The Sizewell C Project

5.2 Main Development Site Flood Risk Assessment Addendum
Appendices A-F Part 10 of 10

Revision: 1.0

Applicable Regulation: Regulation 5(2)(e)

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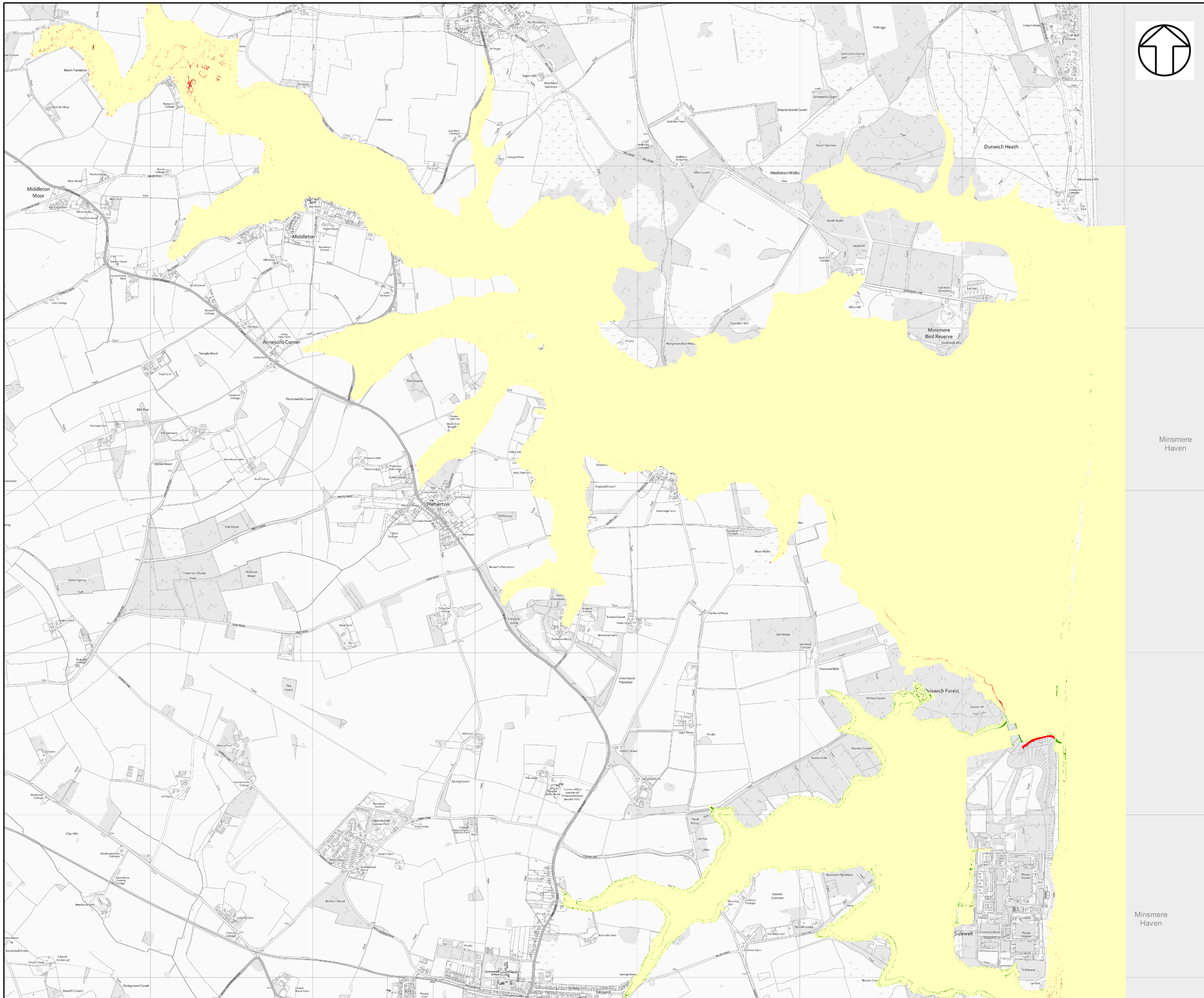
January 2021

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

MAIN DEVELOPMENT SITE FLOOD RISK ASSESSMENT ADDENDUM APPENDICES

Documents included within this issue are as follows:

- Appendix A: Extract of the Environment Agency Relevant Representation Related to Flood Risk
- Appendix B: Collated Comments from the Environment Agency on 5th February 2020 and 4th August 2020
- Appendix C: Fluvial Modelling Report Addendum
- Appendix D: Tidal Breach and Coastal Inundation Modelling Report Addendum (Continued from Part 9 of 10)
- Appendix E: Coastal Wave Overtopping Modelling Report Addendum
- Appendix F: Main Development Site Flood Risk Emergency Plan



NOTES

KEY

FLOOD HAZARD

- HAZARD RATING CLASS INCREASE
- NO CHANGE
- HAZARD RATING CLASS DECREASE

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
COASTAL MODELLING RESULTS

DRAWING TITLE:
DIFFERENCE IN FLOOD HAZARD 1000-YEAR BREACH EVENT 2190 EPOCH

DRAWING NO:
FIGURE C.36

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	E.H.	1:22,500 @A3	2.0

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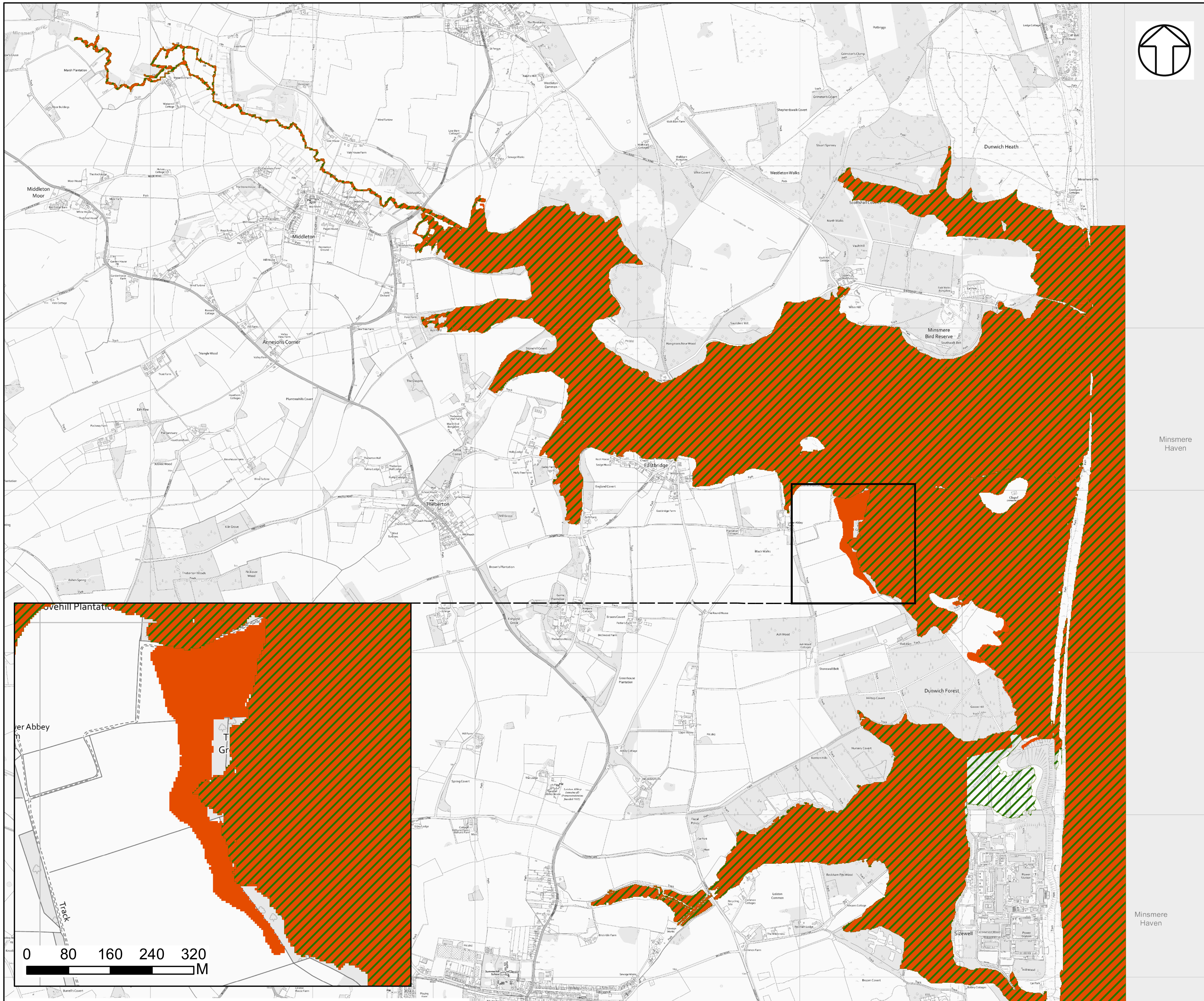

NOTES

KEY

BASELINE FLOOD EXTENT COASTAL INUNDATION 200-YEAR EVENT 2090

WITH SCHEME FLOOD EXTENT COASTAL INUNDATION 200-YEAR EVENT 2090

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
COASTAL MODELLING RESULTS

DRAWING TITLE:
DIFFERENCE IN FLOOD EXTENTS 200-YEAR COASTAL INUNDATION EVENT 2090 EPOCH

DRAWING NO:
FIGURE C.37

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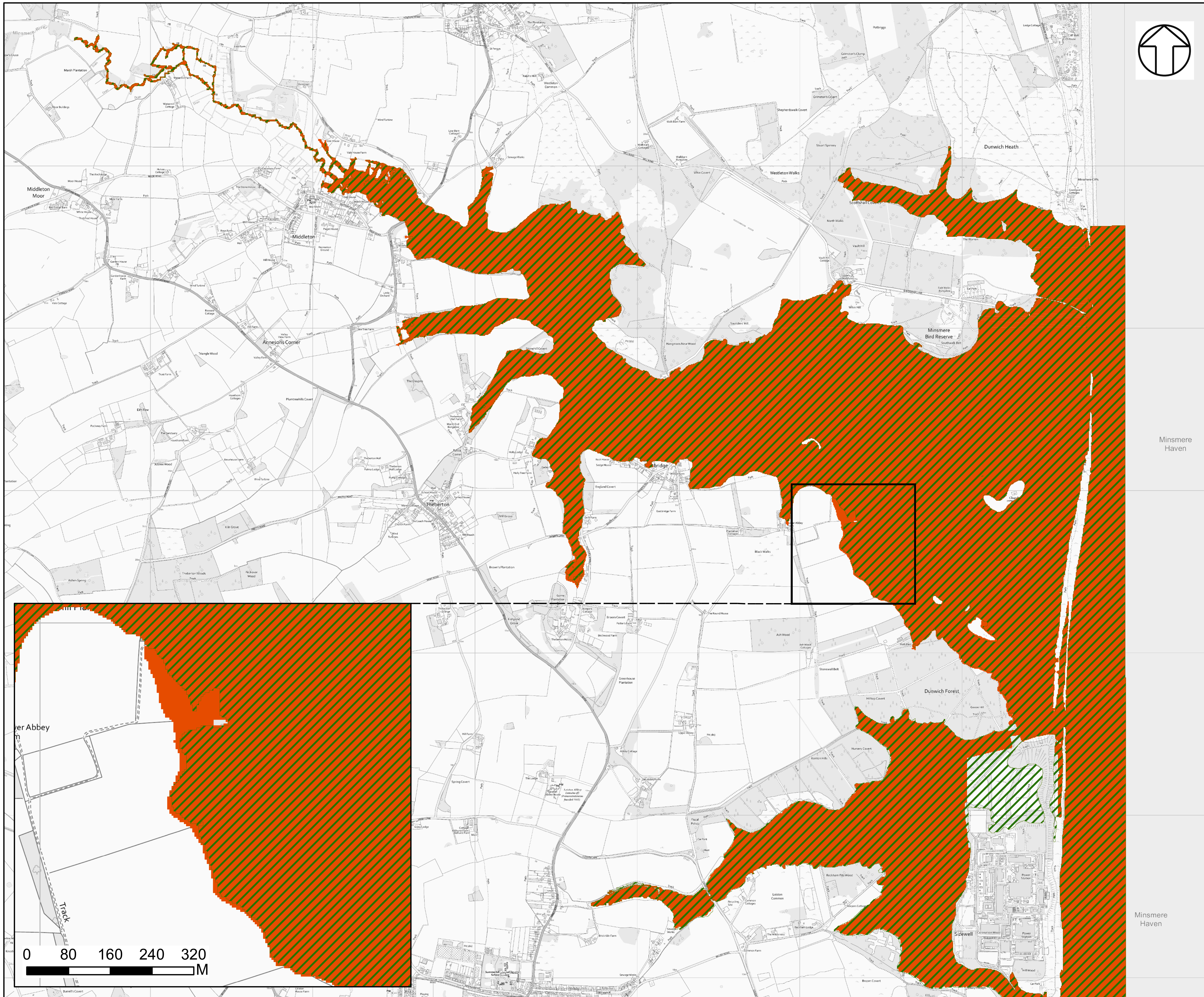

NOTES

KEY

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- WITH SCHEME FLOOD EXTENT BREACH 200-YEAR EVENT 2090

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
COASTAL MODELLING RESULTS

DRAWING TITLE:
DIFFERENCE IN FLOOD EXTENTS 200-YEAR BREACH EVENT 2090 EPOCH

DRAWING NO:
FIGURE C.38

DATE:	DRAWN:	SCALE :	REVISION:
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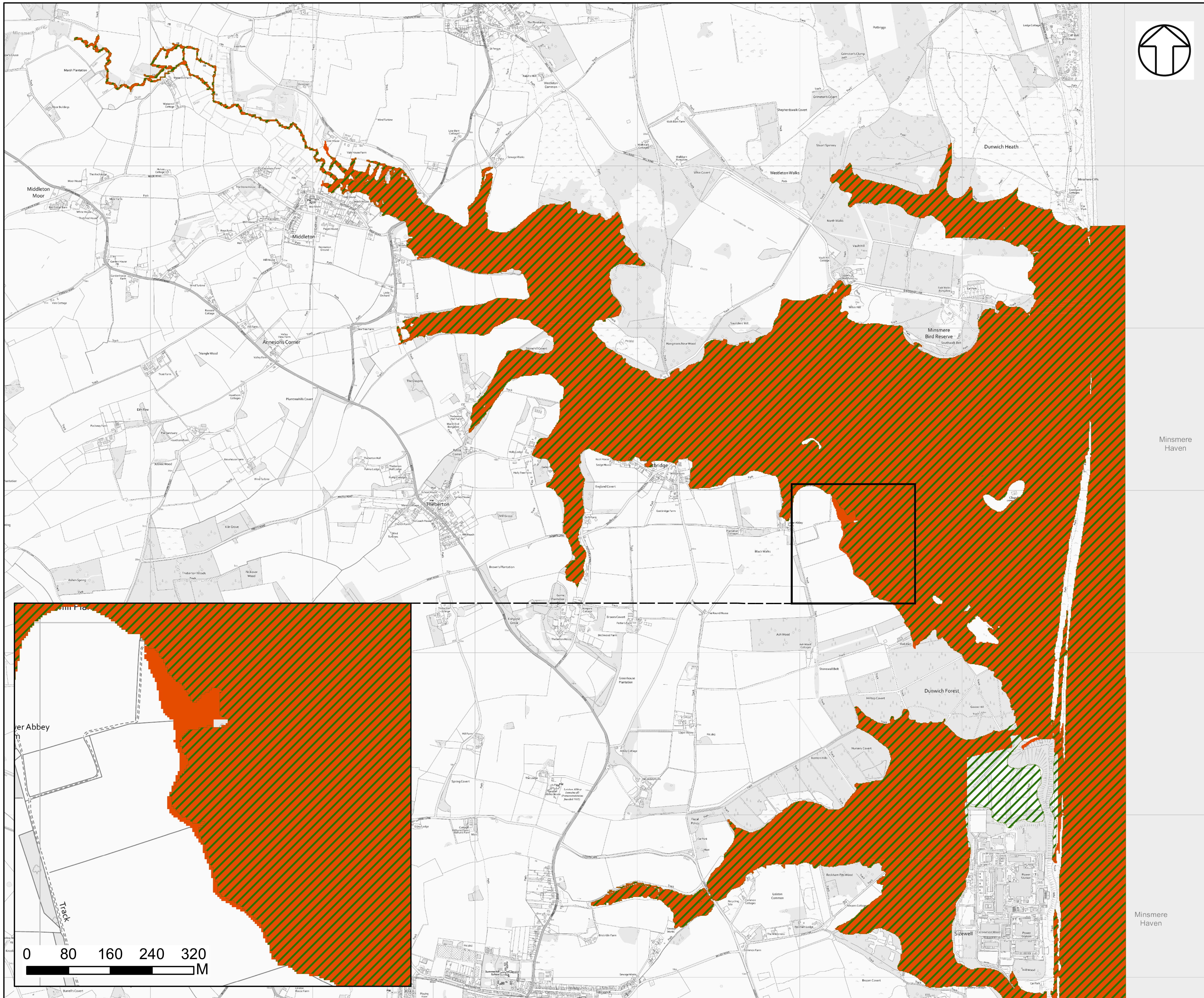

NOTES

KEY

- BASELINE FLOOD EXTENT COASTAL INUNDATION 1000-YEAR EVENT 2090
- WITH SCHEME FLOOD EXTENT COASTAL INUNDATION 1000-YEAR EVENT 2090

NOT PROTECTIVELY MARKED

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SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
COASTAL MODELLING RESULTS

DRAWING TITLE:
DIFFERENCE IN FLOOD EXTENTS 1000-YEAR COASTAL INUNDATION EVENT 2090 EPOCH

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FIGURE C.39

DATE:	DRAWN:	SCALE :	REVISION:
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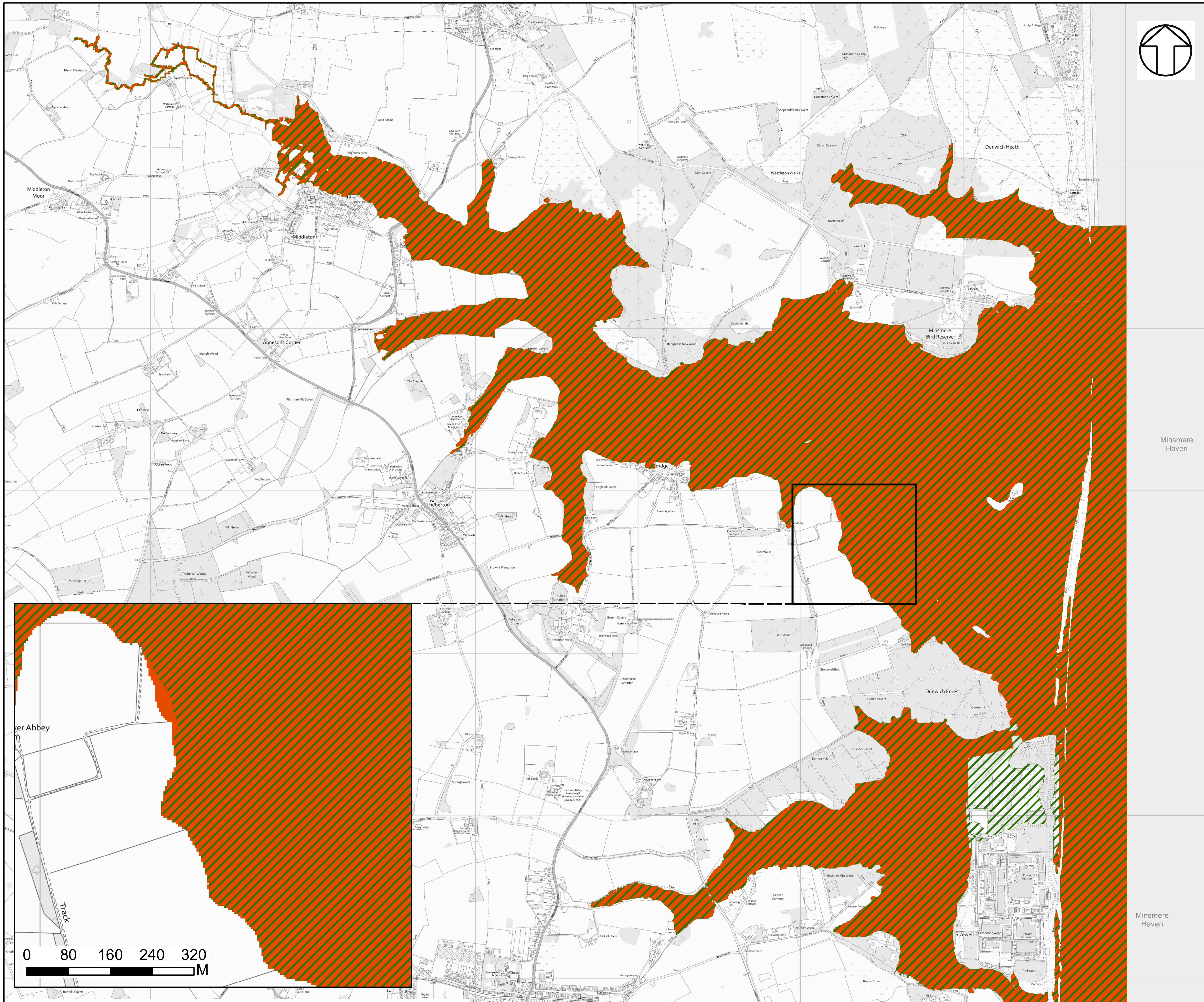

NOTES

KEY

BASELINE FLOOD EXTENT BREACH 1000-YEAR EVENT 2090

WITH SCHEME FLOOD EXTENT BREACH 1000-YEAR EVENT 2090

NOT PROTECTIVELY MARKED

DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
COASTAL MODELLING RESULTS

DRAWING TITLE:
DIFFERENCE IN FLOOD EXTENTS 1000-YEAR BREACH EVENT 2090 EPOCH

DRAWING NO:
FIGURE C.40

DATE:	DRAWN:	SCALE :	REVISION:
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APPENDIX E: COASTAL WAVE OVERTOPPING MODELLING REPORT ADDENDUM

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TABLES

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1 INTRODUCTION

1.1.1 As Part of the Sizewell C Project Development Consent Order (DCO) application ('the Application') submitted in May 2020 a **Main Development Site (MDS) Flood Risk Assessment** (Doc Ref. 5.2) [APP-093]) (hereafter referred to as the **MDS Flood Risk Assessment**) was prepared, which describes flood risk from all sources of flooding, to the proposed main development site and the predicted impact of the development on flood risk elsewhere.

1.1.2 To inform the **MDS Flood Risk Assessment**, a series of hydraulic modelling for fluvial, coastal inundation and tidal breach flooding and wave overtopping calculations were undertaken to assess flood risk for a range of return period events and climate change scenarios. This report focuses on flood risk assessment as a result of the wave overtopping.

1.1.3 The purpose of this report is to describe the assessment activities and present the results of the coastal modelling of wave overtopping of the coastal sea defences at Sizewell C.

1.1.4 This assessment was undertaken to inform the **Main Development Site (MDS) Flood Risk Assessment (FRA) Addendum** (Doc Ref. 5.2(A)Ad), hereafter referred to as the **MDS FRA Addendum,** with overtopping modelling carried out to assess the changes set out in the **Consultation Report Addendum** (Doc Ref. 5.1Ad) and address comments raised by the Environment Agency following review of the pre-submission and May 2020 Application submission documents, which have been collated in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B).

1.1.5 This modelling builds on the overtopping assessments carried out for the Application, presented in **Appendix 1** of the **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-094], adopting the same modelling approach. The primary objective is the assessment of flood risk to the development itself (on-site).

2 ASSESSMENT ACTIVITIES

2.1.1 To address comments raised in the Environment Agency's review and further inform the **MDS FRA Addendum**, this assessment was carried out focusing on following key activities:

- Additional wave overtopping scenarios discussed in **section 2.1.6** – runs for additional return period event / climate change allowances to 'fill-in gaps' in the assessment for the Application;

- Assessment of wave overtopping during construction phase discussed in **section 4**; and
- Assessment of wave overtopping and spreading modelling for the updated Hard Coastal Defence Feature (HCDF) design, i.e. raised crest, discussed in **section 5**.

2.1.2 Although a number of additional simulations were carried out to inform the flood risk assessment and address Environment Agency's comments, the overtopping calculations for the credible maximum climate change scenarios where the extreme still water levels are largely above the platform level (i.e. more than 0.5m above the platform level of 7.3m AOD), were not undertaken. This is on the basis that the main platform area would be inundated by water ingress from the land side due to significant inundation of the existing sand dunes/shingle defences to the north and south of the site (much lower than the proposed defences at Sizewell C and existing power station defences) and therefore horizontal projection would be used instead to assess flood depth on the platform.

2.1.3 It is acknowledged that overtopping might also occur in such scenarios. However, flood risk would be dominated by significant water depth on the platform due to the extreme sea levels and therefore a separate overtopping assessment was not included. This approach is considered valid as results from other modelled coastal spreading scenarios, where extreme still water levels were higher than existing sea defences to the north and south of Sizewell C, show very similar flood levels to the equivalent horizontal projections. Impacts of platform inundation at the credible maximum extreme events on flood risk on-site are discussed in further detail in the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad).

2.1.4 This approach was adopted for all analyses undertaken post Application submission and discussed in this report, whereas more detailed spreading modelling was carried out for key scenarios where overtopping occurred and the extreme still water level was below the platform level. The spreading modelling was undertaken for the latest HCDF design only, as discussed in **section 5**.

2.1.5 **Table 2.1** presents a list of overtopping scenarios for the reasonably foreseeable (RCP8.5 95 percentile) and credible maximum (H++ or BECC Upper) climate change allowances and respective extreme still water levels, highlighting in red bold those scenarios with extreme sea level above platform height that were not undertaken in this assessment

Table 2.1: Summary of wave overtopping scenarios

Return period	2090 epoch		2140 epoch		2190 epoch	
	RCP8.5	H++	RCP8.5	BECC	RCP8.5	BECC
200-year	4.58	5.19	5.48	7.58	6.31	**8.48**
1,000-year	5.12	5.73	6.02	**8.12**	6.85	**9.02**
10,000-year	5.98	6.59	6.88	**8.98**	7.71	**9.88**

2.1.6 The credible maximum scenarios highlighted in red bold in **Table 2.1** are significantly above the platform height (7.3m AOD) and therefore, for these scenarios, horizontal projection was used to determine flood depth on the platform. This is further discussed in the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad).

2.1.7 It should be noted that scenarios where previous results showed no or very limited overtopping rate (less than 1 l/s/m) these were not repeated where the defence crest has been raised.

3 ADDITIONAL WAVE OVERTOPPING SCENARIOS

3.1 Overview

3.1.1 The additional wave overtopping assessment was carried out for scenarios that were not undertaken as a part of the modelling for the Application. Required scenarios were determined based on the Environment Agency's comments quoted in the respective sections.

3.1.2 One of the Environment Agency comments relating to the credible maximum scenario assessment (comment 4.8 in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B)) states:

> *"A credible maximum scenario for the 0.5% (200 year) & 0.1% (1000 year) overtopping event at 2190 has not been modelled…. Run 0.5% & 0.1% credible maximum scenario and provide wave overtopping rates and inundation modelling & mapping so we can establish the possible impacts of climate change into the future."*

3.1.3 As discussed in **section 2**, and presented in **Table 2.1**, the extreme still water levels for most of the credible maximum scenarios are well above the main platform level and therefore overtopping was modelled for a very limited number of scenarios.

3.1.4 The additional scenarios have been assessed for two representative sea defence profiles, i.e. the Northern Mound and the HCDF discussed in **section 3.2** and **section 3.3** respectively.

3.1.5 The Environment Agency also included comments relating to the specific defence profiles. Responding to these, all additional simulations were carried out adopting the defence profiles used in the assessment for the Application. Similarly, input conditions (extreme still water levels, inshore wave height etc.) were derived following the same approach as in the previous assessments within the Application. Details of the methodology and boundary conditions derivation are discussed in **Appendix 1** of the **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-094].

3.1.6 Where required, additional nearshore wave information was obtained from the TOMOWAC wave model developed by Cefas in line with the previous approach. This included scenarios not included in the previous study. The extreme still water levels and sea level rise allowances for climate change were adopted from the study within the Application, i.e. no additional assessment was undertaken.

3.2 Northern Mound

3.2.1 There was one comment raised specifically relating to the Northern Mound defence section (comment 4.6 in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B)), which states:

> *"…table shows overtopping rates at the northern mound at 2110 for UKCP09 and H++ allowances for a range of return periods… This does not follow the latest guidance which is to apply the RCP8.5 95th Percentile from UKCP18."*

3.2.2 Based on the comment quoted above, overtopping assessment for the Northern Mound defence was carried out for additional 6 scenarios for the 200-year, 1,000-year and 10,000-year return period events at 2140 and 2190 climate change epochs. As discussed in **section 2**, the credible maximum scenarios with extreme still water levels largely above the platform height were not assessed. Therefore, only one scenario for the credible maximum climate change allowance (BECC Upper) was considered, i.e. for the 1 in 200-year return period at 2140 epoch.

3.2.3 **Table 3.1** presents predicted mean overtopping rates at the Northern Mound defence for the considered scenarios. All runs were carried out for the design defence crest of 14.2m AOD.

Table 3.1: Predicted mean overtopping rates for the Northern Mound profile

Return Period	Epoch	Climate Change	Extreme Sea Level (m AOD)	Inshore Wave Height (m)	Mean Overtopping Rate (l/s/m)
200-year	2140	RCP8.5 / 95%ile	5.00	3.73	0.00
	2140	BECC Upper	7.10	4.45	0.04
	2190	RCP8.5 / 95%ile	5.83	4.23	0.00
1,000-year	2140	RCP8.5 / 95%ile	5.84	3.94	0.00
	2190	RCP8.5 / 95%ile	6.67	4.43	0.00
10,000-year	2140	RCP8.5 / 95%ile	6.75	4.41	0.00
	2190	RCP8.5 / 95%ile	7.58	4.73	0.45

3.2.4 **Table 3.1** shows that the proposed design crest of the Northern Mound defence would be sufficient to limit overtopping (below 1 l/s/m rate) for the reasonably foreseeable scenario up to the basis of design 1 in 10,000-year return period event throughout the development lifetime (2190 epoch).

3.3 Hard Coastal Defence Feature (HCDF)

3.3.1 There was one comment raised with regard to overtopping of the HCDF (comment 6.2 in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B)) which states:

> *"FRA concludes there is no risk of overtopping at 2090 in the 0.5% (200 year) event when this scenario has not been run with UKCP18 RCP 8.5 95th percentile climate change."*

3.3.2 It is acknowledged that this scenario has not been explicitly simulated, however results for the 200-year return period at 2140 epoch scenario with 10.2m AOD defence crest (sea level rise allowance higher by 0.9m) show very limited overtopping rate of 0.3 l/s/m (well below 1 l/s/m). Hence it is reasonable to assume that at 2090 epoch overtopping would be less or none. Therefore, additional calculations for this scenario were not undertaken as part of this assessment.

3.3.3 As discussed in **section 2**, the credible maximum scenarios with extreme still water levels largely above the platform height were not assessed. Therefore, only one scenario for the credible maximum climate change allowance (BECC Upper) was considered, i.e. for the 1 in 200-year return period at 2140 epoch, however this was undertaken for the revised design defence crest and is discussed in **section 5** of this report.

4 CONSTRUCTION PHASE ASSESSMENT

4.1.1 At the time of assessment undertaken for the Application, information on construction phase was limited, and therefore the Environment Agency raised concerns with regard to the construction sequencing as indicated in comment 4.3 in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B) which states:

> *"EDF have commented that they have a POST DCO action to develop a Better understanding of sequencing and inundation modelling for construction phase... states that current sea defence will be removed, leaving shingle beach and dune... The overtopping rate is estimated… but there is no assessment of what the implication of this rate would be on the site/users."*

4.1.2 Another comment on the construction phase overtopping (comment 4.4 in **Appendix B** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad B) states:

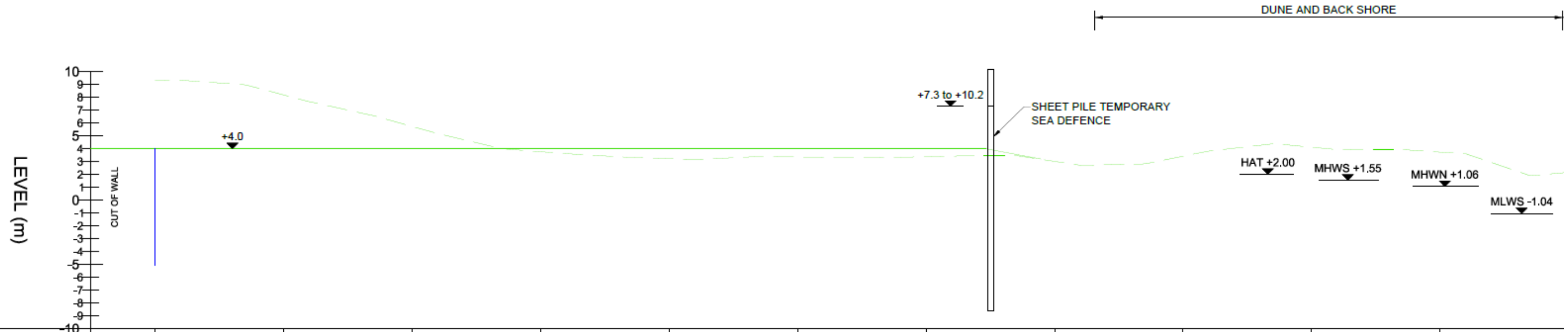
> *"Overtopping rates of 140 l/s/m are expected when the mound is removed and the haul road defence is not yet in place. The FRA does explain what this rate of overtopping means for flood risk on the site."*

4.1.3 Following the Application submission, further design and construction sequencing works have been undertaken giving more detailed information. The most significant change relates to the early stages of construction, where the current proposed approach is to install a temporary sheet pile wall around the construction area extending from the Sizewell B defence to another temporary sheet pile wall at the SSSI crossing construction area. The sheet pile wall would have a crest at 7.3m AOD.

4.1.4 The temporary defence would be installed prior to any existing defences being removed and would remain in place until the permanent defence would be constructed up to a minimum level of 10m AOD. This significantly reduces the risk of overtopping to the whole of the construction area throughout the entire construction phase. To support that conclusion, the overtopping assessment was carried out for the 200-year and 1,000-year return period events at 2030 epoch. This is slightly more conservative as the current construction programme indicates that the full permanent defence would be completed by that time.

4.1.5 **Plate 4.1** illustrates the enabling works (early construction phase) defence profile with minimum crest indicated as 7.3m AOD, which was adopted for the overtopping calculations.

Plate 4.1: Enabling works sea defence profile (extract from EDF Energy drawing no. SZC-EW0601-XX-000-DRW-400025 rev. 01, 27/11/20)



CHAINAGE (m)	00.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000
EXISTING LEVELS (m)	9.286	8.183	5.731	3.769	3.226	3.355	3.383	3.010	3.415	4.115	3.731

4.1.6 Input conditions (extreme sea level, wave height etc.) were adopted as per the assessment for the Application for the same epoch.

4.1.7 **Table 4.1** presents results of the construction phase overtopping calculation for the two considered events showing that the temporary sheet pile defence would be sufficient to limit overtopping for the 200-year and 1,000-year return period events (with overtopping rates well below 1 l/s/m) and therefore flood risk to the site and its users during construction phase is considered not significant.

Table 4.1: Predicted mean overtopping rates for the enabling works defence (+7.3m AOD) during early construction phase

Return Period	Epoch	Climate Change	Extreme Sea Level (m AOD)	Inshore Wave Height (m)	Mean Overtopping Rate (l/s/m)
200-year	2030	RCP8.5 / 95%ile	3.33	2.85	0.00
1,000-year			4.17	3.25	0.36

5 UPDATED HCDF DESIGN

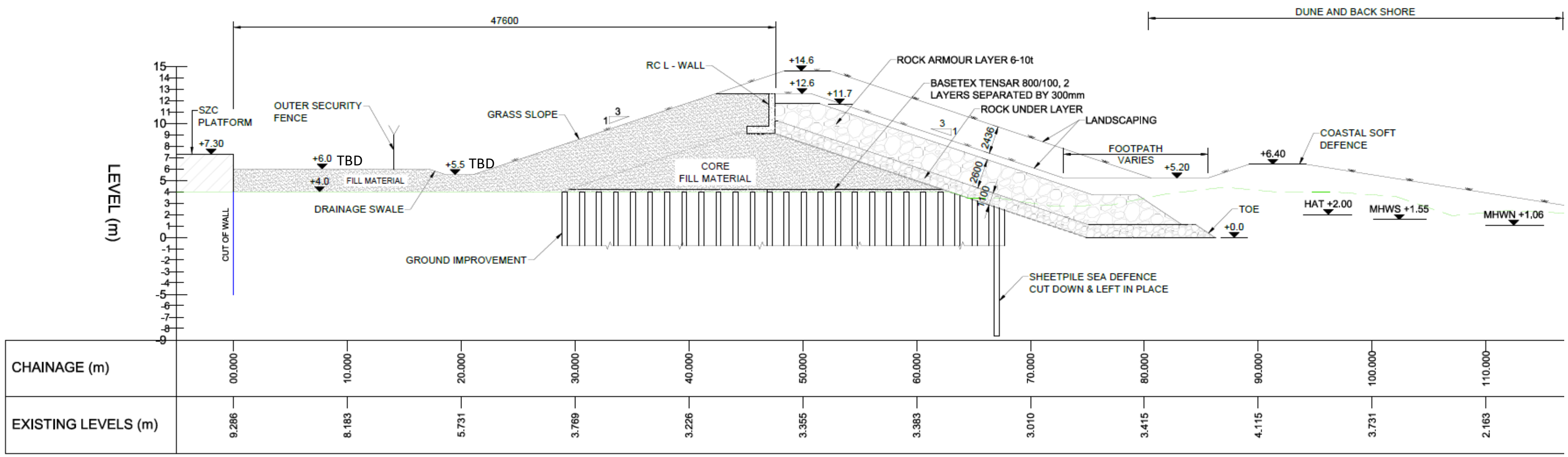
5.1 Overview of design changes

5.1.1 In the period since the Application submission, SZC Co. has, in consultation with internal and external stakeholders (including the Office for Nuclear Regulation and Environment Agency) established an initial set of Safety Functional Requirements. These, in part, are currently expressed as a maximum overtopping rate in order to reduce the risk for the basis of design event, i.e. 10,000-year return period with reasonably foreseeable climate change allowance, through the operation phase of the development. Consequently, it has been concluded that the permanent HCDF (sea defence) should be raised above levels proposed within the Application. These design changes have been set out in Consultation Document (Ref.), although the design works are ongoing.

5.1.2 For the design basis, a tolerable overtopping rate (design basis limit) was adopted as 2 l/s/m to ensure that the defence would withstand such events without failure. That threshold is based on guidance provided in the CIRIA ‘Rock Manual’ (Ref. 1). The EurOtop Manual on wave overtopping (Table 3.1 in Ref. 2) suggests limit for wave overtopping for structural design of rubble mound breakwaters, seawalls, dikes and dams with reinforced rear side between 5-10 l/s/m. Therefore, the adopted overtopping limit of 2 l/s/m for the design basis is considered to be conservative.

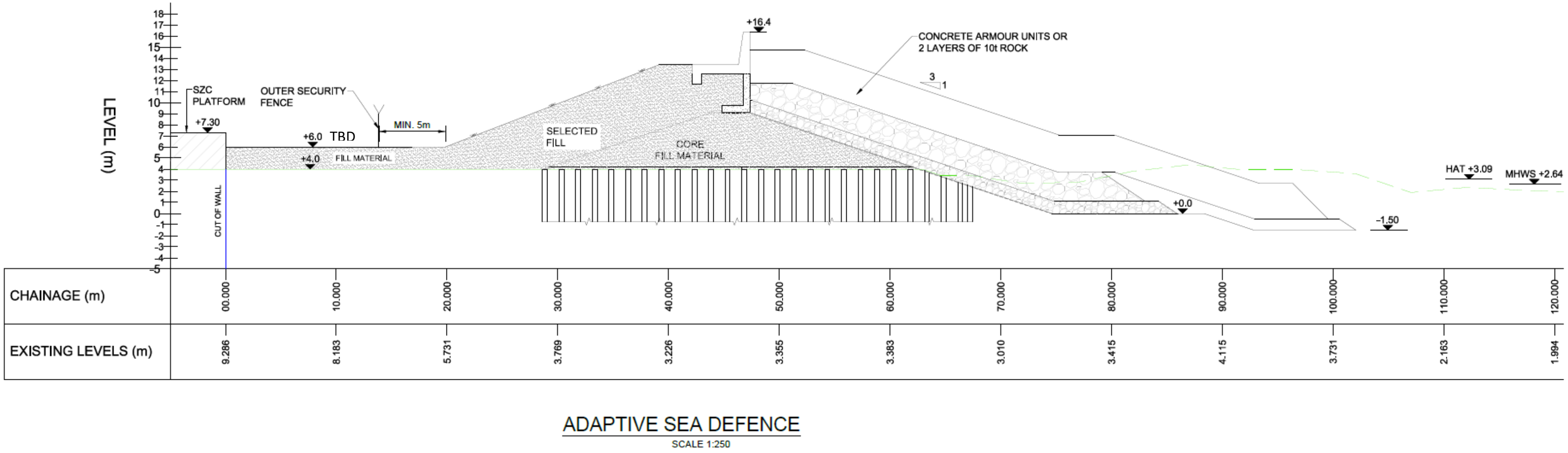
5.1.3 To fulfil the above design basis, the current proposed design of the HCDF assumes permanent defence crest at +12.6m AOD as illustrated in **Plate 5.1** and adaptive defence crest at +16.4m AOD, presented in **Plate 5.2**.

Plate 5.1: Proposed Operational Sea Defence (HCDF) profile (extract from EDF Energy drawing no. SZC-EW0601-XX-000-DRW-400025 rev. 01, 27/11/20)



OPERATIONAL SEA DEFENCE
SCALE 1:250

Plate 5.2: Proposed Adaptive Sea Defence (HCDF) profile (extract from EDF Energy drawing no. SZC-EW0601-XX-000-DRW-400025 rev. 01, 27/11/20)



5.1.4 As illustrated in **Plate 5.1**, the current design also includes a Soft Coastal Defence Feature (SCDF) with crest level raised to +6.4m AOD, that would comprise shingle won from the excavation of the footings for the HCDF, providing that suitable size and quality of the source material is available.

5.1.5 The SCDF is a sedimentary, sacrificial embedded mitigation feature that is designed to erode and release sediment to the beach face during severe storms and high water levels, thereby slowing overall erosion rates locally, as well as supplementing the flood risk protection from the HCDF. For that reason, the SCDF would be maintained throughout the design life of the HCDF up to 2140.

5.1.6 Beyond 2140 epoch, the adaptive defence would be constructed, as required, to comply with the Nuclear Site Licence, depending on the trajectory of current climate change projections and decommissioning activities.

5.1.7 Based on the above design changes, the wave overtopping assessment for the main development site was updated and is presented in the following **section 5.2**.

5.1.8 Where appropriate, inundation modelling was undertaken to assess flood depth, velocity and hazard on the platform due to overtopping of the defences. Also, further assessment of flood depth under extreme sea level scenarios was carried out. Details and results of this assessment are discussed in **section 5.3**.

5.2 Overtopping calculations

5.2.1 Overtopping calculations for the updated defence crest were carried out for the 1 in 200-year, 1,000-year and 10,000-year return period events with reasonably foreseeable climate change allowances; one scenario for the credible maximum climate change allowance (BECC Upper) for the 1 in 200-year return period at 2140 epoch and the H++ scenario for 1 in 10,000-year event at 2090 epoch.

5.2.2 This is following the approach discussed in **section 2**, where scenarios with extreme still water levels largely above the platform height were not assessed for wave overtopping. Instead, inundation due to extreme still water levels was assessed and is presented in **section 5.3**.

5.2.3 Similarly, scenarios for which results presented in the Application (with the lower defence crest) indicated no overtopping or a limited overtopping rate were not repeated for the revised raised defence profile.

5.2.4 Scenarios with the adaptive defence crest were assessed only for the 2190 epoch, i.e. end of theoretical maximum site lifetime for the 1 in 200-year and 1 in 1,000-year return period events.

5.2.5 **Table 5.1** presents a summary of predicted mean overtopping rates for the revised defence profile undertaken in this assessment.

Table 5.1: Predicted mean overtopping rates for the updated HCDF design (crest at +12.6m AOD, and +16.4m AOD where indicated with asterisk)

Return Period	Epoch	Climate Change	Extreme Sea Level (m AOD)	Inshore Wave Height (m)	Mean Overtopping Rate (l/s/m)
200-year	2140	RCP8.5 / 95%ile	5.00	3.73	0.0
	2140	BECC Upper	7.10	4.48	5.2
	2190	RCP8.5 / 95%ile	5.83	4.25	0.1
	2190*	RCP8.5 / 95%ile	5.83	4.25	0.0
1,000-year	2140	RCP8.5 / 95%ile	5.84	3.94	0.0
	2190	RCP8.5 / 95%ile	6.67	4.42	1.9
	2190*	RCP8.5 / 95%ile	6.67	4.42	0.0
10,000-year	2090	RCP8.5 / 95%ile	5.85	4.15	0.1
	2090	H++	6.46	4.34	1.2
	2140	RCP8.5 / 95%ile	6.75	4.42	2.4

**Note: Scenario with adaptive defence crest at 16.4mAOD*

5.2.6 Results in **Table 5.1** show that the updated defence design with the proposed defence crest at +12.6m AOD limits overtopping to below the adopted threshold of 2l/s/m for both the 200-year and 1,000-year events, up to the theoretical maximum development lifetime (2190 epoch).

5.2.7 For the credible maximum scenario (BECC Upper) for the 200-year event at 2140 epoch, the overtopping rate is above the adopted threshold, however this event is beyond basis of design and is used to inform the severe accident and 'cliff-edge' effects analysis required by ONR that would be discussed within the Safety Case assessment.

5.2.8 For the 10,000-year return period event, the proposed defence crest at +12.6m AOD gives overtopping rates within the design basis limit of 2l/s/m, including the H++ scenario at the end of the operational phase of the development. Results for the 2140 epoch are just above 2l/s/m, although still within the numerical tolerance of the model.

5.2.9 To understand the impact of the overtopping on flood depth, velocity and hazard on the main platform, inundation modelling was carried out for the four scenarios where results in **Table 5.1** show overtopping over 1l/s/m and the results of these scenarios are discussed in the following section. Scenarios with overtopping rates of 0.1l/s/m were not considered in the inundation modelling as such overtopping rates are well below any tolerable overtopping rates and would therefore not result in significant flood risk on the platform.

5.3 Inundation modelling

5.3.1 Based on results from the overtopping calculations, inundation modelling was undertaken to determine flood depth, velocity and hazard on the main platform and further inform the flood risk assessment.

5.3.2 For this purpose, the 2D model developed for the coastal inundation and tidal breach studies was used. Details on the model schematisation and parameters can be found in **Appendix 4** of the **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-099] and **Appendix D** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad D).

5.3.3 The model was updated to include a detailed representation of the proposed layout of the buildings on the main platform (as within the Application) and the updated sea defence (HCDF) with proposed defence crest raised to +12.6m AOD.

5.3.4 As part of the Safety Case works, the design of the area between the toe of the HCDF on the landward side and the edge of the platform is being developed and may include some further drainage features (i.e. drainage swale shown in **Plate 5.1**). However, for the purpose of this inundation modelling, a more conservative approach was adopted, where a flat area at platform level of +7.3m AOD was assumed,

5.3.5 Buildings on the main platform were represented as ‘stubby buildings’ by raising the levels within the footprint of the buildings by 0.2m. This threshold was assigned based on design parameters, which state that the threshold level for all buildings on the main platform will be set, as a minimum, 0.2m above the platform level.

5.3.6 Representation of the main platform, buildings and the sea defences in the inundation model is illustrated in **Plate 5.3**.

5.3.7 The sea defence around the Northern Mound shown in **Plate 5.3** was adopted with the crest at +14.2m AOD as per the design set out within the Application. It should be noted that tie in of the HCDF to the Sizewell B sea defence is indicative and may be subject to changes in the detail once design works are completed.

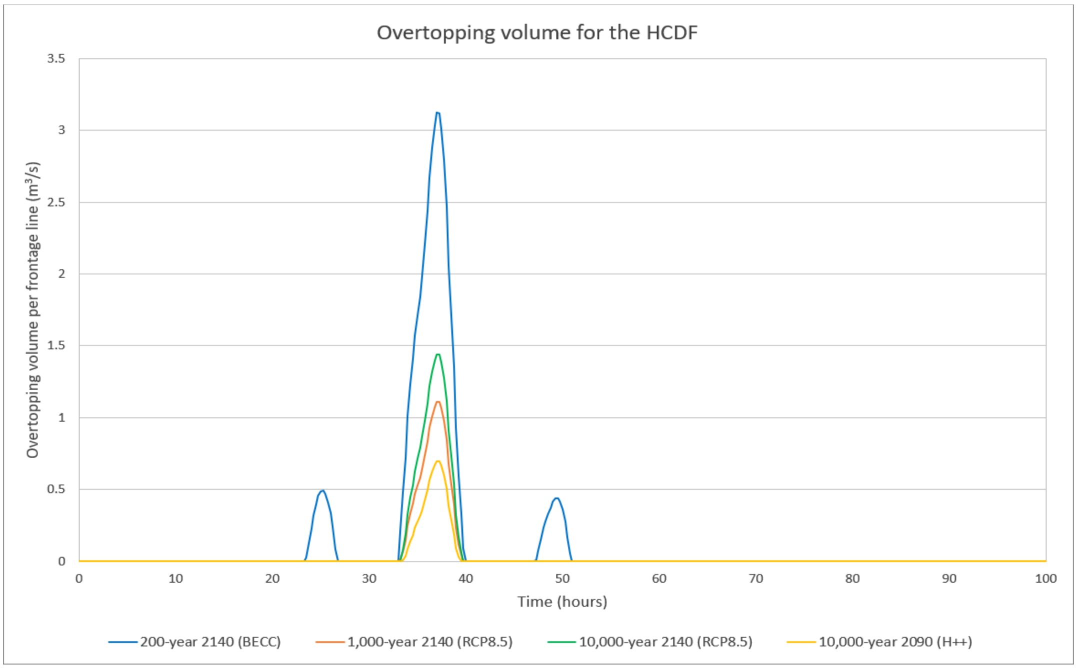
Plate 5.3: Representation of the main platform and HCDF in the inundation model

5.3.8 Boundary conditions in the model were set with a timeseries of tide levels with peak surge level corresponding to extreme still water levels for the relevant return period event and climate change allowance provided in **Table 5.1**.

5.3.9 An inflow boundary with overtopping discharge rates was assigned along all coastal defences, including existing natural defences, Sizewell B and Sizewell A defences and the proposed defence in front of Sizewell C (HCDF). Time series of overtopping volumes was interpolated based on series of overtopping rates calculated for incremental change in tide levels and multiplied by the length of the respective frontage. Overtopping for the existing defences was only applied when extreme still water levels were below the defence crest, when tide levels are higher than the defence crest the water would automatically inundate the defences and spread across the area behind.

5.3.10 **Plate 5.4** presents the time series of overtopping volume for the HCDF frontage line for the four scenarios considered in the inundation modelling.

Plate 5.4: Overtopping volume for the HCDF frontage line for the four considered scenarios



5.3.11 Based on the timings of the overtopping volumes throughout the timeseries of tide levels, the inundation model was simulated up to 60 hours to allow enough time for propagation of the overtopping onto the main platform.

5.3.12 Results for the 1 in 200-year event at 2140 epoch (with BECC Upper climate change allowance) show flood depth on the main platform from up to 0.15m just behind the defence to approximately 0.05m at the back (most landside end) of the platform with flood velocity below 1m/s and low hazard rating, as presented in **Figure 1**, **Figure 2** and **Figure 3** respectively.

5.3.13 Similarly, for the 1 in 1,000-year event at 2190 epoch (RCP8.5 / 95%ile climate change allowance) the maximum flood depth on the main platform is up to 0.1m with flood velocity below 1m/s and low hazard rating. These results are presented in **Figure 4**, **Figure 5** and **Figure 6** respectively.

5.3.14 For the basis of design event, i.e. 1 in 10,000-year event at 2140 epoch (RCP8.5 / 95%ile climate change allowance) the maximum flood depth on the main platform is up to 0.1m (mostly behind the defence) with flood velocity below 1m/s and low hazard rating, showing that the flood risk for this event is not significant and therefore the defence is sufficiently protecting the site. This is illustrated in **Figure 7**, **Figure 8** and **Figure 9** for the flood depth, velocity and hazard rating respectively.

5.3.15 Similarly, for the 1 in 10,000-year event at 2090 epoch with credible maximum climate change scenario (H++) the maximum flood depth on the main platform is up to 0.1m with maximum flood velocity below 1m/s and low hazard rating showing that despite more conservative climate change allowance the flood risk on the main platform for this event is not significant. **Figure 10**, **Figure 11** and **Figure 12** present the maximum flood depth, velocity and hazard rating for this scenario respectively.

5.3.16 For all assessed scenarios, the maximum flood depth on the main platform is well below the 0.2m threshold of the buildings, hence these are shown as 'dry' in the results.

5.3.17 Overall, results from the inundation modelling show that flood risk to the site and its users resulting from overtopping of the HCDF is not significant under the considered scenarios.

5.3.18 As discussed in **section 2**, scenarios where the still water levels are above platform height were not explicitly modelled in the inundation or overtopping assessment. Instead, horizontal projection was used to determine flood depth on the platform and the results of this are presented in **Table 5.2**.

Table 5.2: Assessed flood depth on the main platform for scenarios with extreme still water level above platform height

<table>
<tr><th>Return Period</th><th>Epoch</th><th>Climate Change</th><th>Extreme Sea Level (m AOD)</th><th>Main Platform Level (m AOD)</th><th>Flood Depth on the Main Platform (m)</th></tr>
<tr><td>200-year</td><td>2190</td><td>BECC Upper</td><td>8.00</td><td rowspan="5">7.3</td><td>0.70</td></tr>
<tr><td rowspan="2">1,000-year</td><td>2140</td><td>BECC Upper</td><td>7.94</td><td>0.64</td></tr>
<tr><td>2190</td><td>BECC Upper</td><td>8.84</td><td>1.14</td></tr>
<tr><td rowspan="2">10,000-year</td><td>2140</td><td>BECC Upper</td><td>8.85</td><td>1.55</td></tr>
<tr><td>2190</td><td>RCP8.5 / 95%ile</td><td>7.58</td><td>0.28</td></tr>
</table>

Return Period	Epoch	Climate Change	Extreme Sea Level (m AOD)	Main Platform Level (m AOD)	Flood Depth on the Main Platform (m)
	2190	BECC Upper	9.75		2.45

5.3.19 **Table 5.2** shows that for the 1 in 10,000-year event at 2190 epoch flood depth on the platform is greater than the building threshold set in the design parameters. For the beyond basis of design events (credible maximum climate change scenarios i.e. BECC Upper) flood depth is significantly above the main platform height and threshold of the buildings.

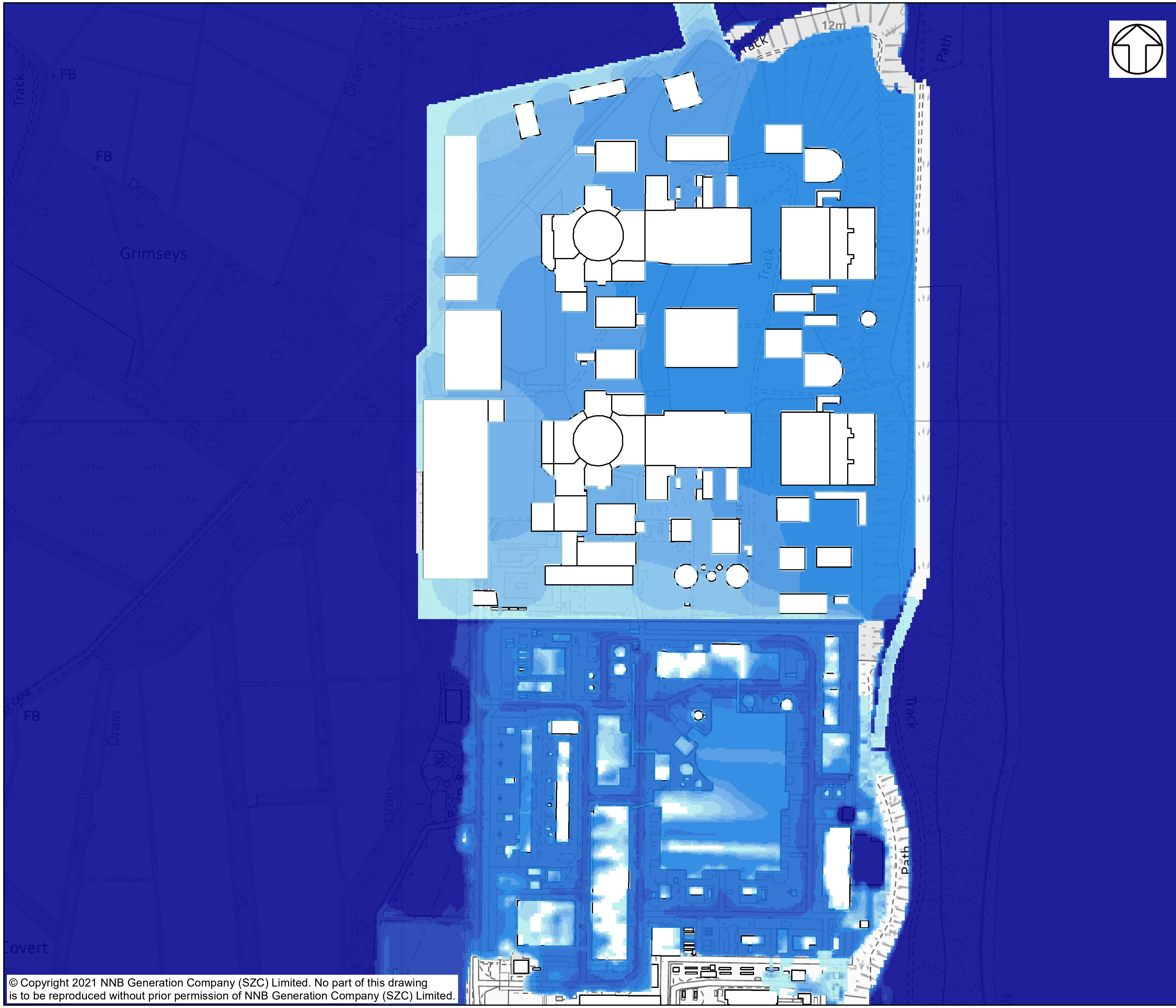
5.3.20 Further discussion on the impacts of flood risk from wave overtopping and main platform inundation to the site and its users is provided in the **MDS FRA Addendum** (Doc. Ref. 5.2(A)Ad).

REFERENCES

1. CIRIA C683 The Rock Manual (2nd Edition), Rev 00, The Rock Manual: The use of rock in hydraulic engineering (2nd edition), CIRIA, 2007

2. EurOtop. Manual on wave overtopping of sea defences and related structures. An overtopping manual largely based on European research, but for worldwide application. Van der Meer, J.W., Allsop, N.W.H., Bruce, T., De Rouck, J., Kortenhaus, A., Pullen, T., Schüttrumpf, H., Troch, P. and Zanuttigh, B. Second Edition 2018: www.overtopping-manual.com

FIGURES



NOTES

KEY

BUILDINGS

FLOOD DEPTH (M)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

NOT PROTECTIVELY MARKED

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EDF CGN

DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
FLOOD DEPTH ON THE MAIN PLATFORM
1 IN 200-YEAR 2140 (BECC UPPER)

DRAWING NO:
FIGURE 1

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	J.T.	1:4,000 @A3	2.0

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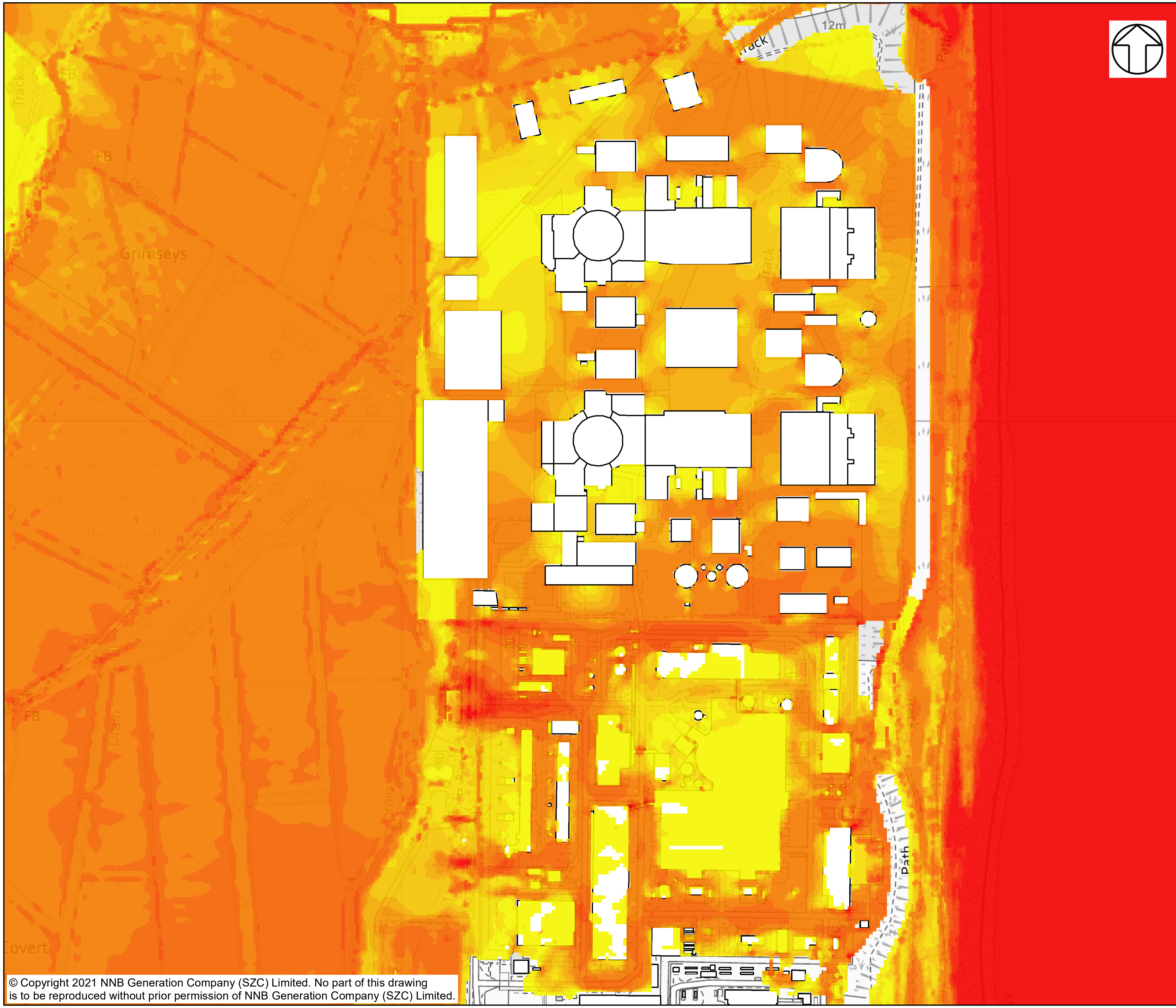

NOTES

KEY

BUILDINGS

MAX VELOCITY (M/S)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

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DOCUMENT:
SIZEWELL C
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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
VELOCITY ON THE MAIN PLATFORM
1 IN 200-YEAR 2140 (BECC UPPER)

DRAWING NO:
FIGURE 2

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	J.T.	1:4,000 @A3	2.0

SCALE BAR
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NOTES

KEY

BUILDINGS

MAX HAZARD

LESS THAN 0.75 (LOW HAZARD)

BETWEEN 0.75 AND 1.25 (DANGER FOR SOME)

BETWEEN 1.25 AND 2.0 (DANGER FOR MOST)

GREATER THAN 2.0 (DANGER FOR ALL)

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DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
HAZARD ON THE MAIN PLATFORM
1 IN 200-YEAR 2140 (BECC UPPER)

DRAWING NO:
FIGURE 3

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	J.T.	1:4,000 @A3	2.0

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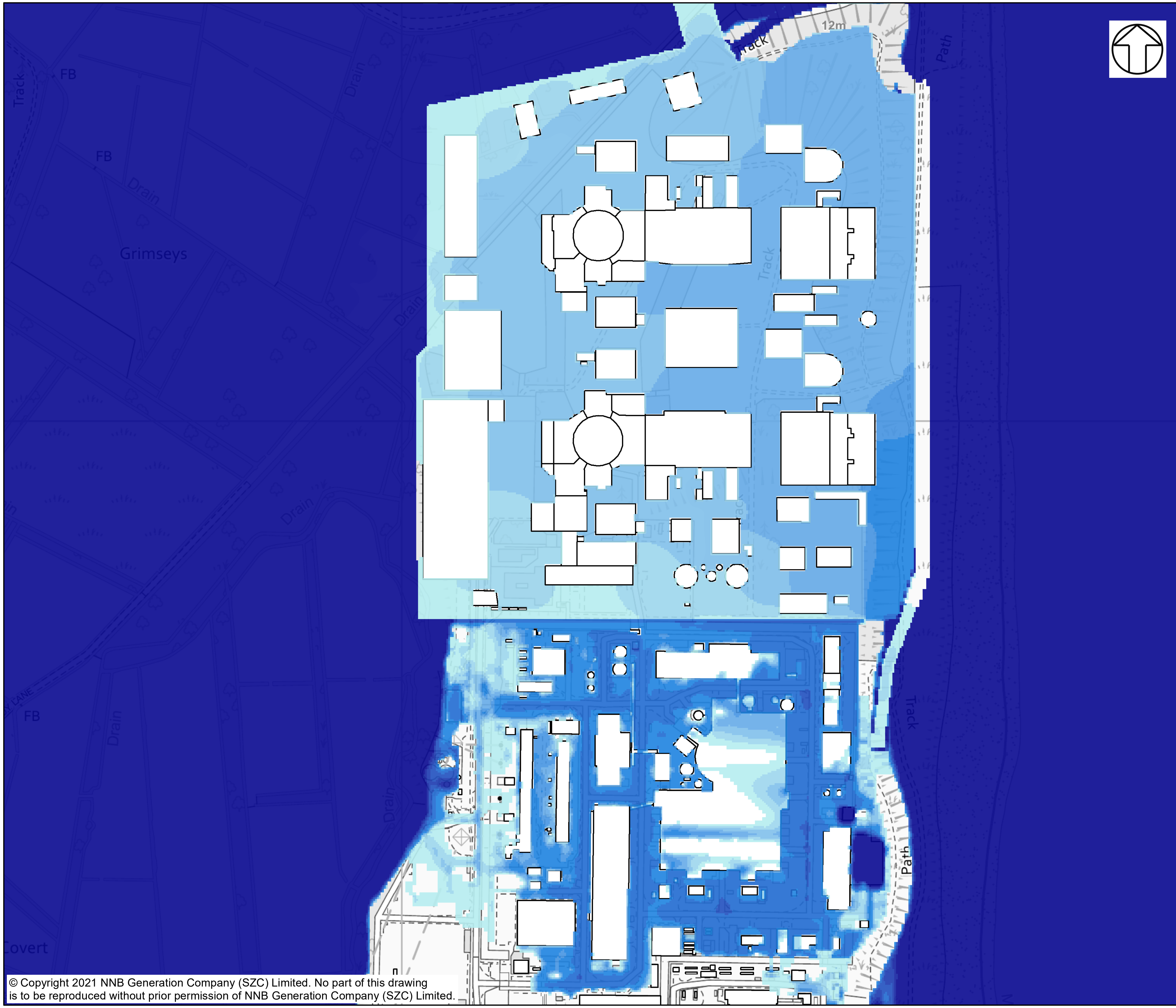

NOTES

KEY

BUILDINGS

FLOOD DEPTH (M)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

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DOCUMENT:
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FLOOD RISK ASSESSMENT ADDENDUM
INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
FLOOD DEPTH ON THE MAIN PLATFORM
1 IN 1,000-YEAR 2190 (RCP8.5)

DRAWING NO:
FIGURE 4

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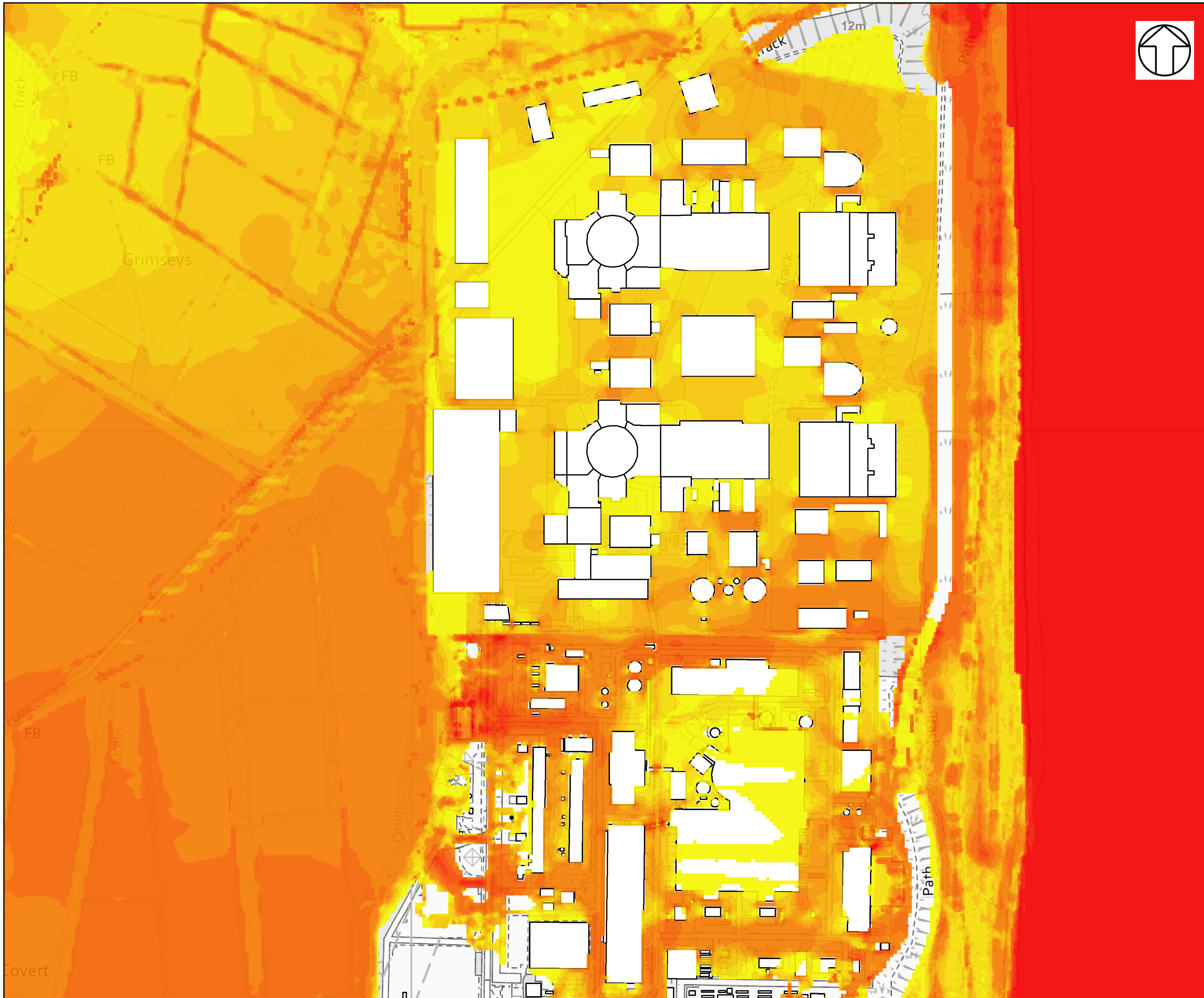

NOTES

KEY

BUILDINGS

MAX VELOCITY (M/S)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
FLOOD RISK ASSESSMENT ADDENDUM
INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
VELOCITY ON THE MAIN PLATFORM
1 IN 1,000-YEAR 2190 (RCP8.5)

DRAWING NO:
FIGURE 5

DATE:	DRAWN:	SCALE :	REVISION:
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SCALE BAR
0 30 60 90 120 150 Metres

NOTES

KEY

BUILDINGS

MAX HAZARD

LESS THAN 0.75 (LOW HAZARD)

BETWEEN 0.75 AND 1.25 (DANGER FOR SOME)

BETWEEN 1.25 AND 2.0 (DANGER FOR MOST)

GREATER THAN 2.0 (DANGER FOR ALL)

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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
HAZARD ON THE MAIN PLATFORM
1 IN 1,000-YEAR 2190 (RCP8.5)

DRAWING NO:
FIGURE 6

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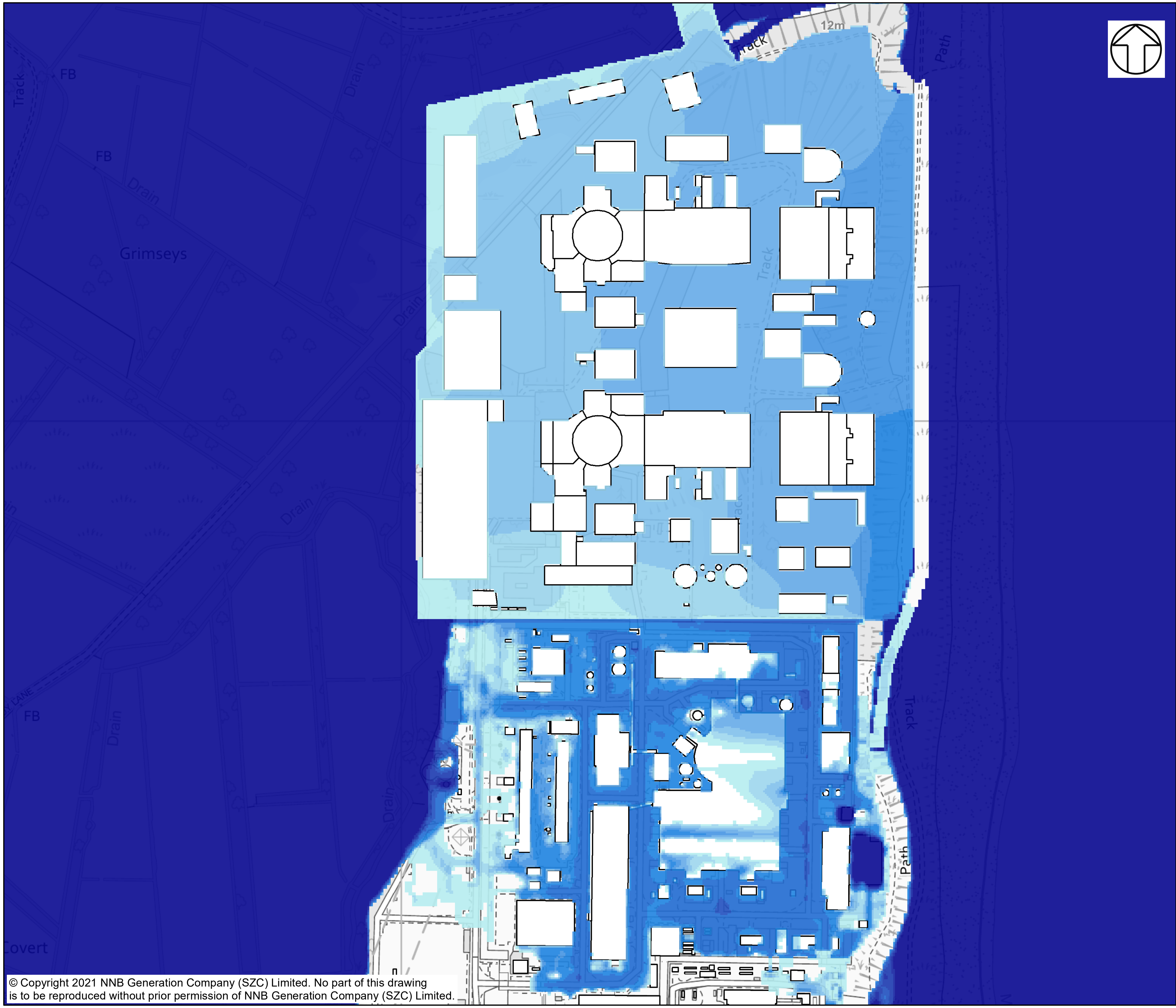
Metres



NOTES

KEY

BUILDINGS

FLOOD DEPTH (M)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
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- 0 - 0.02

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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
FLOOD DEPTH ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2140 (RCP8.5)

DRAWING NO:
FIGURE 7

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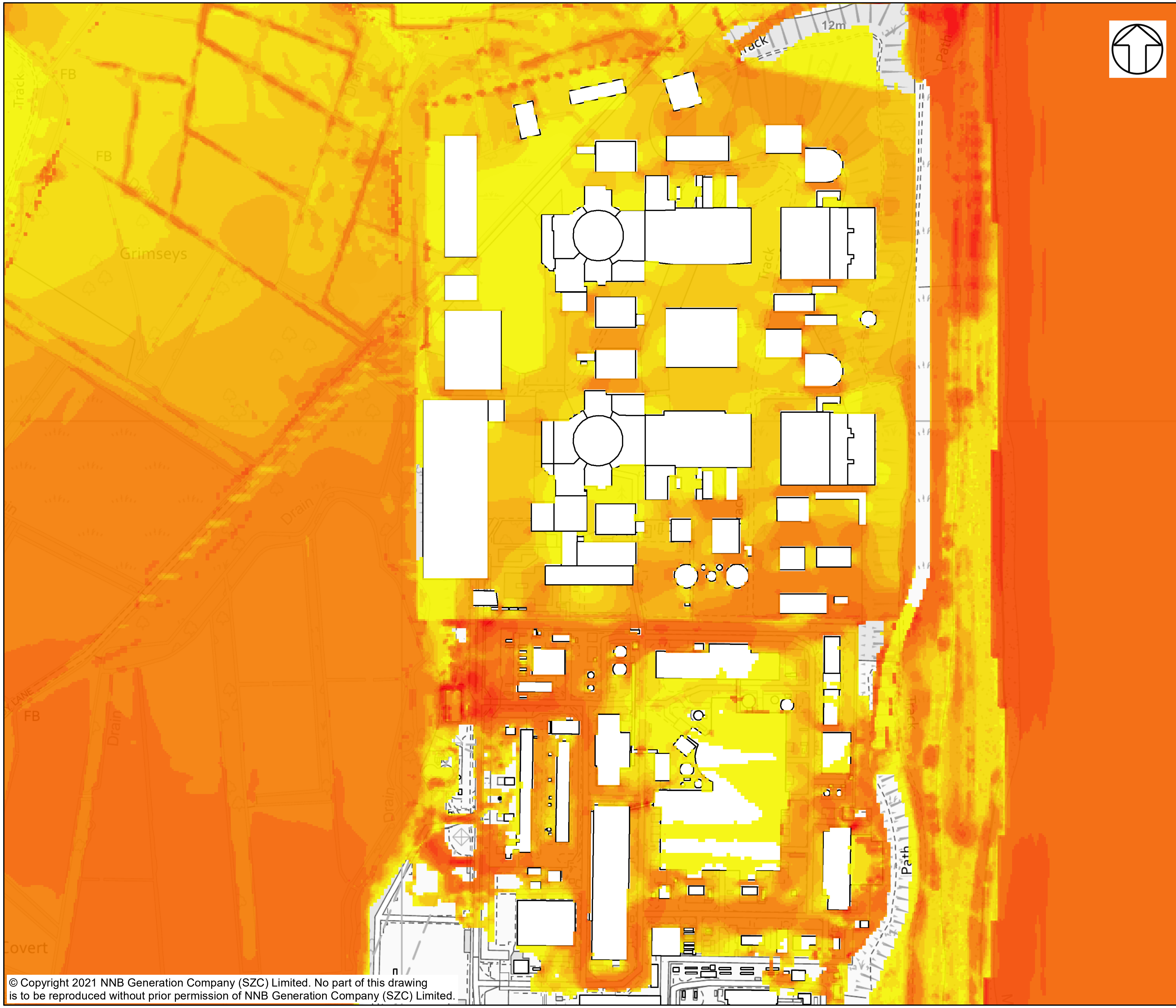

NOTES

KEY

BUILDINGS

MAX VELOCITY (M/S)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

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DRAWING TITLE:
VELOCITY ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2140 (RCP8.5)

DRAWING NO:
FIGURE 8

DATE:	DRAWN:	SCALE :	REVISION:
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SCALE BAR
0 30 60 90 120 150 Metres

NOTES

KEY

BUILDINGS

MAX HAZARD

LESS THAN 0.75 (LOW HAZARD)

BETWEEN 0.75 AND 1.25 (DANGER FOR SOME)

BETWEEN 1.25 AND 2.0 (DANGER FOR MOST)

GREATER THAN 2.0 (DANGER FOR ALL)

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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
HAZARD ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2140 (RCP8.5)

DRAWING NO:
FIGURE 9

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JAN 2021	J.T.	1:4,000 @A3	2.0

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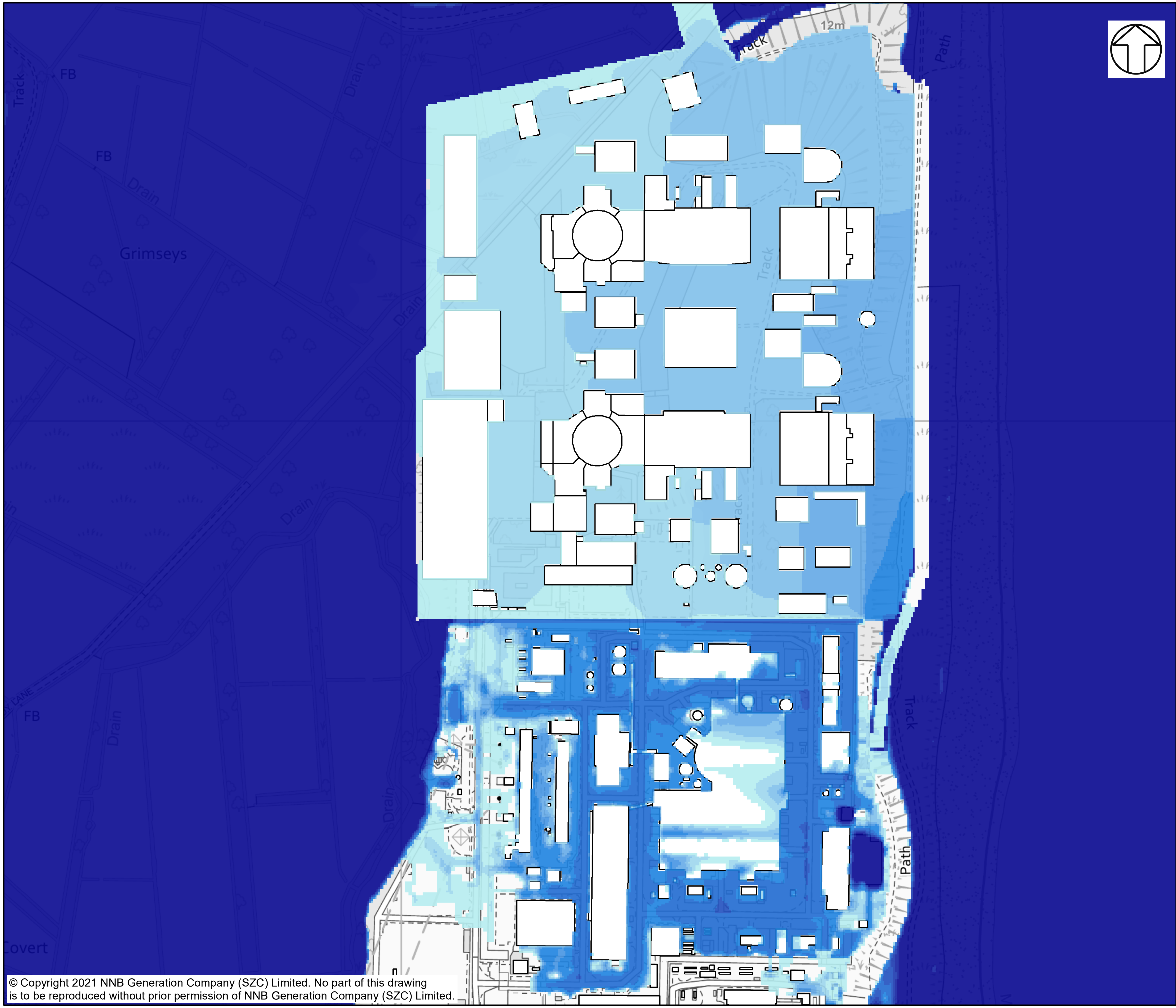

NOTES

KEY

BUILDINGS

FLOOD DEPTH (M)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
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- 0.04 - 0.06
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FLOOD RISK ASSESSMENT ADDENDUM
INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
FLOOD DEPTH ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2090 (H++)

DRAWING NO:
FIGURE 10

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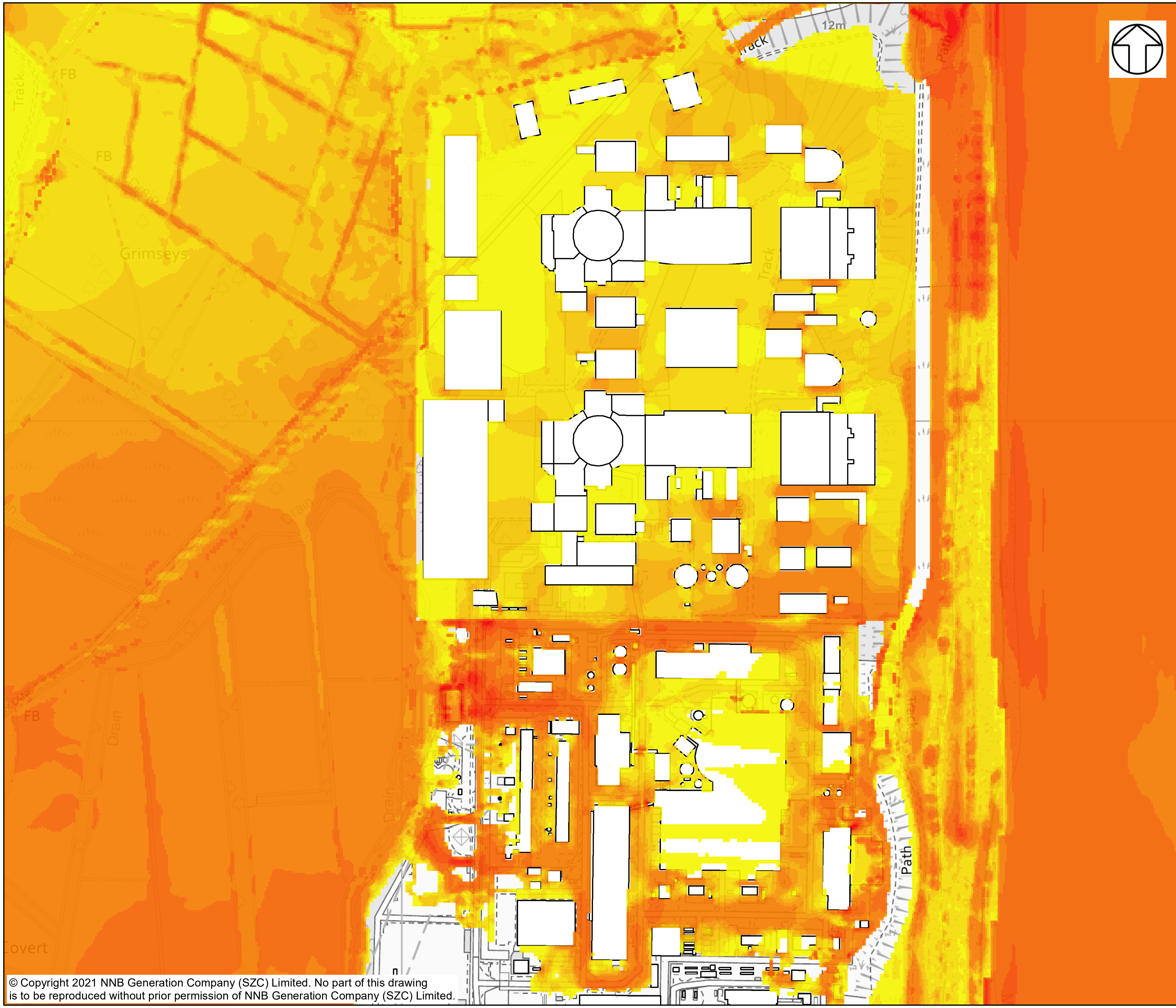

NOTES

KEY

BUILDINGS

MAX VELOCITY (M/S)

- >1
- 0.8 - 1
- 0.6 - 0.8
- 0.4 - 0.6
- 0.2 - 0.4
- 0.1 - 0.2
- 0.08 - 0.1
- 0.06 - 0.08
- 0.04 - 0.06
- 0.02 - 0.04
- 0 - 0.02

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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
VELOCITY ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2090 (H++)

DRAWING NO:
FIGURE 11

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	J.T.	1:4,000 @A3	2.0

SCALE BAR
0 30 60 90 120 150 Metres

NOTES

KEY

BUILDINGS

MAX HAZARD

LESS THAN 0.75 (LOW HAZARD)

BETWEEN 0.75 AND 1.25 (DANGER FOR SOME)

BETWEEN 1.25 AND 2.0 (DANGER FOR MOST)

GREATER THAN 2.0 (DANGER FOR ALL)

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INUNDATION OF THE MAIN PLATFORM

DRAWING TITLE:
HAZARD ON THE MAIN PLATFORM
1 IN 10,000-YEAR 2090 (H++)

DRAWING NO:
FIGURE 12

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	J.T.	1:4,000 @A3	2.0

SCALE BAR
0 30 60 90 120 150 Metres

APPENDIX F: MAIN DEVELOPMENT SITE FLOOD RISK EMERGENCY PLAN

CONTENTS

TABLES

PLATES

APPENDICES

1 INTRODUCTION

1.1 Background

1.1.1 The nature and scale of the Sizewell C Project (the Project) is such that the proposed development requires a number of temporary associated development sites to facilitate the construction of the new nuclear power station, as well as the construction of the main development platform itself.

1.1.2 The **Main Development Site (MDS) Flood Risk Assessment** (Doc Ref. 5.2) [APP-093] was carried out for the main development site and submitted by SZC Co. on 27 May 2020 as part of the Development Consent Order application ('the Application'). The **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-093] provided a summary of flood risk to all elements of the proposed development and identified that where there is a risk of flooding there is a need for a Flood Risk Emergency Plan (FREP) to comply with current policy and guidance (e.g. Ref. 1, Ref. 2 and Ref. 3).

1.1.3 Flood risk to the proposed development is primarily mitigated through a number of embedded measures, as summarised in the **Main Development Site (MDS) Flood Risk Assessment** (Doc Ref. 5.2) [APP-093]. However, as there remains a small risk of flooding to the proposed development, under some scenarios, current policy (Ref. 1 and Ref. 2) requires that this FREP be prepared. It should be read alongside other key documents including the **Code of Construction Practice (CoCP)** (Doc Ref. 8.11(A)), which sets out principles in relation to flood risk and drainage during the construction phase.

1.2 Requirement for a Flood Risk Emergency Plan

a) Policy background

1.2.1 The National Planning Policy Framework (NPPF) (Ref. 1) and associated Planning Practice Guidance (PPG) (Ref. 2) note that there is a need for applicants to demonstrate that a proposed development site will be safe and that people will not be exposed to hazardous flooding from any source. Specifically that:

> *"163e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."* (Ref. 1)

1.2.2 A FREP should therefore be created where emergency response is an important component of the safety of the proposed development.

1.2.3 Guidance set out in the Environment Agency and Association of Directors of Environment, Economy, Planning & Transport (ADEPT) publication entitled "Flood risk emergency plans for new developments" (Ref. 3) notes that a FREP should be provided as part of the FRA, or as a separate document accompanying the FRA, if relevant pedestrian and / or vehicular access and escape routes from a proposed development would be affected during:

- a design flood from any source (with an appropriate allowance for climate change) with any existing flood risk management structures or features operating as intended; or
- a design flood from any source (with an appropriate allowance for climate change) with a failure of any relevant flood risk management structures or features.

1.2.4 The above guidance is relevant to all new development, however, it focuses on flood risk response in design events up to and including the 1 in 1,000-year plus climate change event. The nature of the proposed development is such that the mitigation measures included within the design of the proposed development provide protection from flooding for more extreme events (i.e. 1 in 10,000-year event) well in excess of those considered within the above guidance.

b) Site-specific requirement for a FREP

1.2.5 During the construction works for the Project there will be a need to work within, or close to, Flood Zones 2 and 3 to facilitate construction of the temporary works areas as well as the main development platform. Although the site is currently protected from flooding by the presence of the existing coastal defences, up to the present day 1 in 1,000-year event, there is still the potential for flooding to occur in extreme events or, as a residual risk, should there be a breach / overtopping of these defences during an extreme event (i.e. greater than a 1 in 1,000-year event or in the event of a failure of the defences).

1.2.6 However, as the proposed works will be taking place in areas that have a relatively high flood risk a FREP is required to manage residual flood risk and ensure the preparedness of both construction personnel and operational staff in the event of an emergency due to flooding.

1.2.7 To mitigate the risk of flooding, a temporary sheet pile wall would be installed around the construction area. The temporary defence would be installed prior to the removal of any existing defences and would remain in place until the core of the permanent defence is completed.

1.2.8 Therefore, whilst the proposed development is at risk of flooding during the construction period, the provision of a temporary defence together with the permanent increased flood defence would provide protection to users of the site. Therefore, in line with national policy, the flood risk to the main development platform is significantly reduced by the presence of the temporary and permanent defences which will, remain in situ throughout construction and, where relevant, throughout the development lifetime.

1.2.9 Furthermore, once operational the potential for flood risk to affect the main development platform, should there be overtopping of the proposed defences, has been considered. The updated assessment of coastal flood risk, set out in the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad) shows that the proposed sea defences would be sufficient to protect the main platform area against the 1 in 200-year and 1 in 1,000-year events with reasonably foreseeable climate change until the end of the development life and up to the 2140 epoch for the basis of the design event (1 in 10,000-year return period). Therefore, there is highly unlikely to be any risk to users of the main development platform from flooding during the operational phase.

1.2.10 Once operational the Sizewell C power station will be subject to wider regulation as part of the Nuclear Site Licence and emergency measures related to flooding will be incorporated into the wider emergency plans for the site.

1.2.11 Following review of an outline template for this FREP, it has been acknowledged by the Suffolk Resilience Forum (**0**) that although there is a need to consider the decommissioning phase of the Project, this is at a point so far into the future that predicting flood risk, even allowing for climate change, is unrealistic.

1.2.12 Therefore, this FREP encompasses the construction phase and operation phases. It is noted that, once operational, emergency measures to protect users will be included within more detailed emergency plans / documents and therefore this FREP provides a summary only of the main actions and measures required to ensure the safety of users during the operational phase.

1.3 Aim of the FREP

1.3.1 The key aim of the FREP is to provide the regulators, construction contractor and operator with clear information to show that flood risk has been appropriately considered and to set out clear guidelines as to how the construction areas should be evacuated in the unlikely event of a flood emergency.

1.4 Approach and Future Updates

1.4.1 The FREP has been prepared in accordance with the guidance set out by the Environment Agency and ADEPT (Ref. 3), which has been applied throughout the remainder of this document.

1.4.2 The FREP should be considered as a live document and is therefore subject to update / review:

- whenever there is a change to any of the contact numbers, names or roles set out within the FREP;
- when the Project enters a different phase and the nature of the works changes; and
- during construction, as a minimum every three months, there should be a review to confirm all the information is still relevant.

1.4.3 In respect of the FREP, in accordance with the guidance set out by the Environment Agency and ADEPT (Ref. 3), it is the responsibility of the Local Planning Authority

> *"to form an overall view of its adequacy and be satisfied it can be safely and reasonably achieved".*

1.4.4 All subsequent updates and reviews of the FREP shall be documented and recorded and it will be the responsibility of the operator to ensure that an up-to-date version of the FREP is available at all times during the construction phase.

1.4.5 When the FREP is updated it should be recorded within a document control table setting out the changes that were made, when and why these changes were needed.

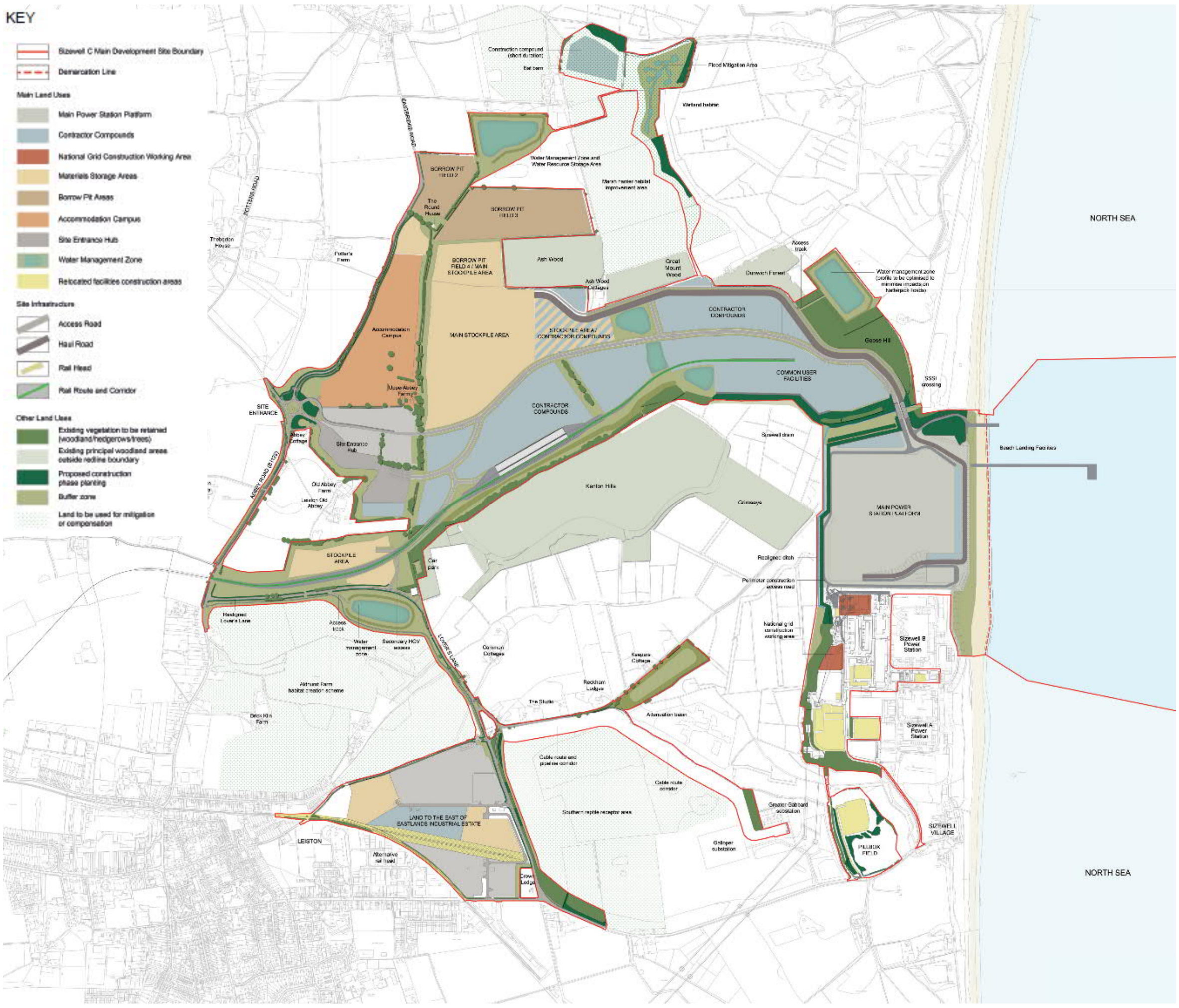
2 LOCATION AND PROPOSAL

2.1 Location

2.1.1 The main development site for the Sizewell C power station comprises an area that extends inland from the coast to the eastern edge of Leiston and north towards Eastbridge.

2.1.2 The main development site includes a number of elements including the main development platform, which is located immediately to the north of the existing Sizewell B power station, as well as a number of temporary works areas which are primarily located inland from the main platform, as shown in **Plate 2.1**.

Plate 2.1: Key elements of the MDS taken from the Construction Masterplan (Figure 2.2.33, Environmental Statement Addendum, Volume 2, Chapter 2 Main Development Site)



2.2 Existing Environment

2.2.1 As the Project covers a number of discrete geographical areas there is significant variability between the existing ground levels for various elements.

2.2.2 The topography for the main development site and its associated temporary works generally slopes from west to east (i.e. towards the coastline) and is predominantly rural, undeveloped agricultural land, other than the adjacent existing Sizewell power station complex.

2.2.3 The lowest topography in the areas are generally associated with the watercourses and marshlands, which are designated as a Site of Special

Scientific Interest (SSSI), including the Sizewell Belts and the Minsmere Levels. The neighbouring areas of existing urban development, such as Leiston, are generally positioned on land that is located at a relatively higher elevation.

2.2.4 The temporary construction area covers an area from Goose Hill northwards towards the Minsmere Levels and inland towards the B1122. The connection to the main development platform would be via an outcrop of higher topography, known as Goose Hill, with the highest ground levels located to the west of this area.

2.3 Proposed Development

a) Overall description

2.3.1 The proposed Sizewell C development comprises the main development platform area, a bridge crossing over the SSSI, Hard and Soft Coastal Defence Features, offshore works, beach landing facility, temporary construction area to the north of the main development site (as shown in **Plate 2.1**) and a series of off-site associated development sites.

2.3.2 Where associated development sites are located in areas that are not at risk of flooding i.e. Flood Zone 1 there is no requirement to produce a FREP and therefore these have not been considered further (see **Plate 3.2** for flood zones).

2.3.3 Additionally, this FREP specifically covers those development areas associated with the main development site and separate FREPS will be provided for the off-site associated developments, where needed.

2.3.4 The main development site covers an area of 371.7 hectares (ha), of which approximately 35ha would be occupied permanently by the new power station. The majority of the rest of the site would only be required temporarily for construction works.

2.3.5 The proposed development identified as being the main development site, covers a variety of development types, uses and locations. For the purposes of this assessment they have been divided into key development types to facilitate discussion within this FREP. These are summarised as:

- main development platform area (including sea defences);
- SSSI road crossing;

- temporary construction area to the north of the main development platform area including the temporary water resource storage area and Water Management Zone 1;
- beach landing facility;
- Land East of Eastlands Industrial Estate (LEEIE); and
- Fen Meadow Habitat Compensation Areas.

2.3.6 For the purposes of this FREP, the temporary construction area (including Water Resource Storage Area etc), LEEIE and Fen Meadow Habitat Compensation Areas should only be considered, where necessary, for the construction phase, as once the power station is operational these elements will no longer be required and any infrastructure removed or, in the case of the Fen Meadow Habitat Compensation Areas, no personnel will be present following construction should there be a flooding event.

2.3.7 The key points in time during the Project, as considered in the Application submission, are:

- **2022** – Start of construction;
- **2034** – End of construction (2030 used for assessment of construction phase flood risk, by which point key infrastructure would be in place);
- **2090** – End of operation;
- **2140** – Interim spent fuel store decommissioning; and
- **2190** – Theoretical maximum site lifetime, used for assessment of impacts and/or changes in flood risk-off site up to the end the end of development's lifetime.

b) Main development platform area

2.3.8 The proposed main development platform area would involve extensive alterations to the ground levels to facilitate the platform construction. The proposed platform is located behind the existing sand dunes with a shingle beach and an earth embankment, known as the Bent Hills. The Bent Hills would be excavated in stages during the first phase of construction of the platform as part of the ground improvement works for construction of the sea defences.

2.3.9 A temporary sheet pile wall at a minimum level of 7.3m AOD would be constructed around the construction area prior to removal of any existing defences. The temporary defence would tie into the existing Sizewell B defences and the sheet pile wall around the SSSI crossing construction area, therefore protecting the main construction area.

2.3.10 The Hard Coastal Defence Feature (HCDF) would be constructed between the reinstated shingle beach, known as the Soft Coastal Defence Feature (SCDF), and the proposed platform. The proposed main development platform is to be set at a level of 7.3m AOD.

2.3.11 The HCDF has been designed to protect the main platform from still water levels up to the 1 in 10,000-year return period for the entire operation phase and the spent fuel store decommissioning phases.

2.3.12 The sea defence crest level would initially be constructed to a level of 12.6m AOD with adaptive design to potentially raise the defence in the future up to 16.4m AOD, if sea level changes require.

2.3.13 Breach modelling was undertaken to assess the risk to the site if the coastal defences were to fail. The breach modelling shows the main platform area is not at flood risk from a breach of the existing defences.

2.3.14 Once constructed, the main development platform would be above the current and future 1 in 1,000-year fluvial and coastal flood extents, including allowances for climate change.

2.3.15 Additional overtopping and inundation modelling has been carried out for the main platform and the results presented in **Appendix E** of the **Main Development Site Flood Risk Assessment Addendum** (Doc Ref. 5.2(A)Ad). This shows there is a minimal flood risk to the main development platform during the operational phase, with overtopping rate for the basis of design 1 in 10,000-year event up to 2.4 l/s/m, resulting in less than 0.1m water depth on the platform with flood velocity less than 1m/s and low hazard. There would be no overtopping for the 1 in 200-year and 1 in 1,000-year events up to the 2140 epoch.

2.3.16 Overall, the main development platform is assessed to be at a very low level of flood risk throughout the development lifetime. However, during the early construction phase, there is a risk of flooding to those carrying out the works to realign the Sizewell Drain and install the temporary sheet pile wall. This FREP sets out measures to manage this risk.

c) SSSI crossing and access road

2.3.17 The existing access road located to the south of the existing Sizewell platform would remain in use initially and would provide a secondary access to Sizewell C power station once a new access road and SSSI crossing is constructed.

2.3.18 A new access road is required to link the main development site with the B1122 to the west and this will connect to the site via the SSSI crossing. Once in place, this would comprise the main route onto the main development platform, bringing workers and road-based freight onto the site during construction. It would subsequently comprise the main access to Sizewell C once the power station is operational.

2.3.19 The SSSI crossing is set back from the coastline however, as coastal change occurs the coastline could potentially progress inland (if the existing beach is not maintained) to the SSSI crossing resulting in potential risk of wave overtopping.

2.3.20 The proposed SSSI crossing would be set at a minimum level of 7.3m AOD to match the main platform level and to provide access to the site. It would have an adaptive defence crest (i.e. 10.5m AOD) to prevent risk of overtopping in the 1 in 200-year and 1 in 1,000-year events, such that the risk can be mitigated throughout the development lifetime.

2.3.21 Additionally, once constructed, the SSSI crossing would be above the current and future 1 in 1,000-year fluvial flood extents including allowances for climate change.

2.3.22 As noted previously, the current design proposes the installation of a temporary sheet pile wall around the construction area, extending from the Sizewell B defence to another temporary sheet pile wall at the SSSI crossing construction area. The sheet pile wall would have a crest set at a minimum level of 7.3m AOD.

2.3.23 The temporary defence would be installed prior to the removal of any existing defences and would remain in place until the core of the permanent defence would be completed. Therefore, it is primarily during the early construction phase, when there is a risk of coastal flooding to the SSSI crossing area whilst the temporary coastal defence is being installed, as well as the installation of the crossing over the Leiston Drain and Sizewell Drain. This FREP sets out measures to manage this risk.

d) Temporary construction area

2.3.24 The temporary construction area will be situated primarily to the north of the Sizewell Marshes SSSI between the B1122 and the coast, to the north west of the main platform.

2.3.25 The temporary construction area would contain the contractor compounds, borrow pits, stockpiles, access roads, accommodation campus and other infrastructure to facilitate the construction of the new power station on the main development platform.

2.3.26 After construction is complete, the temporary construction area and the majority of the infrastructure would be removed, and the site reinstated.

2.3.27 The majority of the temporary construction area is situated beyond the coastal and fluvial flood extents for the current and future 1 in 1,000-year including allowances for climate change. The temporary construction area includes three small areas of greater flood risk along the eastern, south eastern and northern boundaries.

2.3.28 On the eastern boundary, the infiltration basin in water management zone 1 and the retained woodland on Goose Hill are within current and future coastal and fluvial flood extents. There remains a residual risk of a breach of the defences along the temporary water resource storage area.

2.3.29 On the south eastern boundary with the Sizewell Belts, the fluvial and coastal flood risk extend into that part of the temporary construction area associated with the common user facilities area and car parking areas. However, the facilities are set back from the boundary to enable boundary treatment to occur which would prevent interaction with the flood extents.

2.3.30 On the northern boundary, the coastal and tidal breach flood risk extends along the boundary, while the fluvial flood risk extends into the site.

2.3.31 In addition to the fluvial and coastal flood risk there is a small surface water flow path in the central area of the temporary construction area which runs from near Ash Wood Cottages to near Sandling Walk, following the local topography. This surface water will flow into the Leiston Drain and is likely to contribute to fluvial flooding in the vicinity of the SSSI crossing.

2.3.32 As there is a risk of flooding to the temporary construction area during the construction phase only this should be considered in the FREP. As a result, the measures set out in the FREP related to flood risk and the actions to be implemented to mitigate the risk to users during the construction phase should be applied to this element of the proposed development.

e) Beach landing facility

2.3.33 The beach landing facility is a jetty with four mooring dolphins located to the north east of the main development platform. It is designed to offload Abnormal Indivisible Loads (AILs) for the construction of the Sizewell C power station. The beach landing facility is to be located on the seaward side of the coastal defences.

2.3.34 Access to the beach landing would be served by a reinforced access road at 5.0m AOD across the beach between the northern mound and the beach landing facility.

2.3.35 Although it will be present all year round, the beach landing facility is designed to operate during the summer months from April to September at high water, with unloading during daylight hours when wave conditions are suitable.

2.3.36 The location of the beach landing facility is such that there is a flood risk to users during its use. Therefore, the measures set out in the FREP related to flood risk and the actions to be implemented to mitigate the risk to users should be applied to this element of the proposed development.

f) Land East of Eastlands Industrial Estate (LEEIE)

2.3.37 The LEEIE site would be used temporarily for contractor compounds, workers' accommodation and stockpiles for the construction phase only (assumed up to 2034 for the purposes of this assessment). Once the Sizewell C power station has been built, the LEEIE construction facilities and the associated infrastructure would be removed, and the site returned to the pre-development state.

2.3.38 The LEEIE is situated beyond the coastal and fluvial flood extents for the current and future 1 in 1,000-year probability events including allowances for climate change. In addition, the majority of the LEEIE is at very low risk of surface water flooding. Small localised areas of 'low' to 'medium' surface water flood risk are present and associated with topographical low spots. The embedded design includes the implementation of a surface water drainage system including interception and attenuation of surface water. Based on the overall flood risk to, and temporary nature of the LEEIE, this element is not considered further within this FREP.

g) Fen Meadow Habitat Compensation Areas

2.3.39 The fen meadows are on low lying ground adjacent to the main rivers of the River Blyth and the River Fromus. The fen meadows are at risk of flooding that will remain throughout the lifetime of the Project. However, the nature of the works is such that once they are constructed there are no planned alterations to the sites or further activities during the operational and decommissioning phases and therefore no users will be at risk during the operational phase.

2.3.40 As a result, the measures set out in the FREP related to flood risk and the actions to be implemented to mitigate the risk to users during the construction phase only should be applied to this element of the proposed development.

3 CONSTRUCTION PHASE FREP

3.1 Construction Phase: Risk Summary

a) Risk of flooding

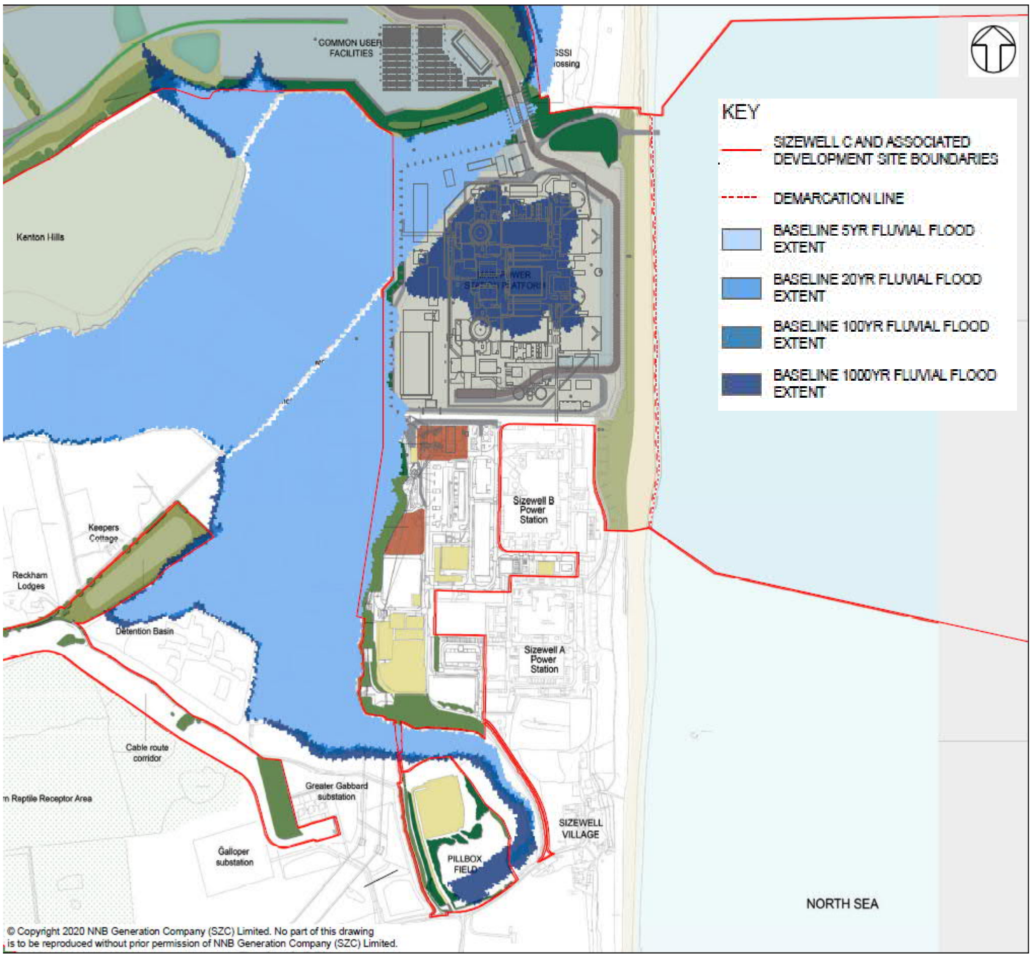
3.1.1 As previously noted, a Flood Risk Assessment (FRA) was prepared for the main development site and submitted as part of the DCO Application. The **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-093] confirmed that in the initial stages of construction while the temporary coastal defence is being constructed this is when the construction site is most exposed to the risk of flooding from a coastal / tidal flooding event.

b) Flood hazard

3.1.2 The greatest risk of flooding would be during the early part of the construction phase related to the realignment of the Sizewell Drain. The area in which the Sizewell Drain will be realigned is relatively low-lying and is known to have elevated groundwater levels which exacerbates the fluvial and surface water flood risk in this location, as shown on **Plate 3.1**. In this location flood depths, during a 1 in 5-year fluvial event with climate change up to the end of the construction phase, are approximately 0.7m with a flood hazard rating of ‘Danger for Most’. Therefore, during early construction there is a risk to the construction workers in this location should there be a fluvial flooding event.

3.1.3 There is also a risk of coastal flooding whilst the new HCDF is under construction. To mitigate the coastal flood risk, a temporary sheet pile wall would be in place around the construction area, tying into the existing Sizewell B defences and another sheet pile wall at the SSSI crossing location, effectively wrapping around the whole of the main development site construction area. This would protect the site from coastal flood risk throughout the construction phase up to the 1 in 1,000-year event. However, whilst the temporary sheet pile wall is being installed there will be a risk to construction workers installing it.

Plate 3.1: Fluvial flood extents for key return period events around the main development site construction area



3.1.4 Once the new HCDF is complete, the coastal flood risk would be reduced to a low level of risk for the remaining construction period. The defence height of 12.6m AOD will be able to withstand the 1 in 200-year, 1 in 1,000-year and 1 in 10,000-year events extreme still water level. It is not possible to show hazard mapping for these coastal events as there is no overtopping, for the above events during the construction phase (i.e. up to 2030 with the reasonably foreseeable climate change scenario), and therefore there will be no water on the main development platform construction site.

c) Embedded design measures

3.1.5 During construction it is anticipated that works to the main development site will be required within Flood Zones 2 and 3. This is principally associated with coastal / tidal flood risk for the construction of the HCDF and fluvial / surface water flood risk during the realignment of the Sizewell Drain.

3.1.6 To manage the impact of flood risk on the proposed development during the construction phase, measures to protect the site from flood risk, where possible, have been identified and summarised within the **CoCP** (Doc Ref. 8.11(A)), including the location of stockpiles away from a watercourse (i.e. both the Leiston Drain and the Sizewell Drain) and the requirement for emergency procedures to protect the construction workforce. Measures related to working in the fluvial flood zone will be developed further within the Flood Risk Activity Permit Application post-DCO.

3.1.7 It has been confirmed that the temporary defence would be installed prior to any existing defences being removed and would remain in place until the reinforced core of the permanent defence has been constructed up to a minimum level of 9.1m AOD. This significantly reduces the risk of overtopping to the whole of the construction area throughout the entire construction phase.

3.1.8 The temporary defence comprises the use of sheet piling around the perimeter of the main development site, tying into higher ground at each end such that a continual line of protection is afforded to the works being carried out behind these defences.

3.1.9 There remains a very low risk of flooding to construction workers during the construction phase, prior to the installation of the temporary defence and when working on the construction of the beach landing facility (i.e. in the unlikely event of a tidal storm surge). However, there is likely to be a long lead time prior to any events of this nature, thus enabling suitable action to be taken to manage this risk.

3.1.10 The remainder of this section of the FREP focuses on the measures and actions that will be put in place to minimise the impact of flooding during the construction phase.

3.2 Construction Phase: Pre-Construction Actions

3.2.1 Prior to the commencement of construction of the proposed main development site it shall be the responsibility of the construction contractor to ensure that all actions outlined in the FREP are implemented.

3.2.2 These actions are summarised as follows:

- Undertake a review of the FREP and make updates to take into account new or additional information;

- Register with the Environment Agency Floodline Warning Direct Scheme. Floodline Warning Direct can be signed up to by calling 0345 988 1188;
- Ensure all construction personnel are aware of the FREP and are trained sufficiently to implement the procedures set out in the FREP;
- Construction contractor to develop an emergency access and egress plan for the works on the proposed SSSI crossing, main development platform and any other works in the floodplain. During site inductions, all staff will need to be made aware of the emergency access and egress arrangements; and
- Construction contractor identify appropriate designated evacuation points for each element of the construction works. The designated points should be located within Flood Zone 1.

3.3 Construction Phase: List of roles

a) Key personnel

3.3.1 **Table 3.1** summarises the key personnel that have significant roles during a flooding event. It should be reviewed and updated by the construction contractor before construction works begin, reviewed periodically and where necessary, updated throughout the construction phase.

Table 3.1: Key Personnel / Agencies and their role

Title	Role
EDF Project Team Manager	Ensure that the Flood Warning and Evacuation Plan has been put in place. Ensure sufficient resources (people, time and money) are provided to implement the FREP.
Construction Manager (prior to commencement of works)	This role is to ensure all the pre-occupation actions have been completed as well as ensure that the FREP is reviewed and updated, ideally every three months.
Construction Manager (during construction)	Once flood warnings / alerts have been received it is the Construction Manager's responsibility to disseminate flood alerts to all members of staff. When severe flood warnings have been issued it is the Construction Manger's responsibility to ensure that the construction work site and compounds are being closed due to potential flooding and plant / materials moved, where appropriate.

Title	Role
	It is also the Construction Manager's responsibility to operate emergency electrical shut off switches that terminate electricity supply to the construction works. The Construction Manager should direct the evacuation of the construction works sites and help other members of staff to move to designated evacuation points located in Flood Zone 1. The Construction Manager should take a register to ensure all staff are accounted for. The Construction Manager should then provide an update to any on-site emergency services confirming that the site has been evacuated.
Environment Agency Floodline	The Environment Agency issues flood warnings and alerts, where available, to the nominated project contact. These can signed up to by contacting 0845 988 1188.
Met Office	The Met Office issues alerts for weather warnings which can be signed up to via email, mobile phone application or via Twitter. Email notifications can be subscribed to via the following link: https://service.govdelivery.com/accounts/UKMETOFFICE/subscriber/new

b) Emergency Services

3.3.2 **Table 3.2** provides contact numbers for relevant Emergency Services. In an emergency where there is a real and immediate threat to life or property always dial 999.

Table 3.2: Key Contact Numbers

Organisation	Contact Number
Suffolk Fire and Rescue	01473 260 588 (Mon -Thurs 9am – 5pm, Fri 9am – 4pm) 01480 444 500 (out of office hours)
Suffolk Constabulary	101
Environment Agency	0845 988 1188

3.3.3 If medical attention is required within the workplace, appropriately trained, First Aiders should be in attendance and a record of the individual affected and the circumstances relating to the incident should be kept.

3.3.4 The closest hospital with an Accident and Emergency Department to the main development site is Ipswich Hospital. The hospital can be contacted on 01473 712233. The address is: Heath Road, Ipswich, Suffolk, IP4 5PD.

3.4 Construction Phase: Emergency Plan

a) Environment Agency Flood Warning Service

3.4.1 The Environment Agency provide a flood warning service and operate a flood forecasting and warning service for areas at risk of flooding from rivers or the sea. This is a free 24-hour service operating 365 days of the year and relies on direct or live observation of rainfall, river levels, tide lives, bespoke in-house predictive models, rainfall radar data and information from the UK Met Office.

3.4.2 The following flood alerts and flood warnings are available from the Environment Agency and are relevant to the proposed main development site:

- Flood Alert – Suffolk Coast from Lowestoft to Bawdsey; and
- Tidal Flood Warning – Minsmere Marshes on the Suffolk coast, including Eastbridge and Sizewell.

3.4.3 The proposed main development site is located within a flood warning area and, as a minimum, it is recommended that these warnings should be subscribed to and acted upon as appropriate, although the flood mechanism may vary across the different elements of the construction site.

3.4.4 As there is a flood risk to the proposed works it is acknowledged that the construction works for the main development site should be linked to the Environment Agency's flood warning service so that when the Environment Agency issues a flood alert or warning, the service would send an automated warning message to the construction contractor.

b) Met Office weather warnings

3.4.5 In addition to the Environment Agency flood warning service it is recommended that the construction contractor also subscribes to weather warnings from the Met Office. These provide an indication of when weather warnings, i.e. extreme rainfall is forecast and enables appropriate action to be taken.

c) Evacuation triggers

3.4.6 Environment Agency flood warnings and Met Office weather warning should be used to set evacuation triggers. Three trigger stages have been identified, namely, to implement a review of the FREP procedures, placed staff on green alert (state of readiness) or issue a red alert (site evacuation).

d) Flood management and evacuation procedures

3.4.7 During construction, it is anticipated that a greater level of emergency planning will be required as a larger number of staff will be on site in a variety of locations, compared with the operational and decommissioning phases. Emergency planning during construction is therefore likely to be more complex due to the transient nature of the construction work and a greater number of construction sites in operation at any one time.

3.4.8 In some locations on the main development platform, such as construction of the nuclear island and cooling water infrastructure, 24-hour working will be required. Shift working will be in place for these locations to cover the full 24-hour period, with the highest numbers of staff on site during times of changeover and peak-material deliveries.

3.4.9 As a result, ensuring that management measures and evacuation procedures are clearly available and communicated is of vital importance to the safety of the site users.

3.4.10 To facilitate the implementation of the FREP it will be necessary to situate signs, lights and / or real-time information boards around the site to alert construction workers to a flood emergency and to direct them towards the appropriate evacuation route.

3.4.11 The proposed flood evacuation procedures are outlined in **Table 3.3** and will need to be adapted to each construction working area, as appropriate, depending on the type and scale of the construction works.

Table 3.3: Flood Evacuation Procedures

Warning Trigger	Trigger Stage	Procedures
Environment Agency Flood Alert or Met Office Yellow Rain Warning	Review FREP	Review FREP and emergency access and egress plans. Review current construction works and whether these are in proximity to a watercourse or the coastal frontage (depending on the type of flood alert received).
Environment Agency Flood Warning or Met Office Amber Rain Warning	Green Alert	Green Alert represents a state of readiness ahead of a potential flood situation. Check that all equipment can be accessed, is available and in good condition for use, with specific reference to –road closure signs, torches (check battery life / spares), high visibility jackets for all staff. Secure construction compounds and relocate vulnerable plant / machinery / stores located in Flood Zone 3 to Flood Zone 1 if possible and cease work in Flood Zone 3.

Warning Trigger	Trigger Stage	Procedures
		Allow for handover should shift change occur before the warning is lowered. Check staff registers are complete and available to ensure all staff are accounted for post-evacuation.
Environment Agency Severe Flood Warning or Met Office Red Weather Warning	Red Alert	Immediately commence evacuation of construction work sites and compounds. Use allocated evacuation route to facilitate / direct the safe evacuation of all personnel. A register should be taken to ensure all staff are safe. Contact the Emergency Services and Environment Agency to confirm that the Construction Compounds are being closed due to possible risk of flooding. The Construction Manager shall operate the emergency electrical shut off switches terminating the electricity supply and all power supplies to construction works sites / compounds, where necessary.

e) Evacuation routes and designated evacuation points

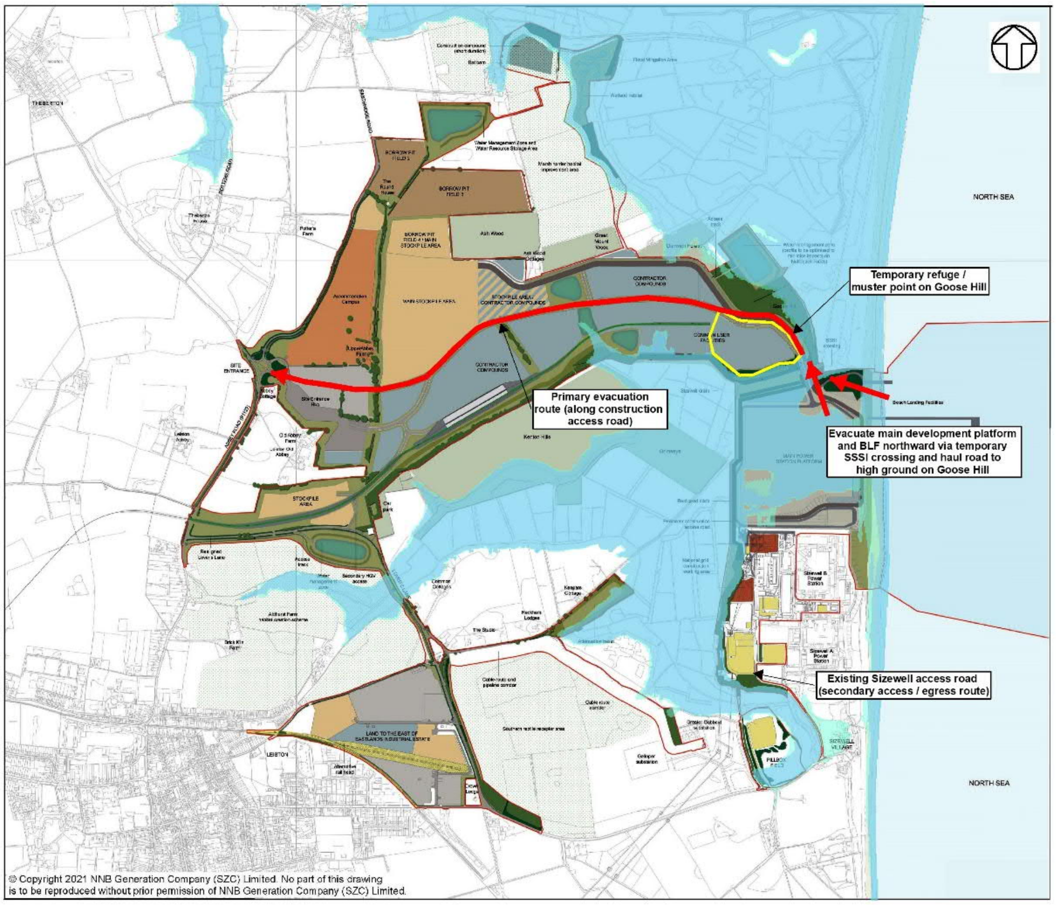
3.4.12 It is recommended that evacuation from the main development site area and the SSSI crossing works area would be via the route of the access road and through the temporary construction area via Goose Hill, to levels that are topographically higher and within Flood Zone 1, as shown on **Plate 3.2**.

3.4.13 Evacuation will be inland, away from the coastline towards designated evacuation points at the temporary construction area, located in Flood Zone 1. Access and egress will be along the proposed carriageway for the access road and a temporary refuge / muster point set up on Goose Hill, where required.

3.4.14 In the case of the beach landing facility, once a warning related to a potential coastal flooding event is received then this part of the site will be closed down, any staff on the landward element will evacuate through the rest of the site, any unloading and loading activities will be ceased and vessels will be advised that they are unable to dock at the beach landing facility.

3.4.15 These details will be confirmed with the construction contractor for the proposed main development area prior to commencement of construction.

Plate 3.2: Proposed evacuation route(s) during the construction phase for the Main Development Site



4 OPERATIONAL PHASE FREP

4.1 Operational Phase: Risk Summary

a) Operational development

4.1.1 As noted previously, a number of the temporary elements related to the main development site will be removed following completion of the construction phase. Additionally, a number of elements will remain *in situ* (i.e. Fen Meadow Habitat Compensation Areas) but these will not require users to work or access them on a regular basis.

4.1.2 Therefore, the only elements remaining in the operational phase, which users of the site will be required to regularly access comprise the main development platform, SSSI crossing and the beach landing facility.

4.1.3 The key buildings and infrastructure critical to the operation of the Sizewell C power station are situated on the main platform development and include the following:

- Nuclear islands (reactor buildings) with associated infrastructure;
- Conventional islands (including turbine hall basements and other electrical infrastructure);
- Cooling water pumphouse basements;
- Fuel and waste storage facilities;
- Emergency Diesel Generators; and
- Control buildings

4.1.4 The buildings listed above are sensitive and safety-critical in the event of a flood. Emergency access and evacuation is therefore essential from these buildings.

4.1.5 The SSSI crossing is also key infrastructure to the safety of staff. This crossing will be used as the main access and egress to the site from the north, via a new access road linking the site to the B1122.

4.1.6 In addition, users of the permanent beach landing facility remain at risk from flooding during the operational phase of the Project, due to its location in front of the coastal defences.

b) Risk of flooding

4.1.7 As previously noted, a Flood Risk Assessment (FRA) was prepared for the main development site and submitted as part of the DCO Application.

4.1.8 The **MDS Flood Risk Assessment** (Doc Ref. 5.2) [APP-093] identified the risks to the proposed development over its lifetime, including the operational phase. Supplementary information on flood risk to the proposed development has also been provided within the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad), which incorporates a number of design changes since the Application.

4.1.9 **Appendix E** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad) notes that following the Application submission, there was a revision to the sea defence design. As a result, the permanent HCDF (sea defence) was raised above the levels proposed within the Application.

4.1.10 Following this amendment, overtopping calculations for the updated defence crest were carried out for the 1 in 200-year, 1,000-year and 10,000-year return period events with reasonably foreseeable climate change allowances (i.e. RCP 8.5).

4.1.11 These overtopping calculations found that there is no overtopping during the 1 in 200-year and 1 in 1,000-year event up to 2140 (i.e. during operation), and although there is overtopping in the 2190 scenario, this is below 2l/s/m.

4.1.12 In addition, there is no fluvial flood risk to the main development platform and SSSI crossing during the operational phase and no flood risk as a result of wider coastal inundation throughout the whole of the operational phase.

4.1.13 There would, however, be a coastal flood risk to the beach landing facility throughout the operational phase.

c) Hazard mapping

4.1.14 To understand the impact of overtopping on flood depth, velocity and hazard on the main platform, inundation modelling was carried out for key scenarios where the results of coastal overtopping modelling indicated overtopping rates greater than 1l/s/m. These scenarios comprise the 1 in 200-year, 1,000-year and 10,000-year return period events with reasonably foreseeable climate change allowances (i.e. RCP 8.5) for both the 2140 and 2190 epoch.

4.1.15 There is no flooding of the platform forecast as a result of overtopping of the defences, as demonstrated within the inundation modelling, in 2140 for both the 1 in 200-year and 1 in 1,000-year events.

4.1.16 Scenarios with overtopping rates of 0.1 l/s/m were not considered in the inundation modelling as such overtopping rates are well below the tolerable overtopping rates, as set out in the EurOtop manual, and would therefore not result in significant flood risk on the platform.

4.1.17 As noted in **Appendix E** of the **MDS FRA Addendum** (Doc Ref. 5.2(A)Ad) a number of future climate change scenarios were reviewed. The inundation modelling using RCP 8.5 results in no overtopping to the main development platform, and only in the more extreme credible maximum climate change allowance (BECC Upper) is there flooding to the main development platform.

4.1.18 The beyond basis of design scenario has also been tested for the credible maximum climate change scenario. In this scenario, the results for the 1 in 200-year extreme event in the 2140 epoch (with BECC Upper climate change allowance) show that flood depth on the main development platform is up to 0.15m immediately behind the defence, lowering to approximately 0.05m at the rear of the main development platform (most landward end) with flood velocity below 1m/s and a low hazard rating, as illustrated in **Plate 4.1**.

4.1.19 The hazard mapping differentiates between four levels of flood hazard, which have been calculated using a combination of flow depths and velocities:

- Low Hazard: Hazard factor of less than 0.75;
- Danger for Some: Hazard factor between 0.75 and 1.25;
- Danger for Most: Hazard factor between 1.25 and 2.0;
- Danger for All: Hazard factor of greater than 2.0.

Plate 4.1: Platform inundation modelling for the 1 in 200-year 2140 BECC Upper (credible maximum) scenario

d) Embedded design measures

4.1.20 To manage the impact of flood risk on the proposed development during the operational phase, measures to protect the site from flood risk, where possible, have been identified.

4.1.21 The HCDF has been designed to provide protection to the site thorough the development lifetime, with the crest set at an initial level of 12.6m AOD and an adaptive crest height of 16.4m AOD.

4.1.22 Furthermore, buildings on the main platform would be built with a 200mm threshold above the main platform to reduce risk of flooding. They will also be constructed with a flood resistant design to prevent water ingress during either extreme rainfall events (resulting in surface water flooding) or minor wave overtopping during extreme coastal events.

4.1.23 These measures provide protection from the potential overtopping and inundation that would occur beyond the lifetime of the proposed development and therefore reduces the risk of flooding affecting the users of the site.

4.2 Operational Phase: List of roles

a) Key personnel

4.2.1 **Table 3.1** summaries the key personnel that have significant roles during a flooding event. It should be reviewed and updated by EDF Energy at regular intervals throughout the operational lifetime of the Sizewell C power station and where necessary, updated throughout the operational phase.

4.2.2 It is anticipated that whilst the following includes a summary of key roles and actions, these will be set out in greater detail within the Sizewell C Non-nuclear Emergency Handbook, which covers multiple hazard types and events and is not just limited to flood risk.

Table 4.1: Key Personnel / Agencies and their role

Title	Role
EDF Project Team Manager	Ensure that the Flood Warning and Evacuation Plan has been put in place. Ensure sufficient resources (people, time and money) are provided to implement the FREP.
Shift Manager / Emergency Controller (during operation)	Once flood warnings / alerts have been received it is the Shift Manager / Emergency Controller's responsibility to disseminate flood alerts to all members of staff. When severe flood warnings have been issued it is the Shift Manager / Emergency Controller's responsibility to ensure that the construction work site

Title	Role
	and compounds are being closed due to potential flooding and plant / materials moved, where appropriate. It is also the Shift Manager / Emergency Controller's responsibility to operate emergency electrical shut off switches that terminate electricity supply to the construction works. The Shift Manager / Emergency Controller should direct the evacuation of the main development platform and help other members of staff to move to the designated evacuation points away from the main development platform, located in Flood Zone 1. The Shift Manager / Emergency Controller should take a register to ensure all staff are accounted for. The Shift Manager / Emergency Controller should then provide an update to any on-site (or remote) emergency services confirming that the site has either been fully evacuated or that only the minimal specialist staff required for the continued operation of the power station remain.
Environment Agency Floodline	The Environment Agency issues flood warnings and alerts, where available, to the nominated project contact. These can signed up to by contacting 0845 988 1188.
Met Office	The Met Office issues alerts for weather warnings which can be signed up to via email, mobile phone application or via Twitter. Email notifications can be subscribed to via the following link: https://service.govdelivery.com/accounts/UKMETOFFICE/subscriber/new

b) Emergency Services

4.2.3 **Table 3.2** provides contact numbers for relevant Emergency Services. In an emergency where there is a real and immediate threat to life or property always dial 999.

Table 4.2: Key Contact Numbers

Organisation	Contact Number
Suffolk Fire and Rescue	01473 260 588 (Mon -Thurs 9am – 5pm, Fri 9am – 4pm) 01480 444 500 (out of office hours)
Suffolk Constabulary	101
Environment Agency	0845 988 1188

4.2.4 If medical attention is required within the workplace, appropriately trained, First Aiders should be in attendance and a record of the individual affected and the circumstances relating to the incident should be kept.

4.2.5 The closest hospital with an Accident and Emergency Department to the main development site is Ipswich Hospital. The hospital can be contacted on 01473 712233. The address is: Heath Road, Ipswich, Suffolk, IP4 5PD.

4.3 Operational Phase: Emergency Plan

a) Environment Agency Flood Warning Service

4.3.1 The Environment Agency provide a flood warning service and operate a flood forecasting and warning service for areas at risk of flooding from rivers or the sea. This is a free 24-hour service operating 365 days of the year and relies on direct or live observation of rainfall, river levels, tide lives, bespoke in-house predictive models, rainfall radar data and information from the UK Met Office.

4.3.2 The following flood alerts and flood warnings are available from the Environment Agency and are relevant to the proposed main development site.

- Flood Alert – Suffolk Coast from Lowestoft to Bawdsey; and
- Tidal Flood Warning – Minsmere Marshes on the Suffolk coast, including Eastbridge and Sizewell.

4.3.3 The proposed main development site is located within a flood warning area and, as a minimum, it is recommended that these warnings should be subscribed to and acted upon as appropriate.

4.3.4 The main development site should be linked to the Environment Agency's flood warning service so that when the Environment Agency issues a flood alert or warning, the service would send an automated warning message to the Shift Manager.

b) Met Office weather warnings

4.3.5 In addition to the Environment Agency flood warning service it is recommended that the operator subscribes to weather warnings from the Met Office, alongside the warnings from the Environment Agency. These provide an indication of when weather warnings, i.e. extreme rainfall is forecast and enables appropriate action to be taken.

c) Evacuation triggers

4.3.6 Environment Agency flood warnings and Met Office weather warning should be used to set evacuation triggers. Three trigger stages have been identified, namely, to implement a review of the FREP procedures, placed staff on green alert (state of readiness) or issue a red alert (site evacuation), as stated in **Table 3.3**.

d) Flood management and evacuation procedures

4.3.7 During operation, it is acknowledged that emergency planning will need to be in place to protect the staff working on the main development platform and that the number of staff will vary depending on the operational status of the power station.

4.3.8 Staff numbers on site will be highest during the main operational phase, reducing as the power station reaches the end of its operational lifetime.

4.3.9 In some locations on the main development platform, such as the staff monitoring and maintaining the nuclear island and cooling water infrastructure, 24-hour working will be required. Shift working will be in place for these locations to cover the full 24-hour period, with the highest numbers of staff on site during times of changeover, planned outages and during peak-material deliveries to the beach landing facility.

4.3.10 As a result, ensuring that management measures and evacuation procedures are clearly available and communicated is of vital importance to the safety of the site users.

4.3.11 To facilitate the implementation of the FREP it will be necessary to situate signs, lights and / or real-time information boards around the site to alert staff to a flood emergency and to direct them towards the appropriate evacuation route.

4.3.12 The proposed flood evacuation procedures are outlined in **Table 3.3** and will need to be adapted, as appropriate to suit the nature of the ongoing operational works.

Table 4.3: Flood Evacuation Procedures

Warning Trigger	Trigger Stage	Procedures
Environment Agency Flood Alert or Met Office Yellow Rain Warning	Review FREP	Review FREP and emergency access and egress plans
Environment Agency Flood Warning or Met Office Amber Rain Warning	Green Alert	Green Alert represents a state of readiness ahead of a potential flood situation. Check that all equipment can be accessed, is available and in good condition for use, with specific reference to –road

Warning Trigger	Trigger Stage	Procedures
		closure signs, torches (check battery life / spares), high visibility jackets for all staff. Secure storage compounds and relocate vulnerable plant / machinery / stores located in Flood Zone 3 to Flood Zone 1 if possible. Allow for handover should shift change occur before the warning is lowered. Check staff registers are complete and available to ensure all staff are accounted for post-evacuation.
Environment Agency Severe Flood Warning or Met Office Red Weather Warning	Red Alert	Immediately commence evacuation of the main development platform. Use allocated evacuation route to facilitate / direct the safe evacuation of all personnel. A register should be taken to ensure all staff are safe. Contact the Emergency Services and Environment Agency to confirm that the main development platform has been evacuated and that the minimal staff needed to maintain the operation of the power station are in place.

e) Evacuation routes and designated evacuation points

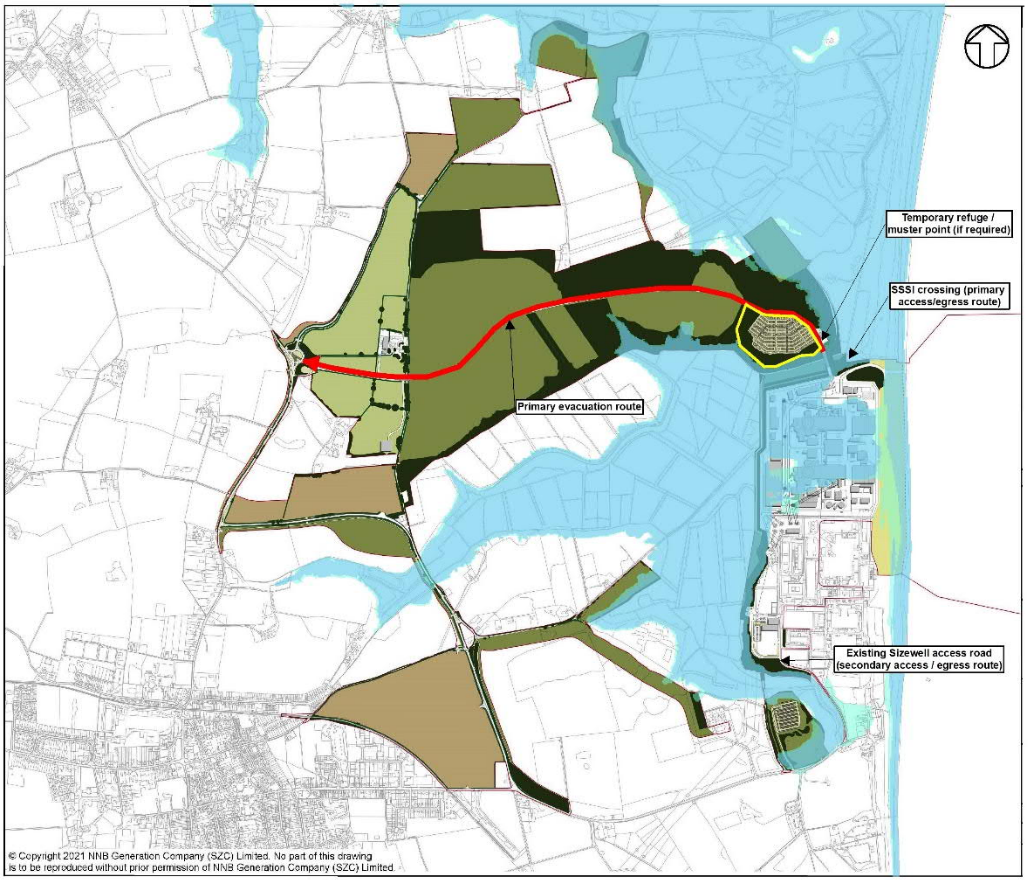
4.3.13 It is recommended that evacuation from the main development site, SSSI crossing and beach landing facility would be via the SSSI crossing and permanent access road towards Goose Hill, to levels that are topographically higher and within Flood Zone 1, as shown on **Plate 4.2**.

4.3.14 Evacuation will be inland, away from the coastline with non-essential staff returning to their homes and any remaining staff moving towards designated evacuation points either in Leiston or another suitable location, to be identified. Access and egress will be along the carriageway for the permanent access road and a temporary refuge / muster point set up on Goose Hill, where required.

4.3.15 In the case of the beach landing facility, once a warning related to a potential coastal flooding event is received then this part of the site will be closed down, any staff on the landward element will evacuate through the rest of the site, any unloading and loading activities will be ceased and vessels will be advised that they are unable to dock at the beach landing facility.

4.3.16 All of the above details will be confirmed and summarised in the Sizewell C Non-Nuclear Emergency Handbook prior to commencement of operation.

Plate 4.2: Proposed evacuation route(s) during the operational phase for the Main Development Site



REFERENCES

1. Ministry of Housing, Communities and Local Government. National Planning Policy Framework. London: The Stationery Office, February 2019.

2. Ministry of Housing Communities and Local Government. National Planning Practice Guidance – Flood Risk and Coastal Change. London: The Stationery Office, September 2018.

3. Association of Directors of Environment, Economy, Planning & Transport and Environment Agency. Flood risk emergency plans for new development. 2019.

APPENDIX A: SUFFOLK RESILIENCE FORUM RESPONSE TO THE DRAFT TEMPLATE MAIN DEVELOPMENT SITE FLOOD RISK EMERGENCY PLAN (28 OCTOBER 2020)

OFFICIAL

Suffolk County Council – Sizewell C Programme Director
East Suffolk Council – Energy Projects Manager

28th October 20

SIZEWELL C – FLOOD RISK EMERGENCY PLAN (FREP)

Reference:

A. Sizewell C Main Development Site (MDS) Flood Risk Emergency Plan v1.1 dated 16 Jul 20.

This document represents the Suffolk Resilience Forum's (SRF's) response to information contained in the EDF Energy Sizewell C Flood Risk Emergency Plan (FREP) (Reference A).

The FREP has very similar requirements to the Exception Test under the National Planning Policy Framework (NPPF); namely that there is a requirement to demonstrate that a site will be safe and that people will not be exposed to hazardous flooding from any source. The SRF met virtually on Wed 28 Oct 20 to consider the FREP using the Exception Test process developed by the SRF for determining planning applications in areas at risk of flooding. This process allows any agency (Environment Agency (EA), emergency services, local authority emergency planners) to highlight issues or concerns within the competence of the organisation over the development of the site, although they will not state the development is safe or that the flood mitigation measures, including the Flood Evacuation Plan are adequate.

In considering the FREP it is the opinion of the SRF that:

- The FREP provides a framework to consider the flood risks and impacts associated with the new nuclear power station at Sizewell and its associated developments, during the constructed, operation and decommissioning phases of the lifecycle.
- The lack of data and analysis in the FREP means that the flood risk is unknown, it has not been adequately assessed and consequently, the impacts and proposed suitability of mitigations measures and their implementation cannot be judged at this time.

The SRF recognise the complex nature of the Sizewell C project but are concerned that the submission is incomplete. We are unsure of the value of all elements within the proposed FREP; particularly given that the flood risk mitigation during operation will be considered as part of REPPIR 19 and the decommissioning phase is so far in the future that predicting the flood risk, even allowing for climate change, is unrealistic.

Regards,

[redacted]

SRF Partnership Manager

OFFICIAL