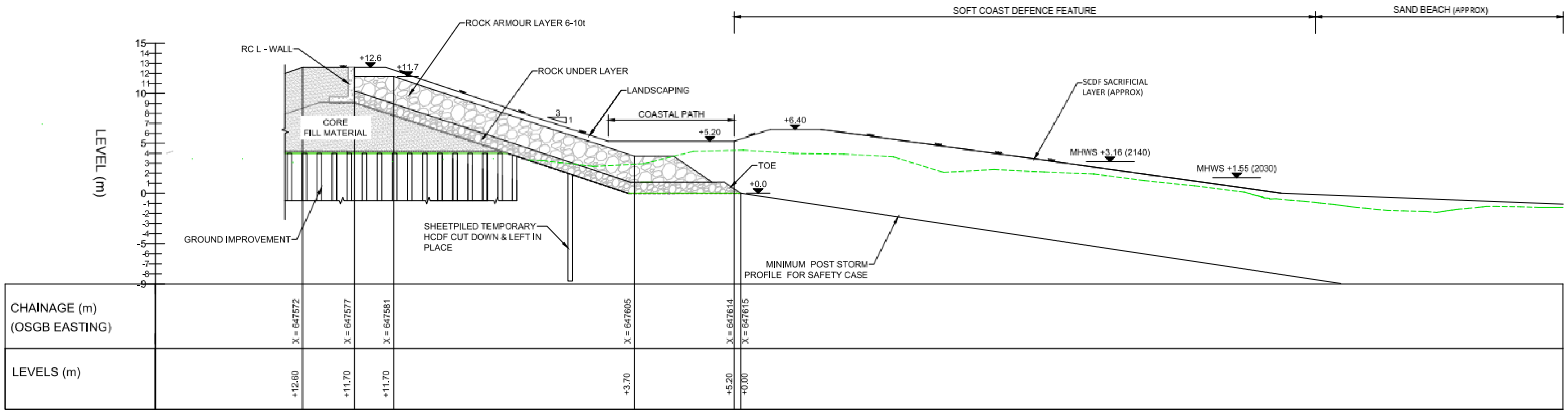
A.2. Temporary HCDF, Typical Cross-section (Figure 3-2)

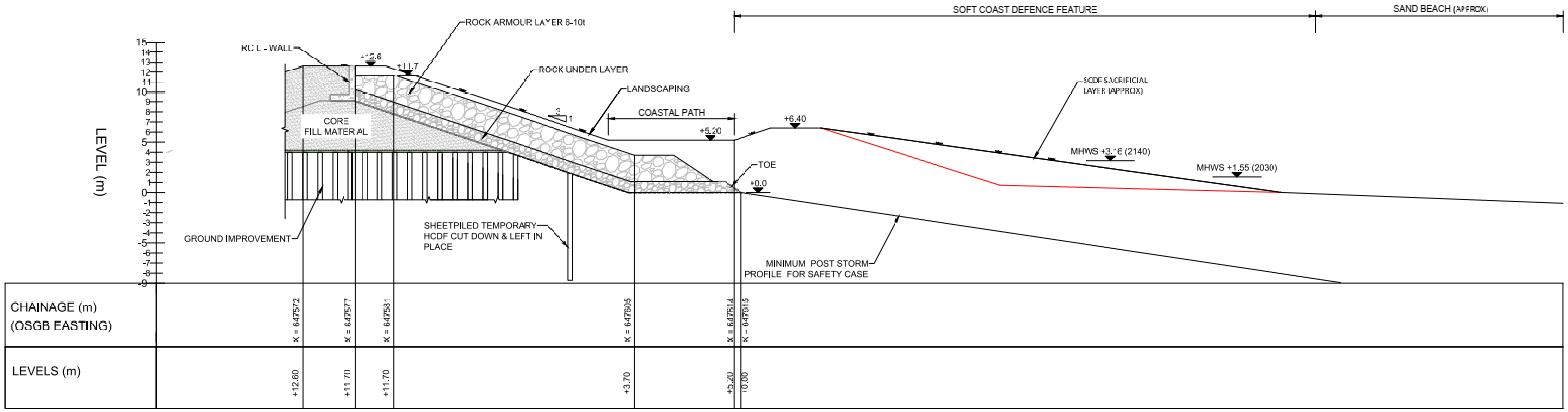


A.3. Permanent Sea Defence, Typical Cross-section and Northern Mound (Figure 3-5)



A.4. SCDF, Initial Beach Recharge Profile (Figure 3-12), Indicative Recharge Threshold Profile (Figure 3-13)

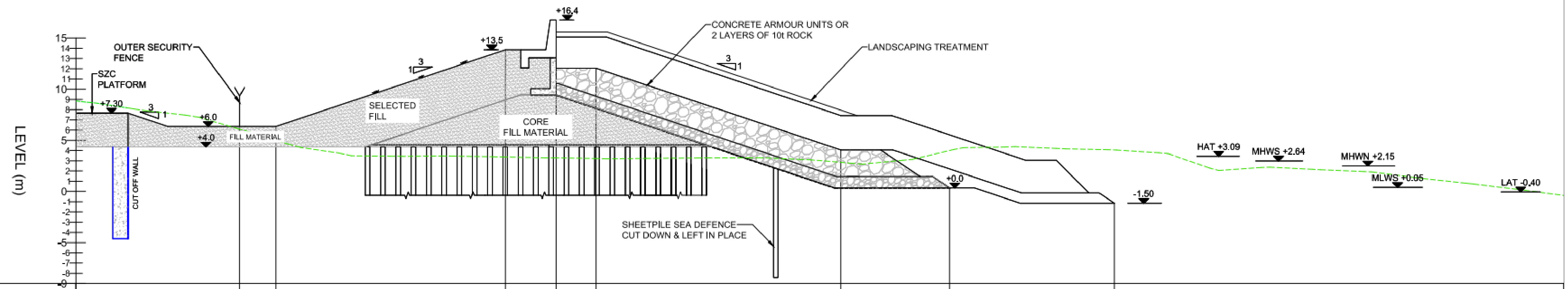




Existing beach profile (indicative) – shingle fill above this line is initial beach recharge

Minimum Maintained Profile (indicative)

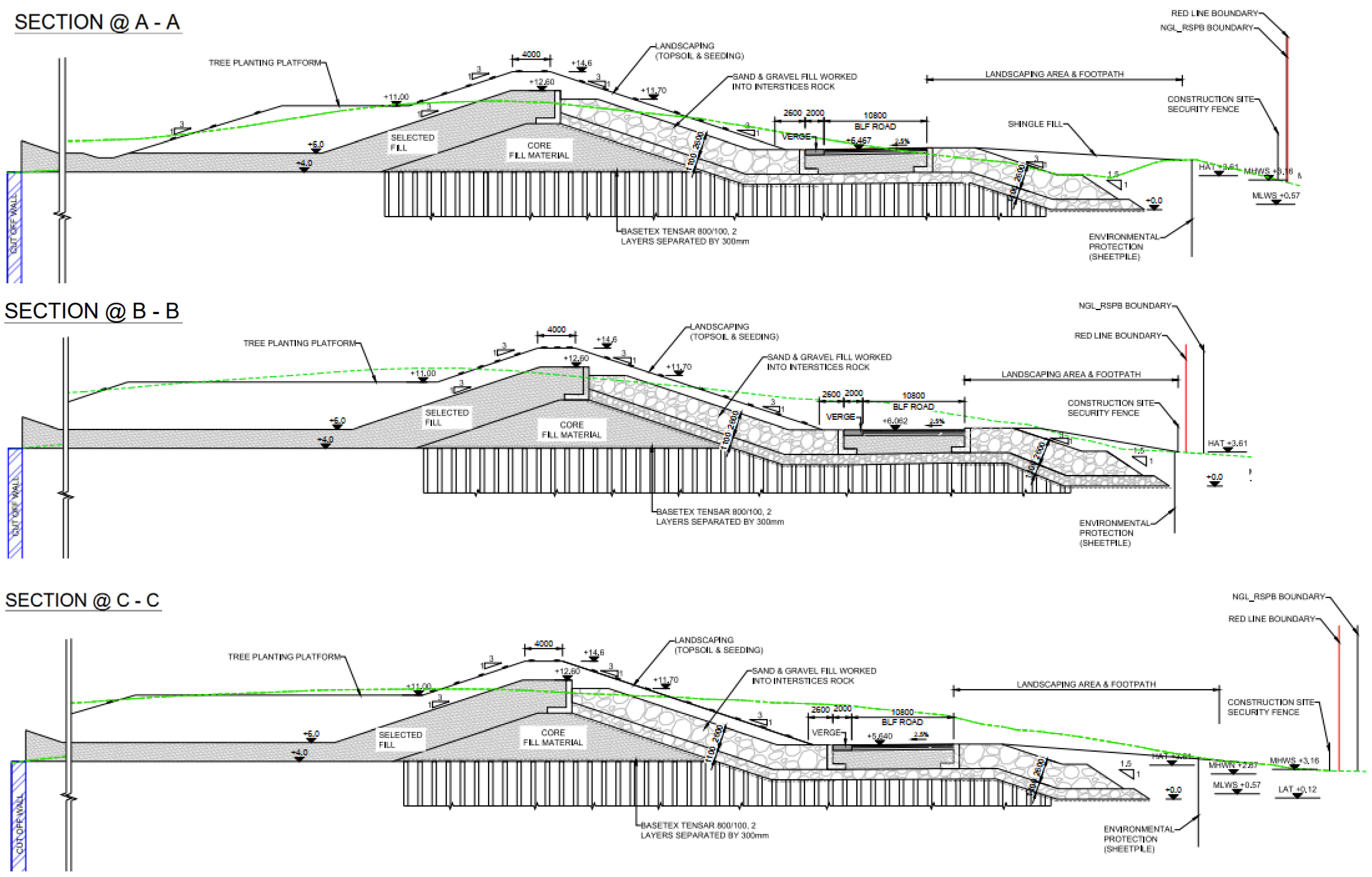
A.5. Adaptive Design - Typical Cross-section of HCDF (Figure 3-15)



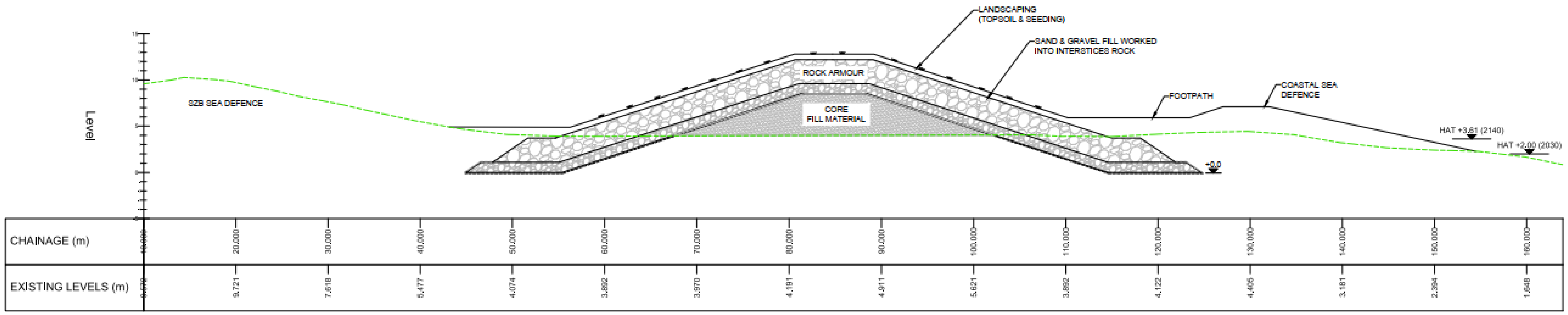
CHAINAGE (m) (OSGB EASTINGS)	X = 647545	X = 647549	X = 647572	X = 647577	X = 647581	X = 647605	X = 647615	X = 647632
LEVELS (m)	+6.00	+6.00	+13.50	+16.40	+11.70	+3.70	+0.00	+0.00

- - - - - - Existing beach profile (indicative)

A.6. Typical Sections at RSPB Interface (Figure 3-11)



A.7. SZB Interface - Roundhead (Figure 3-9)



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