The Sizewell C Project

5.5 Two Village Bypass Flood Risk Assessment Addendum Appendices A-D

Revision: 1.0

Applicable Regulation: Regulation 5(2)(e)

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APPENDIX A: EXTRACT OF THE ENVIRONMENT AGENCY RELEVANT REPRESENTATION RELATED TO FLOOD RISK

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A.1. Introduction

A.1.1. The following responses are those relevant to the two village bypass and its associated flood risk and have been taken directly from the Environment Agency's Relevant Representation on Sizewell C Development Consent Order, document AE/2020/125515/01(September 2020).

A.2. Relevant Responses

A.2.1. The following is the response provided by the Environment Agency within the main body of the Relevant Representation document:

> *"The FRA has assessed fluvial flood risk and demonstrated some localised areas of increased depths as a result of the proposals. Confirmation of written consent from the landowner must be included in the Flood Risk Assessment (FRA) that they accept the increased flood depth, hazard and velocity on their land in order for this to be acceptable without further mitigation as required by EN-6 3.6.16."*

A.2.2. **Table A. 1** identifies the additional matters raised by the Environment Agency.

Table A. 1: Additional matters raised by the Environment Agency in the Relevant Representation

Document Title	Paragraph number	Issue	Comment	Environment Agency suggested solution
Two Village Bypass Flood Risk Assessment	4.3.3, 7.2.5, 7.2.6, 7.2.8, 7.2.9	FRA has assessed fluvial flood risk and demonstrated some localised areas of increased depths as a result of the proposals. Landowner agreements will need to be sought to confirm that the potential impacts on landowners are accepted.	4.3.3 Report is updated to consider flood zone 3b and this is now mapped. The FRA has determined that flood depths (and extents) will be increased in places as a result of the proposals. 7.2.5 identifies increased peak water levels in design event of 30-32mm and concludes no floodplain compensation or further mitigation (beyond the 'embedded mitigation') is proposed. Paragraph 7.2.6 states that increases in depth are higher upstream of the proposed crossing. Paragraph 7.2.8 states depths increase with scheme by 220mm-320mm near the flood relief culvert on R.B. On L.B., depths increase by up to 140mm. 7.2.9 clarifies R.B depths up to 350mm extend 80m u/s of bridge; and L.B depths up to 250mm extend up to 25m u/s.	Discussions are ongoing with the landowner to mitigate for an increased flood risk on the flood plain. Written consent from the landowner must be included in the final FRA for the increased flood depth, hazard & velocity on their land in order for this to be acceptable without further mitigation, as required by EN-6 3.6.16.

APPENDIX B: COLLATED COMMENTS FROM THE ENVIRONMENT AGENCY RECEIVED ON 5TH FEBRUARY 2020 AND 4TH AUGUST 2020

No.	Document Title	Paragraph number	Issue	Comment	Suggested solution	Priority	Date Raised	SZC Co.'s Response
	Two Village Bypass Flood Risk Assessment	4.3.3, 7.2.5, 7.2.6, 7.2.8, 7.2.9	FRA has assessed fluvial flood risk and demonstrated some localised areas of increased depths as a result of the proposals. Landowner agreements will need to be sought to confirm that the potential impacts of landowners are accepted.	4.3.3 Report is updated to consider flood zone 3b and this is now mapped. The FRA has determined that flood depths (and extents) will be increased in places as a result of the proposals. In order to satisfy the requirements of the exception test, it must be demonstrated that is designed and constructed to: •remain operational and safe for users in times of flood; •result in no net loss of floodplain storage; •not impede water flows and not increase flood risk elsewhere. 7.2.5 identifies increased peak water levels in design event of 30-32mm and concludes no floodplain compensation of further mitigation (beyond the 'embedded mitigation') is proposed. 7.2.6 states that increases in depth are higher upstream of the proposed crossing. 7.2.8 states depths increase with scheme by 220mm-320mm near the flood relief culvert on R.B. On L.B., depths increase by up to140mm. 7.2.9 clarifies R.B depths up to 350mm extend 80m u/s of bridge; and L.B depths up to 250mm extend up to 25m u/s.	Discussions are ongoing with the landowner to mitigate for an increased flood risk on the flood plain. Written consent from the landowner must be included in the final FRA for the increased flood depth, hazard & velocity on their land in order for this to be acceptable without further mitigation as required by EN-6 3.6.16.	1	01/07/2020	SZC Co. is currently in talks with and will continue to engage with the landowner for the affected area, with the view to reaching an agreement for the increased flood depth, hazard and velocity.
8.3	Two Village Bypass Flood Risk Assessment	7.2.10	FRA states there is negligible impact at the Environment Agency gauge at Farnham downstream of the A12.	7.2.10 indicates that peak water levels will be between 2mm higher and 8mm lower at nearest node point.	We agree the impact at the Farnham gauge is small and should not impact our flow measurement based on the information provided. 7.2.10 indicates that peak water levels will be between 2mm higher and 8mm lower at nearest node point. The FRA concludes that this will be a "Negligible impact" on the gauging station.	2	05/02/2020	Further sensitivity tests have been carried out at the proposed crossing and impact at the Farnham gauging station has been assessed. Results are summarised in the FRA Addendum and accompanying Modelling Report Addendum.
8.4	Two Village Bypass Flood Risk Assessment	7.1.4	No information is provided on the construction phase & methodology.	It is important that we understand how the bridge crossing and embankment is likely to be constructed and how this will impact on flood risk. It must also assess if it is likely to impact the gauge at Farnham.	Provide details on construction phasing and methodology.	2	05/02/2020	The flood risk during construction phase and the management of safety of site staff and visitors have been described in the Flood Risk Emergency Plan. The detailed methodology for the construction phase is not currently available and will be provided post DCO as part of the Flood Risk Activity Permit (FRAP), prior to commencing construction.
8.5	Two Village Bypass Flood Risk Assessment	7.1.5	The FRA states that sensitivity testing was undertaken by increasing the number of culverts under the embankment but this sensitivity testing does not appear to have been provided.	Additional runs were undertaken with up to 20 culverts to see if the afflux could be reduced. Assessment should not be solely based on afflux. There are significant increases in floodplain depth and there is a decrease in extent and flood depth upstream and downstream. This reduction in inundation could impact the priority habitat so every effort should be made to improve upon the design and minimise the impact on flood risk and the environment. Did the additional culverts prevent a reduction in inundation or reduce floodplain depths where there are significant increases?	Provide evidence from culvert sensitivity runs in the FRA and/or modelling report that this did not improve the impact on flood risk and the environment so the decision making is transparent.	2	05/02/2020	Sensitivity test has been carried out within the modelling. The results have been presented in the FRA Addendum and accompanying Modelling Report Addendum .
8.8	Two Village Bypass Flood Risk Assessment	7.1.8	The FRA states that the proposed road will not be at risk of surface water flooding, however, this does not appear to be based upon the sound evidence base of a detailed surface water drainage strategy.		Provide drainage designs and agree in consultation with Suffolk County Council.	2	05/02/2020	The drainage strategy has been developed in consultation with Suffolk County Council. Further details are provided in the Outline Drainage Strategy and a summary of ongoing works has been provided in the FRA Addendum.
9.4	Two Village Bypass Flood Risk Assessment	Table 7.2	Detail on surface water drainage provided in Table 7.1 is high level and does not include information discussed in previous meetings.	This detail has not been included in the FRA. 7.4.5 states the intention is to discharge to river at greenfield runoff rate with pollution control infrastructure if required, to be determined at detailed design stage.	Provide further information on surface water drainage in consultation with Suffolk County Council and the Environment Agency.	2	05/02/2020	Further details are provided in the Outline Drainage Strategy and a summary has been provided in the FRA Addendum.
9.5	Two Village Bypass Flood Risk Assessment	8.1.5 and 8.1.6	FRA states that warnings from the Met Office should be subscribed to during construction.	8.1.5 mentioned Flood Emergency Plan and 8.1.6 references EA flood warning service. Please be aware that Fluvial flood warnings from the Environment Agency's Flood Warning Service are not available for the 2VB site. It is possible that fluvial flooding could occur without warning so it must be clear to site users during construction and road users what they should do in a flood. This should be set out in a Flood Warning and Evacuation Plan.	Update the FRA with flood warning and evacuation procedures for the permanent road and during construction.	2	05/02/2020	The proposed road will be significantly above extreme flood risk levels and therefore flood evacuation procedures are not required post construction. Flood warning and evacuation procedures during the construction phase are included within the Flood Risk Emergency Plan.
9.7	Two Village Bypass Flood Risk Assessment	8	Residual risk of blockage is not considered.	A common residual risk posed by bridge crossings and culverts is the possibility of it becoming blocked by debris. This has not be discussed within the FRA. It is appreciated that the bridge and culverts are large but the likelihood of this happening must be considered in the FRA.	Discuss likelihood of blockage of the bridge and culverts as a residual risk in the FRA.8.1.8 mentions blockages of culvert, but it doesn't appear as though any modelling been carried out to show what the impacts of a blockage may be.	2	05/02/2020	A blockage assessment had been carried out, post DCO submission, within the modelling. The results have been presented in the FRA Addendum and accompanying Modelling Report Addendum.
10.1	Two Village Bypass Fluvial Modelling Report	Plate 3.5	A cross section of the embankment and culverts has not been provided.	A cross section of the bridge element of the crossing has been provided in Plate 3.5 but this does not extend to include the embankments and culverts either side.	Provide cross section including elevations for the whole 2VB crossing, bridge and embankments and culverts.	2	05/02/2020	The design for the bridge over the River Alde and the carriageway has been submitted within the DCO submission documentation.
10.2	Two Village Bypass Fluvial Modelling Report	3.2.7	Mammal passage is provided in two culverts in the 2VB, one to the east, which is outside the flood zone and one to the west which is within the same culvert as an existing drain.	It is understood the culvert to the west is not included in the model but flood extents on the upstream side of the embankment do extend to its location so it could be flooded.	3.2.7 states culvert to be located outside of flood extent. Although, no evidence of this proposal is provided. Provide plans as evidence that the mammal passage to the west adjacent to an ordinary watercourse will remain dry.	2	05/02/2020	Sensitivity test has been carried out within the modelling. The results have been presented in the FRA Addendum and accompanying Modelling Report Addendum.
10.4	Two Village Bypass Fluvial Modelling Report	6.2.10 and 7.1.4 of the FRA	Inconsistencies in mAOD of carriageway between model report and FRA. This must be corrected.	EDF comments provided have indicated that at the crossing, the carriageway will be set at 7.0mAOD. 7.1.4 of the FRA states lowest level of carriageway at 9.7mAOD. 6.2.10 of the modelling report states that the carriageway will be set at approximately 7.0mAOD. This is inconsistent, although both of these are well above the maximum modelled water levels in the 0.1% event levels with 65%cc of 5.64mAOD at the node ALDE_06245u (just upstream of the proposed carriageway).	Confirm road and bridge height and update report to ensure consistencies.	2	05/02/2020	It has been confirmed that the design for the bridge over the River Alde, submitted within the DCO submission documentation, will set the carriageway at an increasing level from 12.2m AOD to 12.6m AOD. This is considerably higher than the modelled extreme flood levels including the 1 in 1,000 year with 65% allowance for climate change.
10.6	Two Village Bypass Fluvial Modelling Report	Section 6.3 and Table 6.3	Table 6.3 shows some changes in flood level which are not fully explained.	Levels at node 06245u show decreases in flood level of up to 11cm. This is most notable in smaller more frequent events.6.3.8 of the modelling report states that the two village bypass is shown to have "very localised impact on flood levels". Depth mapping for range of return periods in Appendix C indicates that the west bank shows increased depths upstream of the proposed bridge, and decreased depths downstream.	Does this indicate that the new bridge may act as a constraint, restriction or obstruction to floodplain flows? This should be explained in the FRA	2	05/02/2020	Further discussion of the results has been included in the FRA Addendum and accompanying Modelling Report Addendum.
10.9	Two Village Bypass Fluvial Modelling Report	Appendix C Figures C.10 & C.11	Figures show changes is flood depth including those below 3cm and decreases. Changes are not discussed in the FRA or model report.	The figures show that there are large areas of decreases in flood depth both upstream and downstream of the crossing which is not discussed or explained. There are also areas of increased depth adjacent to the channel further upstream below 3cm which are not mentioned in the reporting.	Please provide a full discussion on the changes in flood risk, increases and decreases, to fully illustrate the changes as result of the crossing. Please discuss the changes in flooding mechanism and why depths decrease upstream and downstream of the crossing.	2	05/02/2020	Further discussion of the results has been included in the FRA Addendum and accompanying Modelling Report Addendum.

No.	Document Title	Paragraph number	Issue	Comment	Suggested solution	Priority	Date Raised	SZC Co.'s Response
1.3	**Sizewell Link Road & Two Village Bypass Flood Risk Assessment**	**General Comment**	The 2VB and SLR sites fall within the East Suffolk Internal Drainage Board (IDB) area.		Ensure East Suffolk IDB are consulted.	**2**	**05/02/2020**	Consultation is ongoing and is being progressed by SZC Co. with the relevant landowners and stakeholders.
2.6	**SZC - 2VB Modelling Report_v1.0**	**4.2.2**	Tidal Boundary	The lowest level in the applied tidal boundaries is not -0.075 mAOD as reported. Please check	Please check tidal boundary conditions and update report accordingly	**3**	**05/02/2020**	N/A
2.7	**SZC - 2VB Modelling Report_v1.0**	**4.3.6**	Tidal boundary CC uplifts don't compare to those reported in section 4.3.6	Please review the tidal boundary conditions in the IED files for the CC scenarios as the uplifts don't appear to compare to those reported in section 4.3.6	Review CC scenarios and update the model/report accordingly	**2**	**05/02/2020**	Further checks have been carried out and were found to be appropriate. The uplifts were revised and then tested in the model. This was incorporated in the subsequent sensitivity testing. The results of the sensitivity testing have been presented in the FRA Addendum and accompanying Modelling Report Addendum .
2.8	**2VB Hydraulic Model**	**n/a**	Stability patch roughness value very high	2D roughness values generally appear sensible, with the exception of a stability patch of 0.85 applied along all banks throughout model. This value is very high and requires further justification as to its use. .tmf states that it is for grassed banks, but the "patch value" is much higher than the standard value for grass (is closer to a value used for solid buildings).	Provide justification or amend Mannings's n values for stability patch	**2**	**05/02/2020**	Sensitivity test has been carried out within the modelling. The results of this have been presented in the FRA Addendum and accompanying Modelling Report Addendum.
3	**2VB Hydraulic Model**	**n/a**	Sensitivity testing	No indication of sensitivity testing other than on pier width and referring to sensitivity testing undertaken in the 2012 study. It is recommended that sensitivity testing is undertaken on the parameters selected by the modeller to provide evidence on the effect of these assumptions on the potential conclusions.	Undertake sensitivity tests on manning's roughness values and DS boundary conditions	**2**	**05/02/2020**	Sensitivity test has been carried out within the modelling. The results have been presented in the FRA Addendum and accompanying Modelling Report Addendum.
3.4	**2VB Hydraulic Model**	**n/a**	Z shape used to represent drains	The Z-shape 2d_zsh_fill_drains_004.mif, has been used to fill all drains in the 2012 model. This method has not been carried across to the extended 2D model domain.	Please provide justification as to why the z shape to fill drains (2d_zsh_fill_drains_004) has not been extended to cover the extended 2d domain (2d_bc_hxe_ALDE_005_2VB_001_R)	**3**	**05/02/2020**	Sensitivity test has been carried out within the modelling. The results have been presented in the FRA Addendum and accompanying Modelling Report Addendum.

Priority	Description
1	*Showstopper or potential showstopper* A significant technical issue / deficiency. If this issue is not resolved we would object to the DCO application.
2	*Significantly below the level we would expect of an application or notable technical issues* Incomplete / inaccurate or inadequately substantiated information. We would be likely to request further information prior to the determination of the DCO application or - where appropriate - recommend Requirements be attached to the order to ensure sufficient details are submitted and agreed prior to the commencement of development.
3	*Other* • Information is correct but low quality; or • Minor inaccuracies and lack of clarity Further information / work to resolve these issues will aid our understanding and help us to better inform the DCO determination process.

APPENDIX C: TWO VILLAGE BYPASS MODELLING REPORT ADDENDUM

CONTENTS

TABLES

PLATES

FIGURES

1 INTRODUCTION

1.1.1 The Sizewell C Project ('the Project') Development Consent Order application ('the Application') was submitted by the applicant ('SZC Co.') on 27 May 2020 and accepted for examination by the Planning Inspectorate on 24 June 2020.

1.1.2 A new highway, referred to as the two village bypass, has been proposed as part of the Project. The new highway would cross the River Alde, hence a Flood Risk Assessment (FRA) was required to support the Application.

1.1.3 The **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119] described the flood risk from all sources, to the proposed two village bypass and the predicted impact of the proposed development on flood risk elsewhere.

1.1.4 To inform the **Two Village Bypass Flood Risk Assessment**, hydraulic modelling was undertaken to assess flood risk for a range of return period events and climate change scenarios. Details of the modelling and results are provided in **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] of the **Two Village Bypass Flood Risk Assessment** within the Application.

1.1.5 This report discusses further modelling work carried out following the submission of the Application and will form **Appendix C** of the **Two Village Bypass Flood Risk Assessment (FRA) Addendum** (Doc Ref. 5.5).

1.1.6 The **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] concluded that overall change in flood levels as a result of the two village bypass development was very localised, with no residential or commercial properties located within the floodplain in the vicinity of the crossing, therefore considering the impact of the development on flood risk as minimal.

1.1.7 Following preliminary modelling report submission, the Environment Agency provided comments in relation to the hydraulic modelling, including some queries on general model schematisation and overall model performance.

1.1.8 Further comments were received following review of the model and reports issued as a part of the Application. These were collated in **Appendix B** of the **Two Village Bypass FRA Addendum** (Doc Ref. 5.5).

1.1.9 The aim of this report is to present and summarise the outcomes of sensitivity testing undertaken in response to the Environment Agency's comments and assess whether they have any impact on conclusions drawn in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref .5.5)

[APP-120] and in the **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119] submitted as part of the Application.

2 METHODOLOGY

2.1.1 To address comments raised by the Environment Agency, a range of sensitivity tests have been undertaken to assess the overall model robustness and the response of the model to change in some parameters.

2.1.2 No changes or updates were made to the overall model, either domain schematisation or parameters, prior to commencement of sensitivity testing. All changes henceforth made to the model, discussed in **section 3**, were undertaken independently of each other, unless stated otherwise.

2.1.3 **Section 2** and **section 3** of the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] provide a comprehensive summary of the overall modelling approach, model schematisation, boundary conditions, model parameters, etc.

2.1.4 All simulations were run using Flood Modeller version 4.3.6 and TUFLOW version 2017-09-AA-iDP-w64 for consistency with the main modelling study. The model was run to simulate 50 hours, unless stated otherwise.

2.1.5 Due to the specific nature of each sensitivity test, some of the changes were applied only to the with scheme model (e.g. culvert through the crossing embankment at existing drain). For tests that concerned the general model (e.g. roughness) both baseline and with scheme models were run to check overall model sensitivity and potential change in impact of the development on flood risk off-site.

2.1.6 To assess the off-site impacts in line with advice from the Environment Agency, the sensitivity tests were run only for the 100-year with 35% climate change allowance event, unless stated otherwise where a test specifically required a different return period and/or climate change allowance.

3 SENSITIVITY TESTS

3.1 Overview

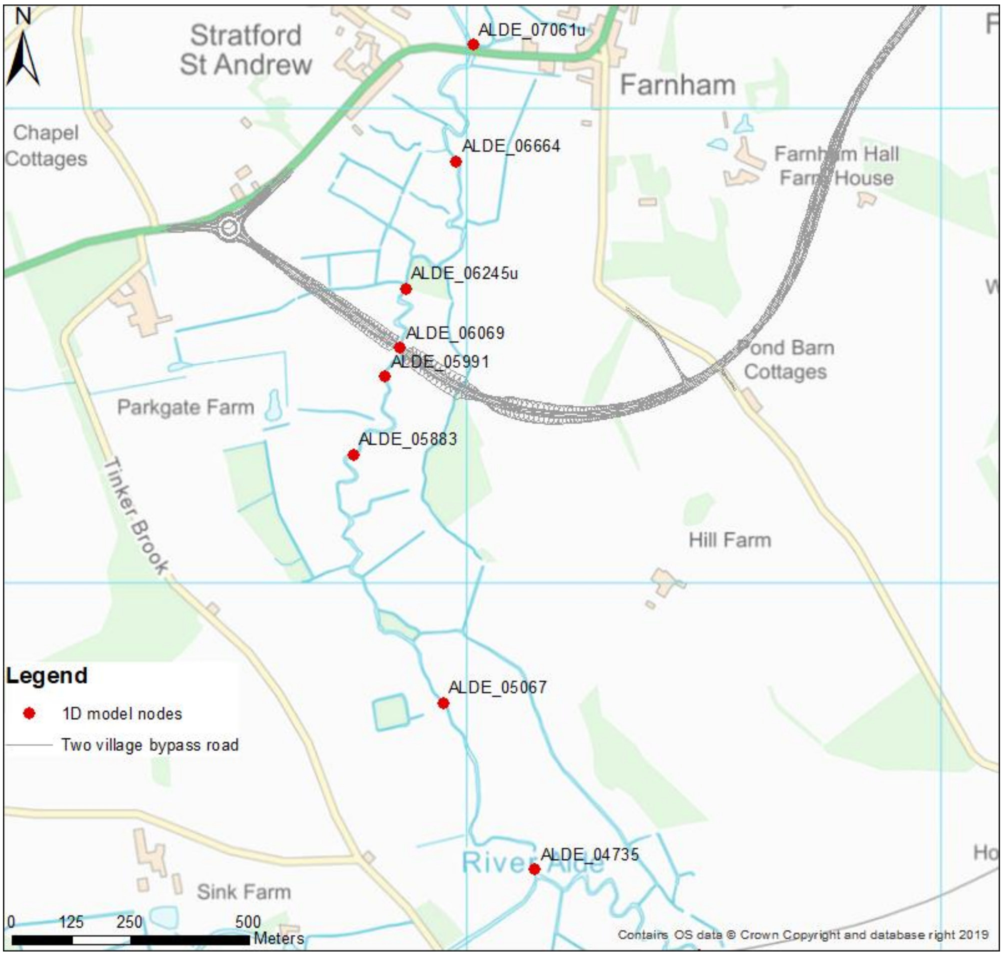
3.1.1 As outlined in **section 2**, no changes or updates were made to the overall model prior to commencement of the sensitivity testing.

3.1.2 This section outlines briefly the comments raised by the Environment Agency provided in **Appendix B** of the **Two Village Bypass FRA Addendum** (Doc Ref. 5.5), describes the amendments made to the model domain or parameters and presents the results for each of the sensitivity tests in the following subsections.

3.1.3 To aid analysis of the results from the sensitivity tests, a series of figures showing the difference in maximum depth between the with scheme and baseline scenarios were prepared, these are attached to this report. This aims to highlight whether despite some local changes in flood depths, the impact of the scheme on flood risk has not worsened from that which was concluded in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120].

3.1.4 In-channel results from the 1D model (Flood Modeller) results are also presented where appropriate, representing maximum flow/stage and/or time series results. Location of the model nodes relating to these results is presented in **Plate 3.1**.

Plate 3.1: Selected 1D model nodes in the area of interest



3.2 Tidal boundary uplifts

3.2.1 The Environment Agency Comments (comment 2.6 in **Appendix B** in the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"The lowest level in the applied tidal boundaries is not -0.075 mAOD as reported … Please check tidal boundary conditions and update report accordingly"*

3.2.2 In the model, the tidal boundary is at Snape Maltings on the River Alde estuary (node Alde_-500 the last node at the downstream extent of the model). An IED file is used to represent the time series of tide levels at the boundary with uplifts for climate change allowances at the 2030 and 2140 epochs representing the end of the construction phase and (beyond) design lifetime of the development, respectively.

3.2.3 As the sea level rise allowances at Alde_-500 had been previously underestimated, the correct uplifts (as detailed in in section 4.3 of the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120]) were subsequently applied for the two sensitivity tests, as detailed in **Table 3.1**.

Table 3.1: Sea level rise allowances applied for the two considered sensitivity test scenarios

Modelled Scenario	Development Phase	Sea Level Rise Allowance (m)
With Scheme 100-year with 25% CC	2030	0.15
With Scheme 100-year with 35% CC	2140	1.82

3.2.4 As presented in **Table 3.1**, the tidal boundary uplift test was carried out for the 100-year return period event at two epochs, i.e. 2030 with 25% climate change allowance for fluvial flow and 2140 with 35% climate change allowance for fluvial flows, in line with the Environment Agency guidance (Ref. 1) for the Higher central allowance category.

3.2.5 Given that the revised uplifts were higher than previously applied (+0.33m to both return period runs), both the baseline and with scheme scenarios were run to assess the impact of the proposed development on changes to the flood risk in the surrounding areas.

3.2.6 **Plate 3.2** shows that for the baseline 1 in 100-year with 25% climate change scenario and the 2030 tidal boundary uplift, maximum flood depths have not changed in the floodplain surrounding the development. **Plate 3.3** shows the same trend for the with scheme run of the same scenario.

Plate 3.2: Difference in maximum flood depth – baseline 1 in 100-year event with 25% climate change allowance for 2030 tidal boundary uplift

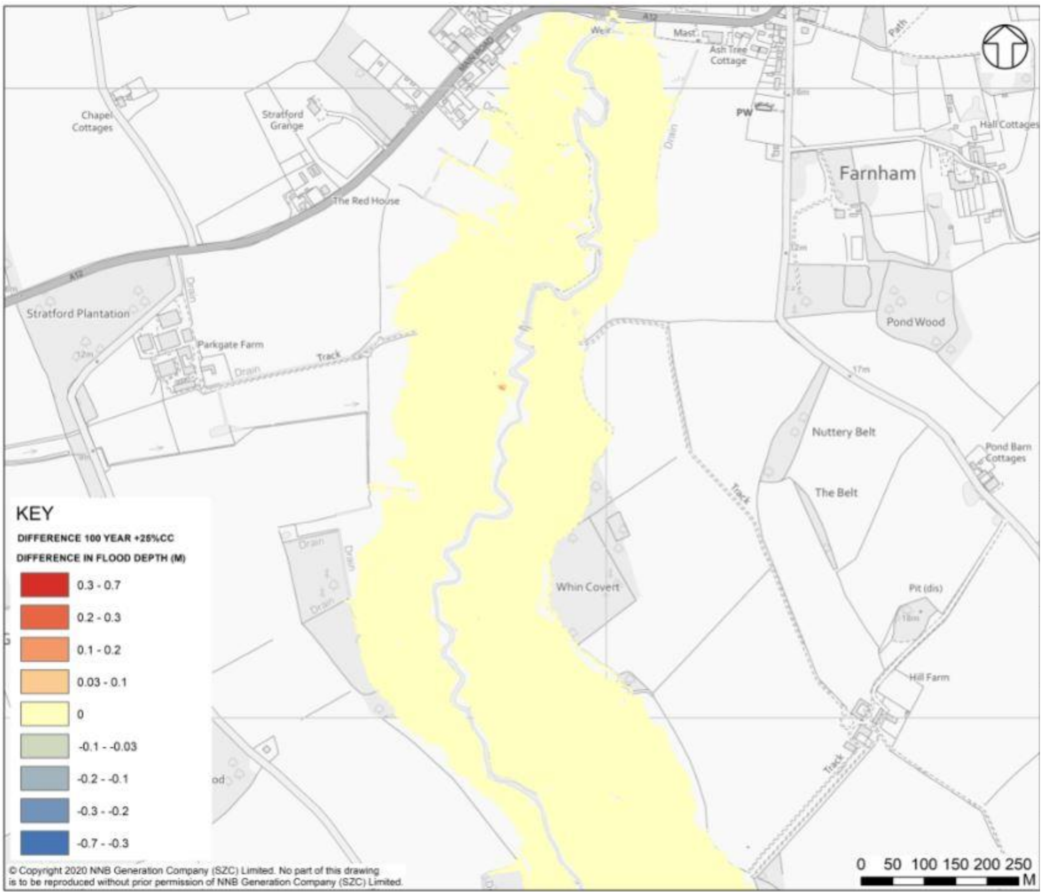
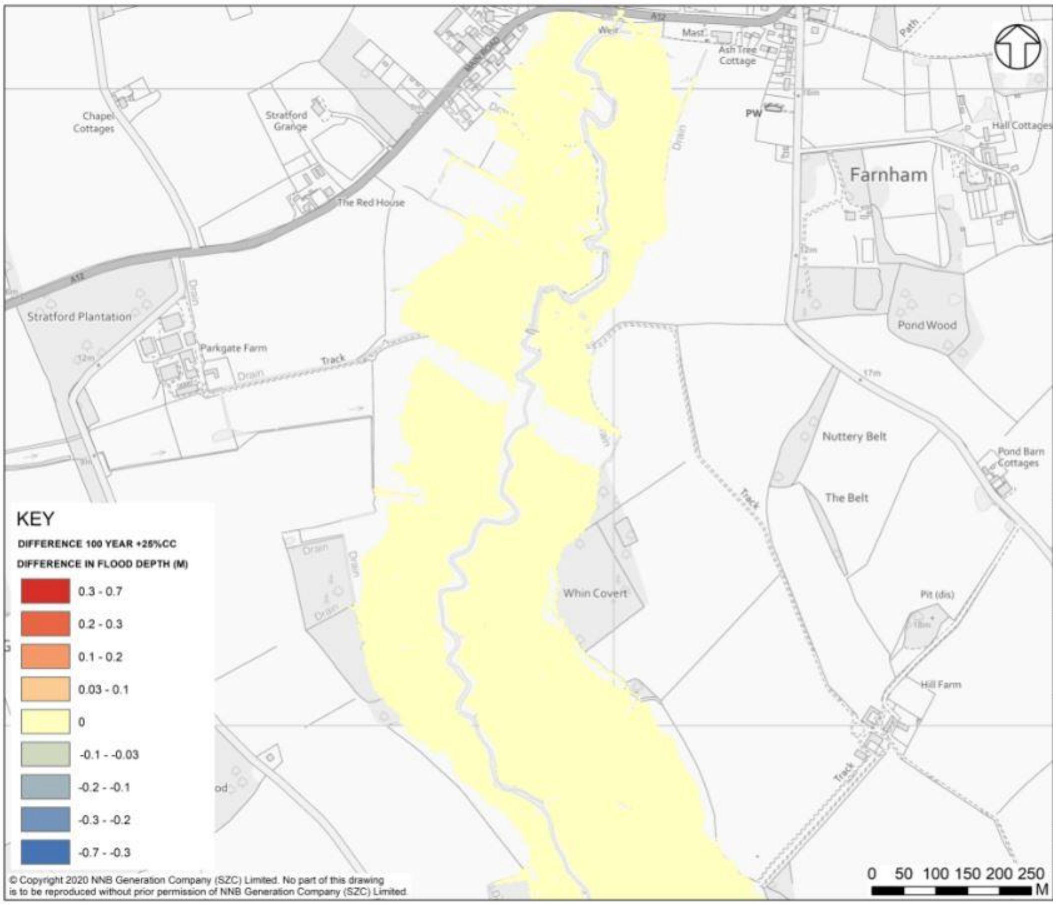


Plate 3.3: Difference in maximum flood depth – with scheme 1 in 100-year event with 25% climate change allowance for 2030 tidal boundary uplift



3.2.7 Similarly, **Plate 3.4** shows that for the baseline 1 in 100-year with 35% climate change scenario for the 2140 tidal boundary uplift, maximum flood depths in the floodplain surrounding the development have not changed as a results of adjusted tidal model boundary. **Plate 3.5** shows the same trend for the with scheme run of the same scenario.

Plate 3.4: Difference in maximum flood depth – baseline 1 in 100-year event with 35% climate change allowance for 2140 tidal boundary uplift

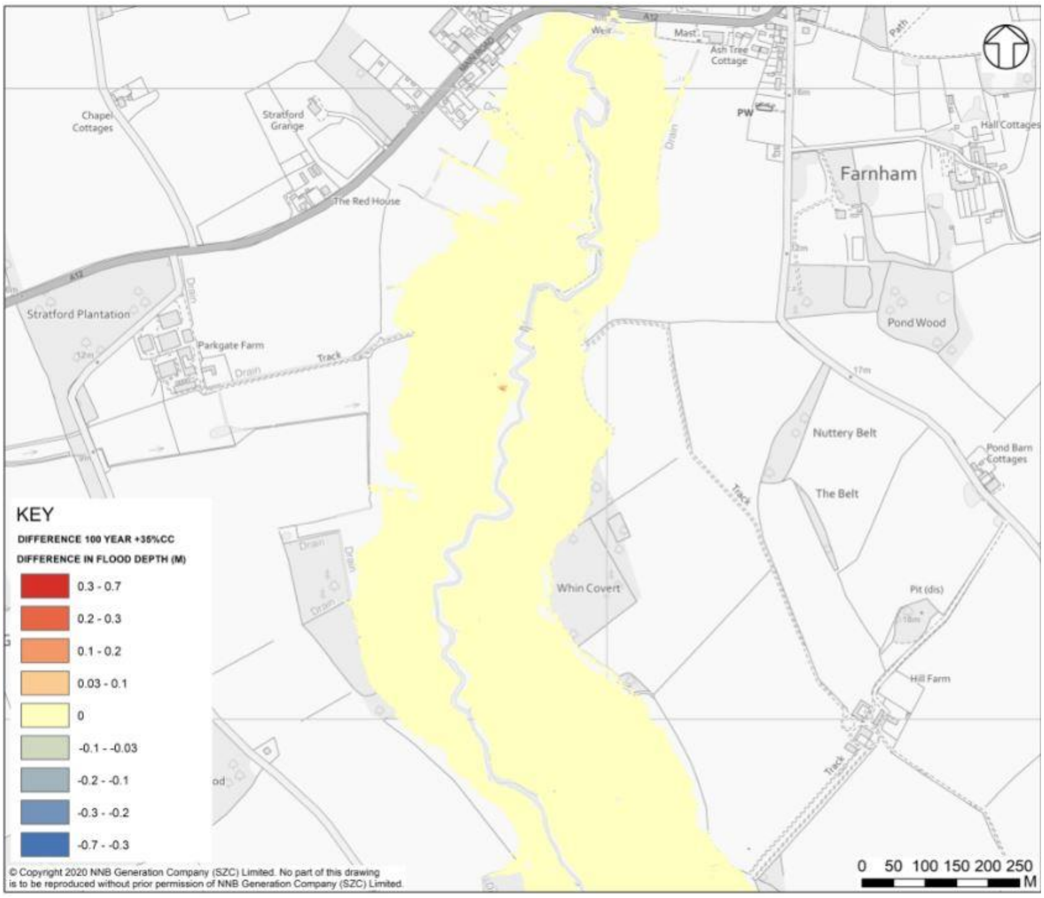
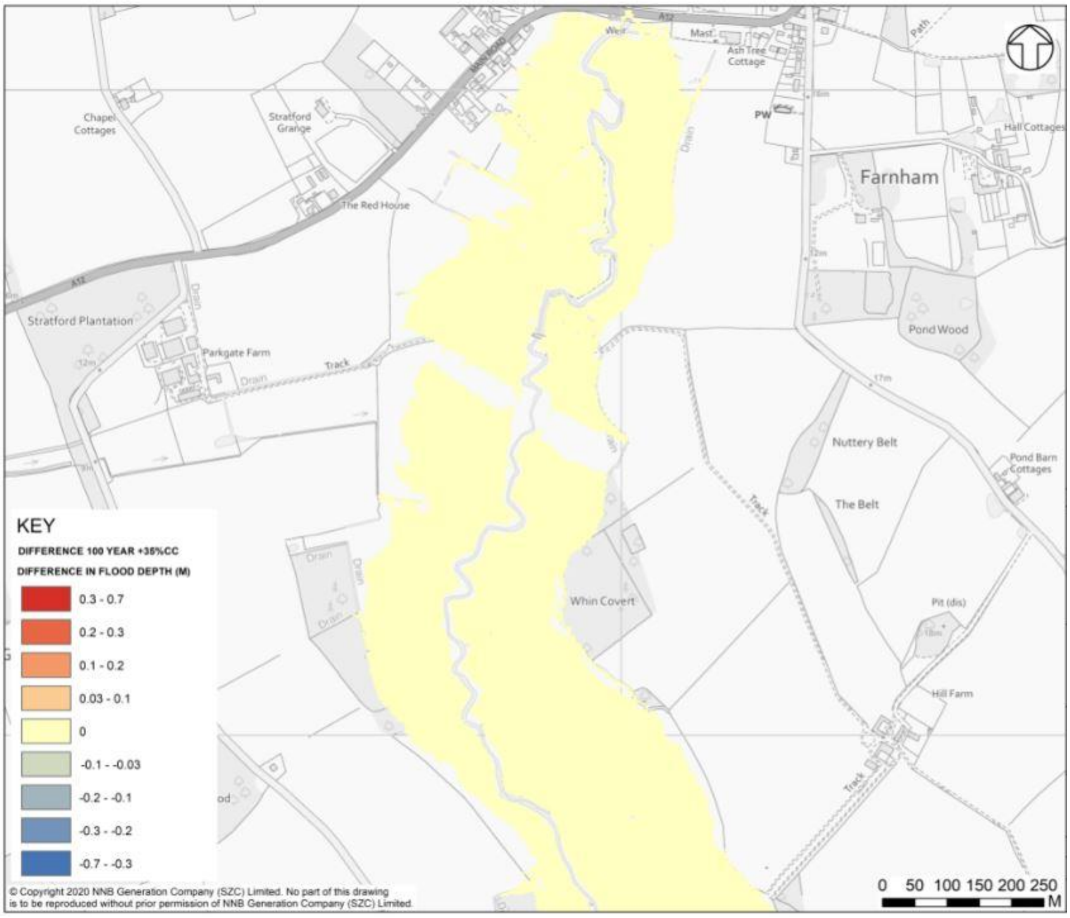


Plate 3.5: Difference in maximum flood depth – with scheme 1 in 100-year event with 35% climate change allowance for 2140 tidal boundary uplift



3.2.8 In-channel 1D results were also checked at several model nodes in the vicinity of the proposed crossing and further upstream. These show no difference in maximum flow or stage between the previous results and the revised uplift results for either of the test runs or scenarios.

3.2.9 Based on the above, it can be concluded that change in flood risk due to the development remains the same as previously reported in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] in the Application. This is confirmed by **Figure 1** for the 2030 uplift scenario and **Figure 2** for the 2140 uplift scenario when compared with results for equivalent scenarios presented in **Appendix C** of **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-125] and [APP-126].

3.3 Roughness coefficient

3.3.1 The Environment Agency Comments (comment 3.0 in **Appendix B** of the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"It is recommended that sensitivity testing is undertaken on the parameters selected by the modeller to provide evidence on the effect of these assumptions on the potential conclusions … Undertake sensitivity tests on manning's roughness values."*

3.3.2 Following comments from the Environment Agency, assessment of sensitivity of the hydraulic model to a change in roughness coefficient was carried out to provide evidence on the effect of these changes on the overall conclusions.

3.3.3 Two sensitivity tests were undertaken with Manning's n values of all materials in the 2D domain (.tmf file) and cross-section nodes in the 1D domain (.dat file) increased and decreased by 20% respectively for each run. To limit the number of variations, the Manning's n value for the stability patch was unaltered for both runs, as the stability patch was assessed in a separate sensitivity test discussed in **section 3.4**.

3.3.4 The model has some issues with instability, which were present when the model was obtained from the Environment Agency (Ref. 2). This instability relates to an error in the model at a node towards Gromford (a significant distance from the proposed development).

3.3.5 As a result, the plus 20% simulation stopped at 32 hours, however a review of the TUFLOW 2D Tmax grid showed that in the area of interest, at the proposed development and surrounding floodplain the results were a minimum of 7 hours passed their peak flood depth. It was thus decided to use these truncated results given the unlikelihood of flood levels rising further in the simulation when inflows recede (results from other scenarios also show similar time of peak and generally one peak flood level).

3.3.6 **Plate 3.6** shows that for the baseline 1 in 100-year with 35% climate change allowance scenario with roughness decreased (minus) by 20%, there is an area on the western floodplain where food depths decreased between 0.03 – 0.1m. Elsewhere in the area of interest there is no change in maximum flood depths.

3.3.7 **Plate 3.7** shows the similar trend downstream of the proposed road embankment for the with scheme scenario and small area further upstream of the development, where there are also areas with slightly reduced maximum flood depth and no change in flood depths in other areas around the proposed development.

3.3.8 As shown in **Figure 3**, there is no additional flood risk posed by the development with reduced roughness, as the difference between with scheme and baseline scenarios remains unchanged from that which was reported in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] at the Application.

Plate 3.6: Difference in maximum flood depth – baseline 1 in 100-year event with 35% climate change allowance for minus 20% roughness

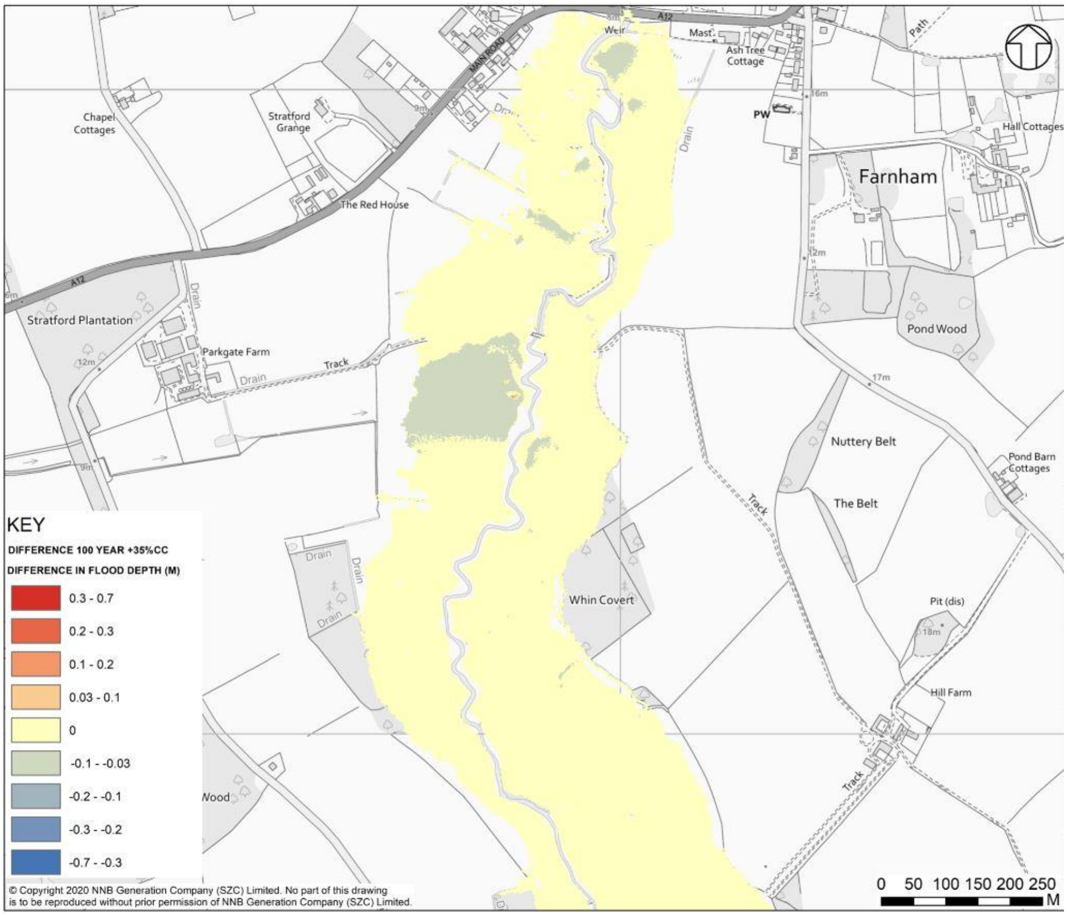
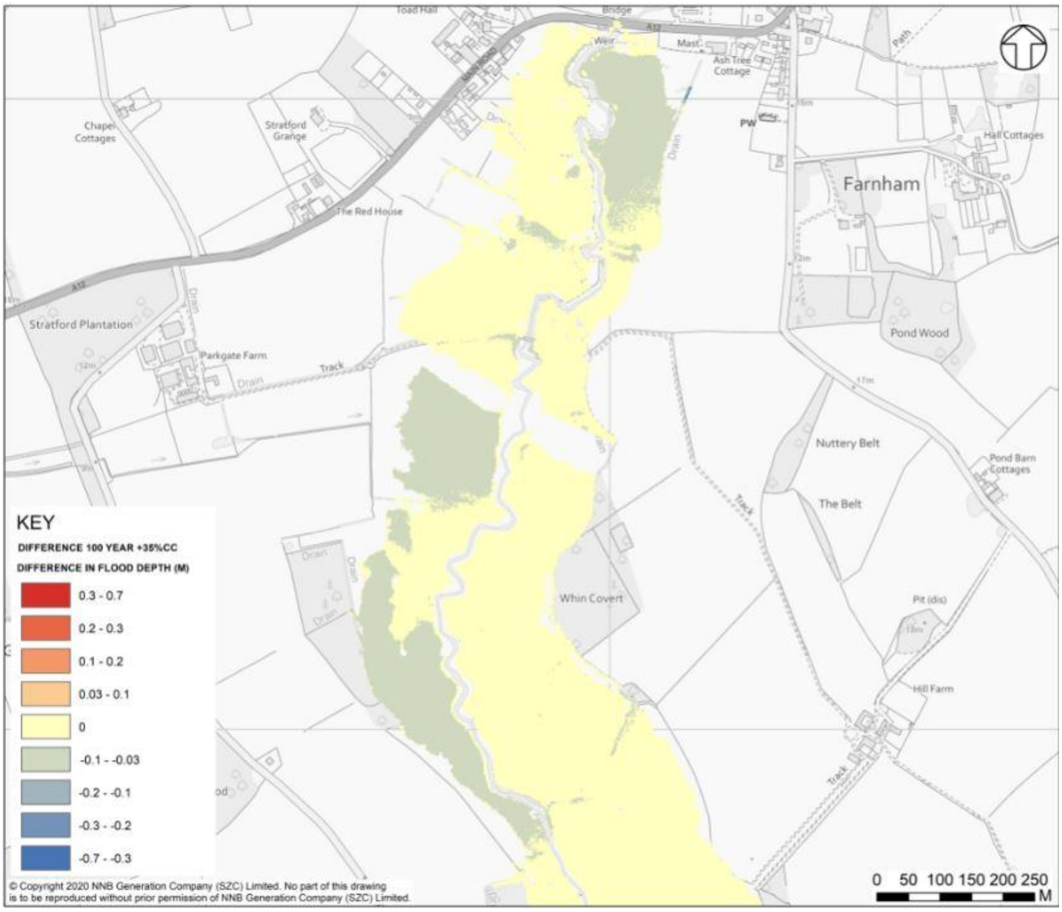


Plate 3.7: Difference in maximum flood depth – with scheme 1 in 100-year event with 35% climate change allowance for minus 20% roughness



3.3.9 As expected, for the baseline in-channel (1D) results there is generally increased and earlier peak flow with the reduced roughness, and consequently slight reduction in stage on the falling limb.

3.3.10 **Plate 3.8** gives an example at model node ALDE_06069 at the location of the proposed crossing where this pattern is apparent, as peak flow increases by as much as $3m^3/s$.

3.3.11 For the with scheme in-channel (1D) results, flow and stage from the original and decreased roughness scenarios follow the trend of the Baseline run, as illustrated in **Plate 3.9**.

3.3.12 The location of the 1D model node is illustrated in **Plate 3.1** in **section 3.1**.

Plate 3.8: Comparison of flow (red and pink) and stage (blue and grey) at 1D model node ALDE_06069 for baseline 1 in 100-year event with 35% climate change allowance for minus 20% roughness

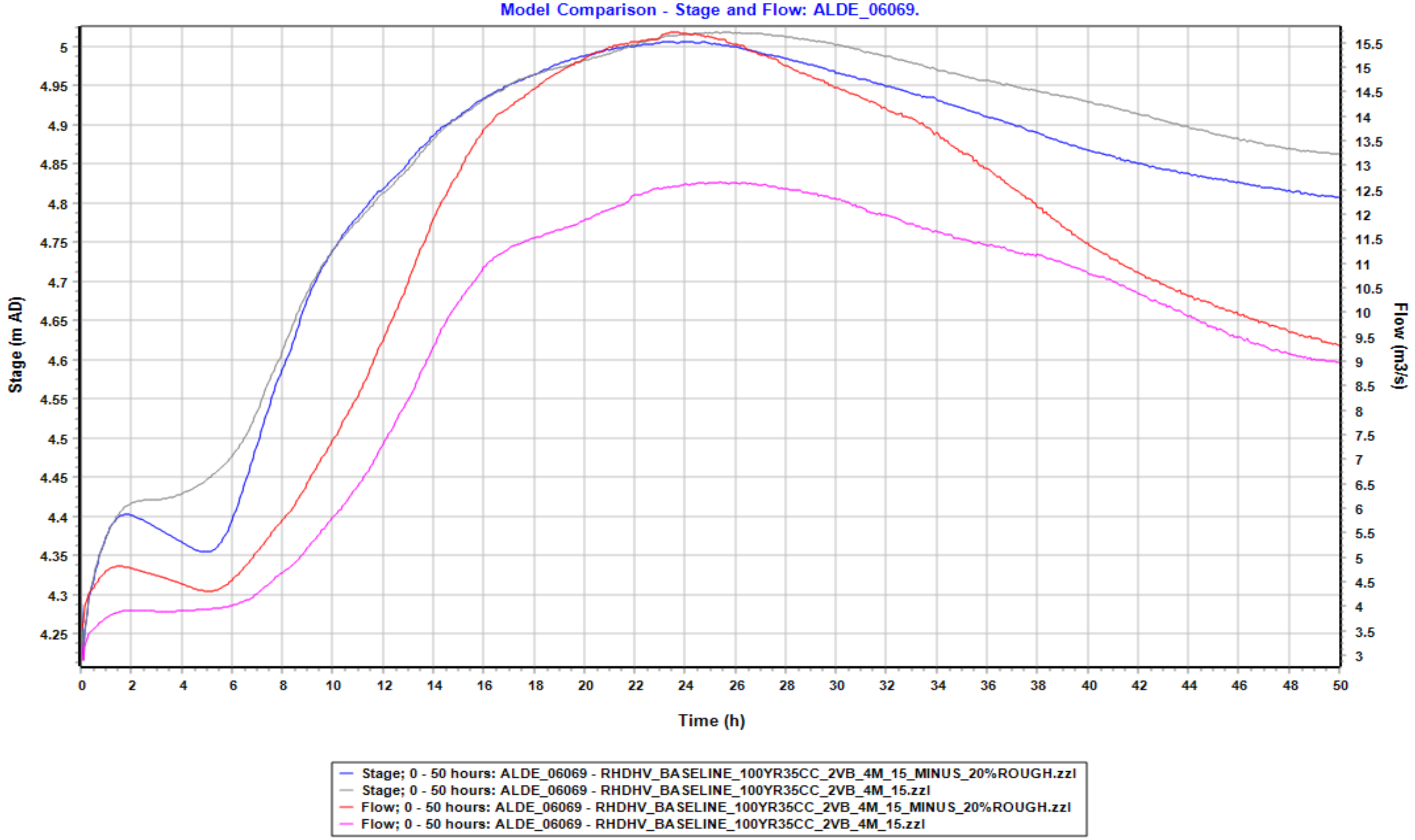
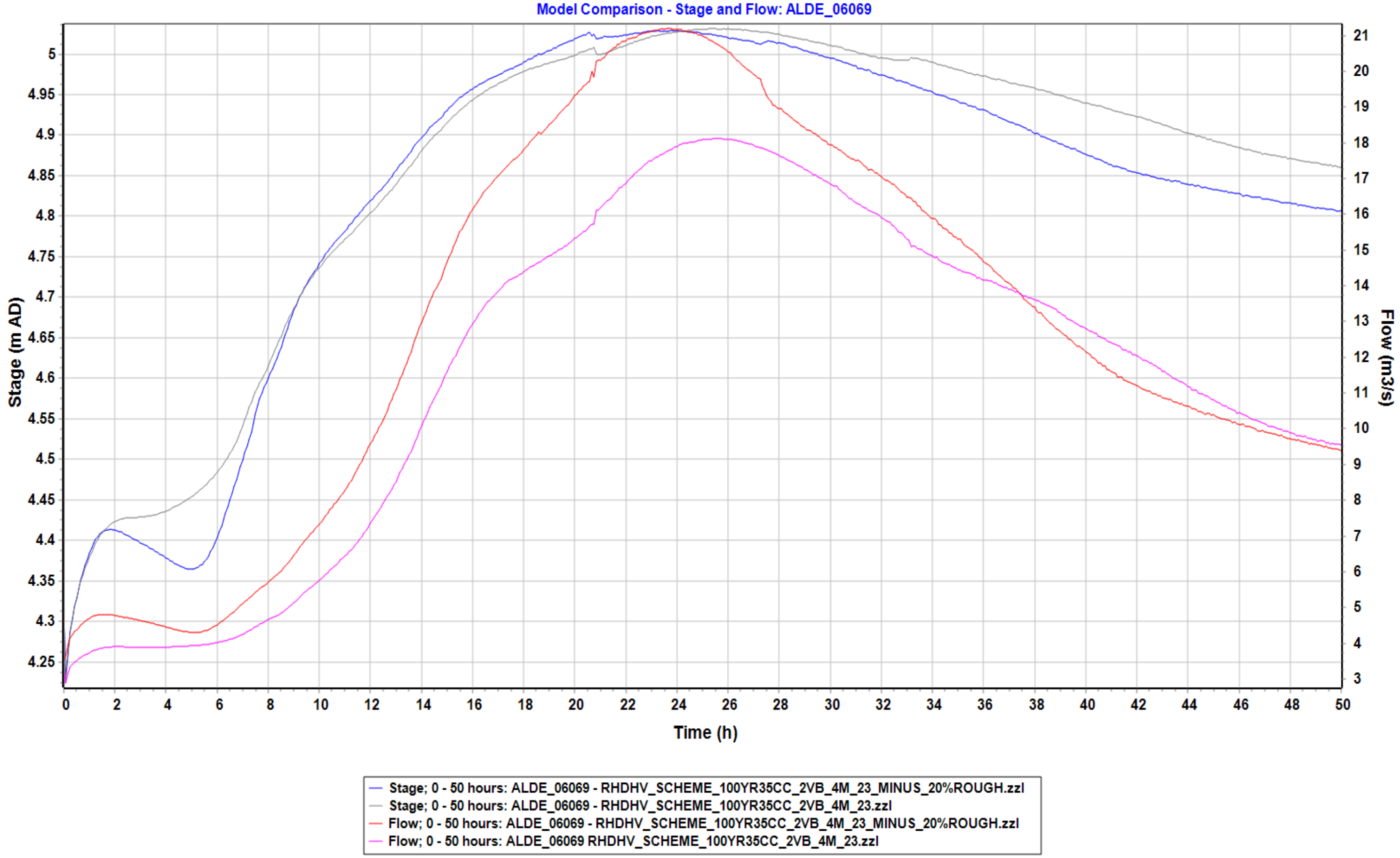


Plate 3.9: Comparison of flow (red and pink) and stage (blue and grey) at 1D model node ALDE_06069 for with scheme 1 in 100-year event with 35% climate change allowance for minus 20% roughness



3.3.13 **Plate 3.10** shows that for the baseline 1 in 100-year with 35% climate change scenario for the plus 20% roughness, flood depths increased by up to 0.03m on the western floodplain, as well as on the eastern floodplain downstream.

3.3.14 **Plate 3.11** shows a similar pattern upstream of the proposed development on the western floodplain.

3.3.15 As shown in **Figure 4**, there is no additional flood risk posed by the development with increased roughness, as the difference between with scheme and baseline scenarios remains unchanged from that which was reported in **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] at the Application.

Plate 3.10: Difference in maximum flood depth – baseline 1 in 100-year event with 35% climate change allowance for plus 20% roughness

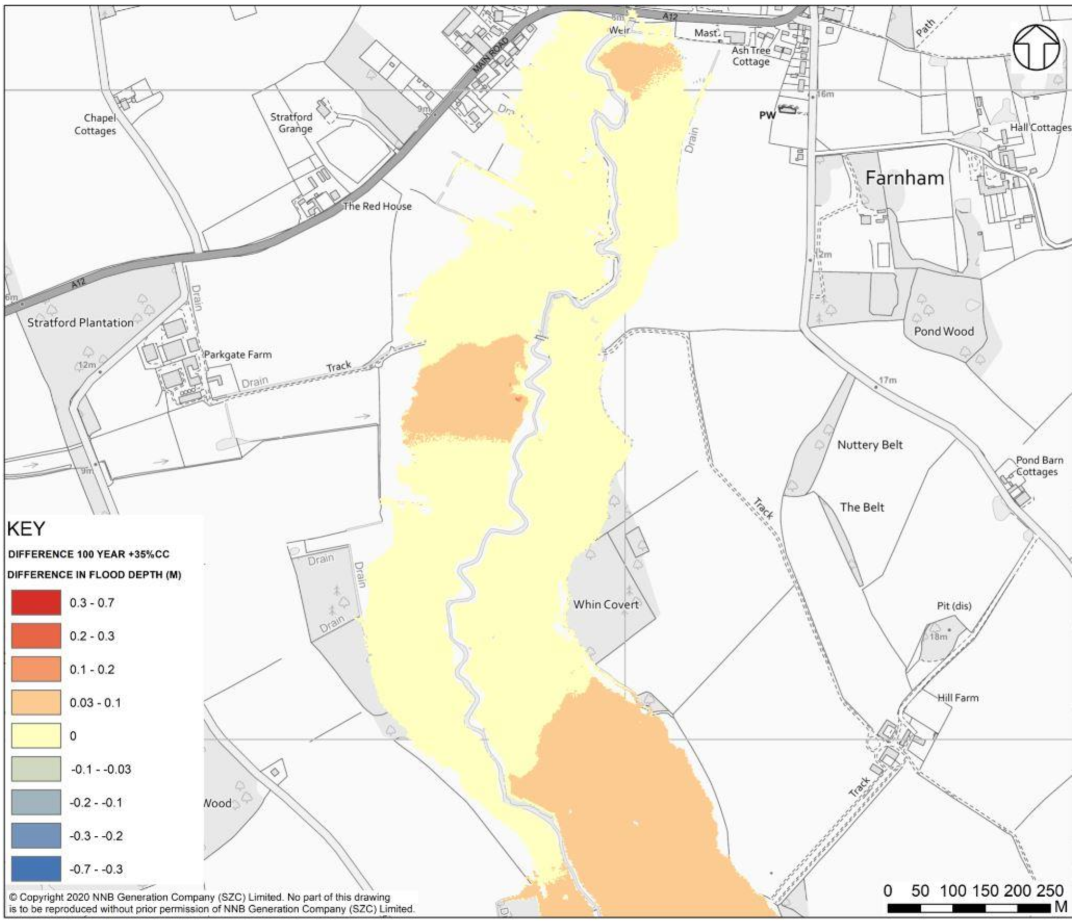
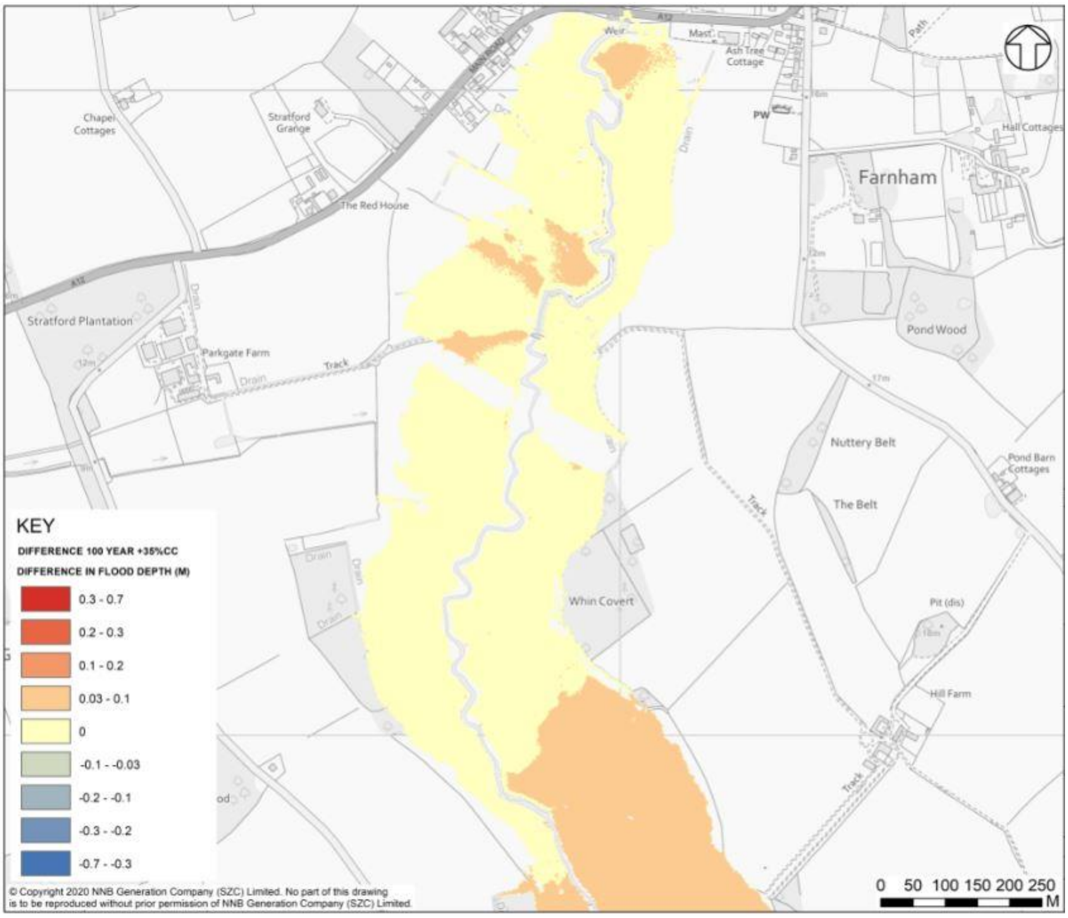


Plate 3.11: Difference in maximum flood depth – with scheme 1 in 100-year event with 35% climate change allowance for plus 20% roughness



3.3.16 As expected, for both baseline and with scheme scenarios with increased roughness the in-channel 1D results show there is a decreased and delay in peak flow and an increased stage on the falling limb.

3.3.17 **Plate 3.12** (baseline) and **Plate 3.13** (with scheme) show the impact of increased roughness at the location of the proposed development at 1D model node ALDE_06069 at which this pattern is apparent, where peak flow decreased by as much as 2m^3/s.

3.3.18 Overall, there is no significant difference in flood depth (2D), and changes in the 1D domain are as to be expected following the changes in roughness. However, the impact of the development on change in flood risk in the surrounding areas is in line with that reported in the Application, therefore suggesting that potential seasonal changes in roughness (vegetation) would not alter overall conclusions.

Plate 3.12: Comparison of flow (red and pink) and stage (blue and grey) at 1D model node ALDE_06069 for baseline 1 in 100-year event with 35% climate change allowance for plus 20% roughness

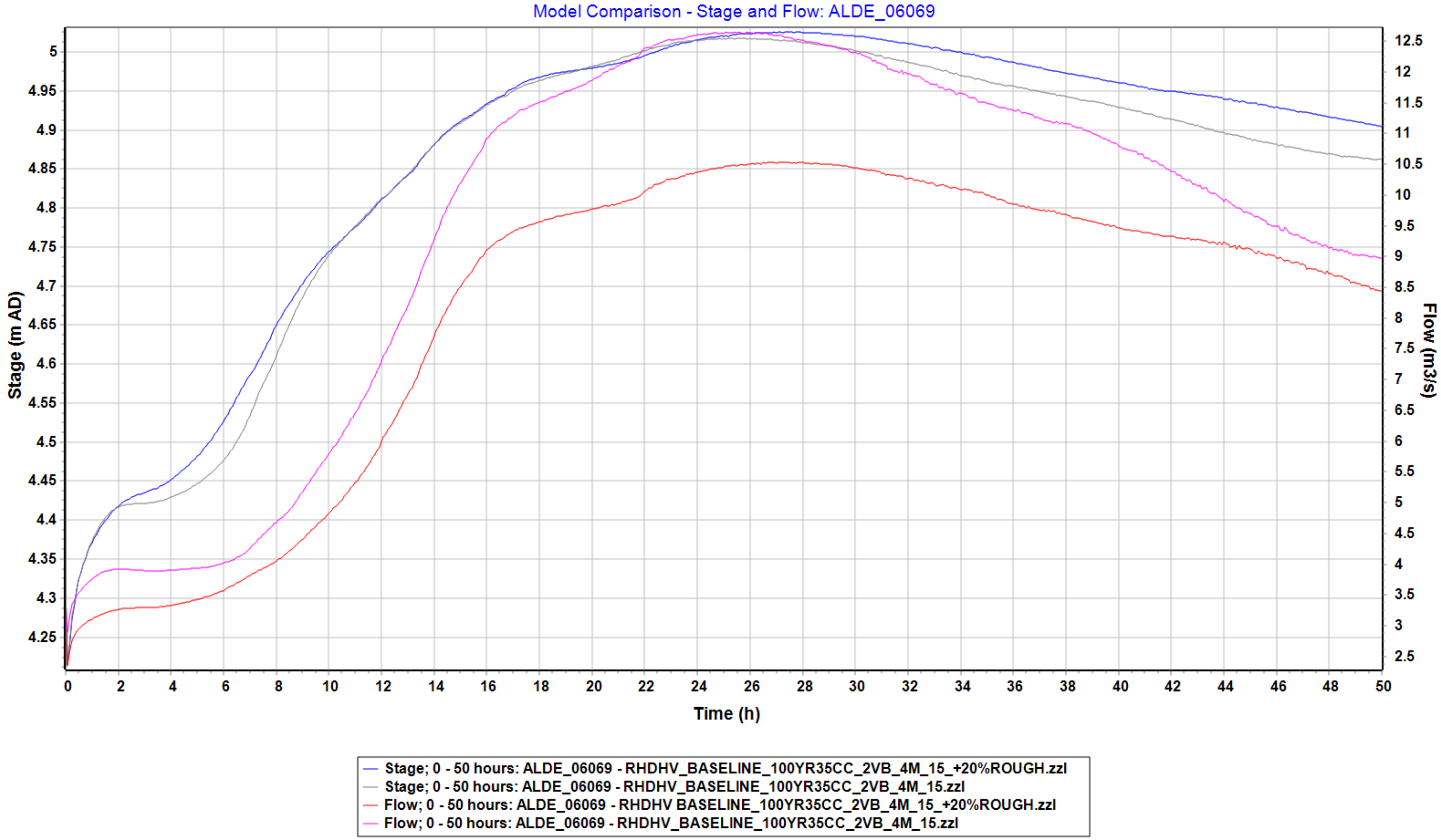
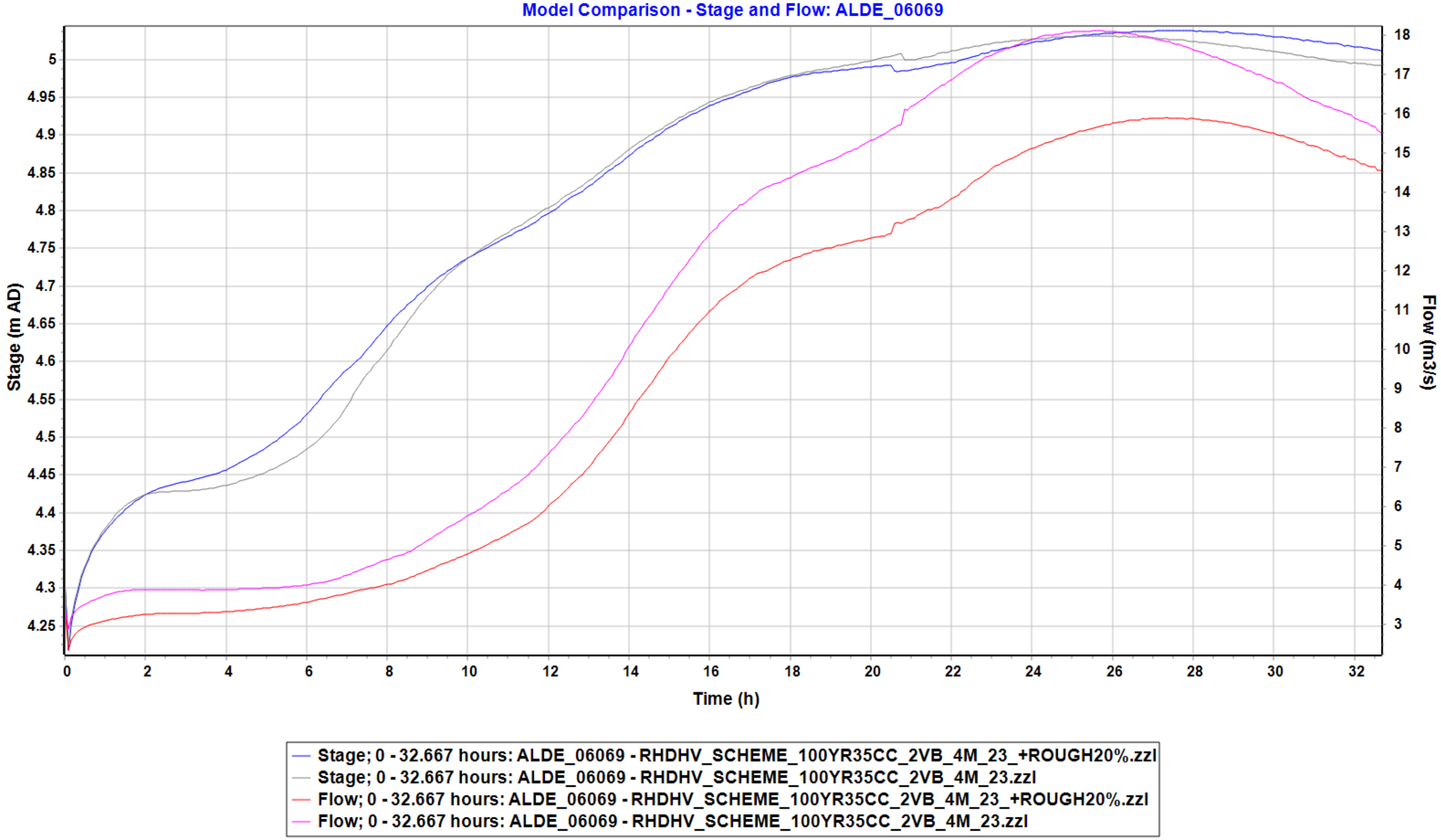


Plate 3.13: Comparison of flow (red and pink) and stage (blue and grey) at 1D model node ALDE_06069 for with scheme 1 in 100-year event with 35% climate change allowance for plus 20% roughness



3.4 Stability patch

3.4.1 The Environment Agency Comments (comment 2.8 in **Appendix B** of the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"2D roughness values generally appear sensible, with the exception of a stability patch of 0.85 applied along all banks throughout model. This value is very high and requires further justification as to its use. .tmf states that it is for grassed banks, but the "patch value" is much higher than the standard value for grass (is closer to a value used for solid buildings)."*

3.4.2 In the model runs for the Application, a stability patch was used in the lower parts of the model, further downstream than the area of interest, to address model instabilities.

3.4.3 Manning's n value of 0.85 was applied within the patch as it was found to best stabilise the model across all scenarios, especially more extreme high flow events. The .tmf file (material file within Tuflow 2D model domain) suggests that this roughness is applied to areas with 'grassed banks', where the Environment Agency stated that such high value is more typical of solid buildings. However, the description in the .tmf file was not updated to reflect that this Manning's n value was applied for the stability patch.

3.4.4 To assess model sensitivity, the Manning's n value at the stability patch was changed from 0.85 to 0.1. To control for variation, Manning's n values for all other materials in the .tmf file remained unchanged. This test was simulated for the 1 in 100-year with 35% climate change scenario as higher events were too unstable when tested with lower roughness value in the stability patch.

3.4.5 **Plate 3.14** shows that for the baseline 1 in 100-year with 35% climate change scenario flood depths are lower in some areas (between -0.1m and -0.3m) mostly downstream of the area of interest and small area on the eastern floodplain upstream of the proposed development. There two small areas with increased max flood depth (up to +0.1m), one upstream of the proposed development on the western floodplain, and the other further downstream.

3.4.6 **Plate 3.15** shows the with scheme 1 in 100-year with 35% climate change scenario where flood depths are also slightly lower, mostly in the downstream area of the model, closer to where the stability patch has a direct impact. Immediately downstream of the proposed development on the western floodplain flood depth decrease (up to -0.1m) and on the eastern floodplain the flood depth increase (up to +0.1m). There is also a very small area with increased flood depth on the eastern floodplain upstream of the crossing.

3.4.7 In summary, the stability patch seems to have greatest impact on the peak flood depth in the downstream area of the model, away from the area of interest, where the roughness value was amended. There is also some impact in the vicinity of the proposed development, however this comprises an increase or decrease in flood depth (up to 0.1m) in both the baseline and with scheme scenarios, suggesting that this is a relative change and the impact of the scheme would not change as a result of the higher roughness values.

3.4.8 This is confirmed with results shown in **Figure 5**, where the current results show no change in the relative impact of the proposed development from that which was reported in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] for the Application.

Plate 3.14: Difference in maximum flood depth – baseline 1 in 100-year event with 35% climate change allowance for change in Manning's n value

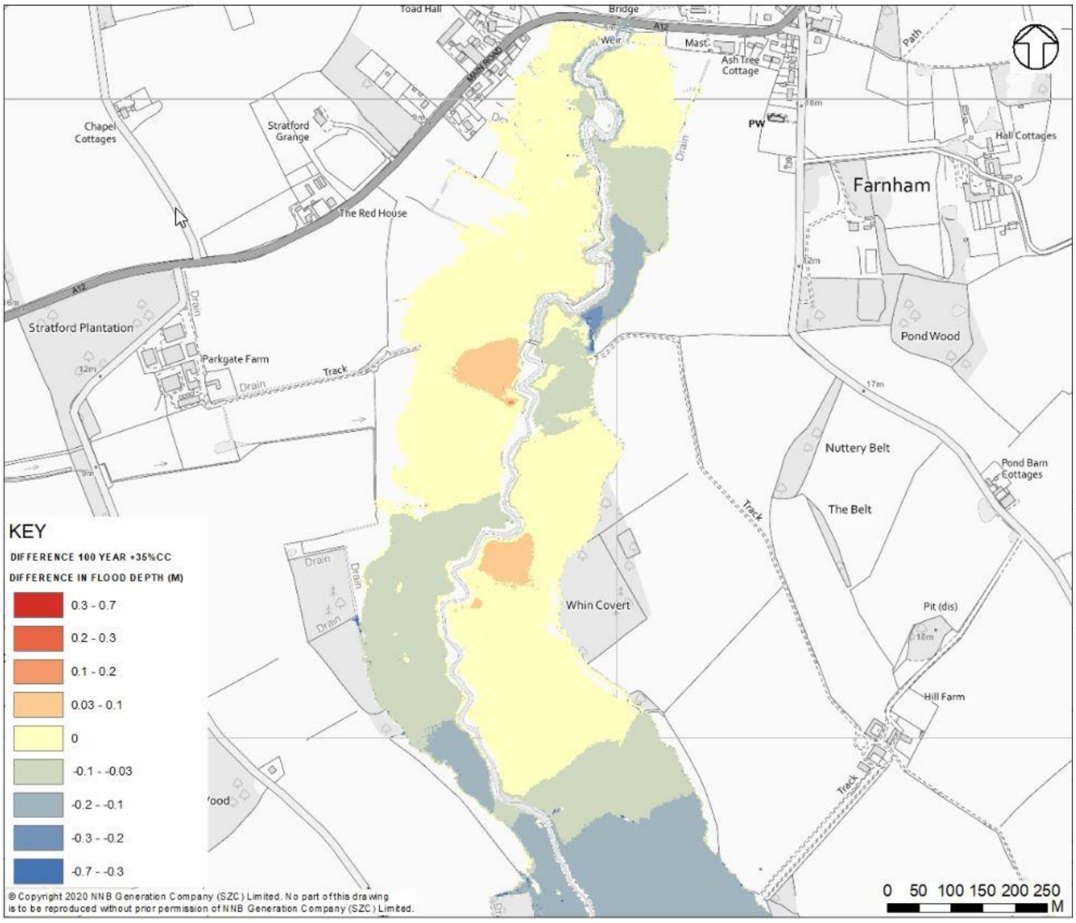
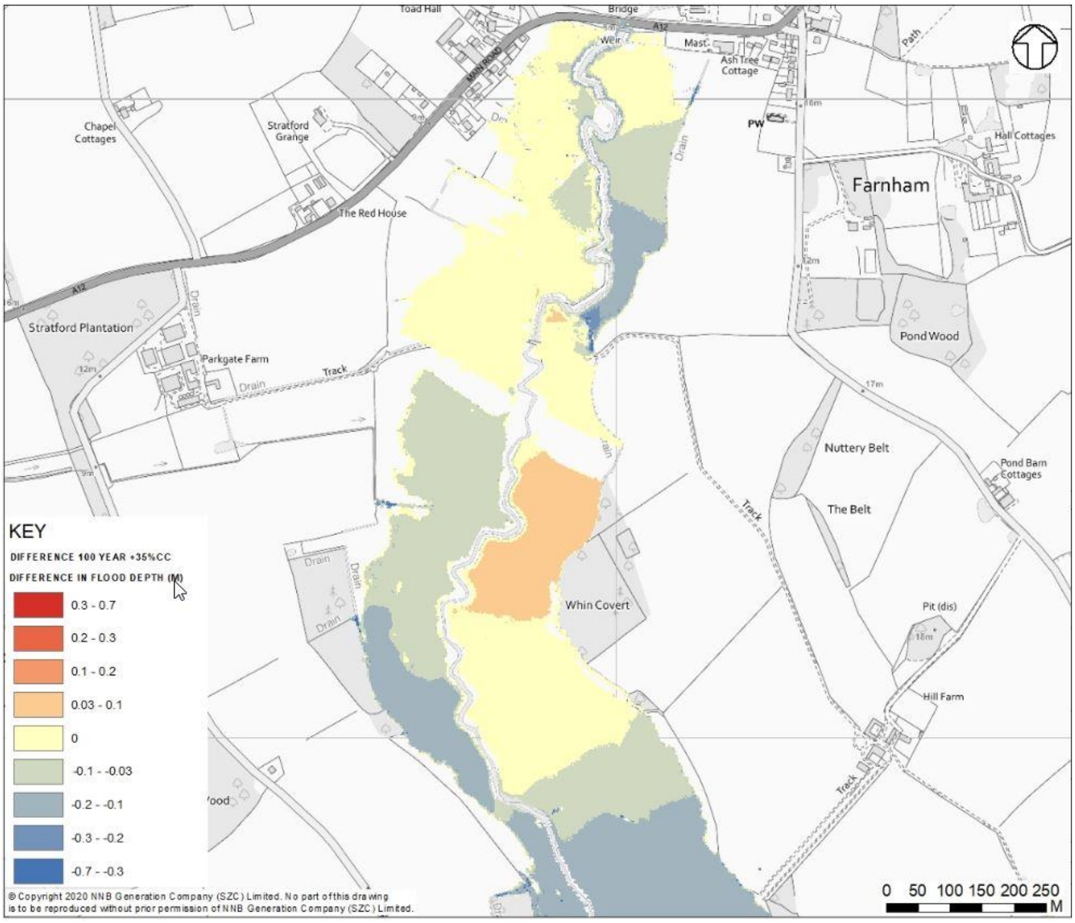


Plate 3.15: Difference in maximum flood depth – with scheme 1 in 100-year event with 35% climate change allowance for change in Manning's n value



3.5 Drains schematisation

3.5.1 The Environment Agency Comments (comment 3.4 in **Appendix B** of the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"The Z-shape 2d_zsh_fill_drains_004.mif, has been used to fill all drains in the 2012 model. This method has not been carried across to the extended 2D model domain."*

3.5.2 In the original Environment Agency Fluvial Alde, Ore and Fromus model (Ref. 2), a 2d_zsh polygon (2d_zsh_fill_drains_004) had been used to 'fill' all drains in the 2D domain south of the Screw Bridge (railway bridge north of Blaxhall) to account for the drains to be 'wet' and adopt conservative approach for assessment of the impact on flood risk.

3.5.3 This approach was adopted for the Application in the extended 2D model domain between the A12 at Farnham and the railway line to the south.

3.5.4 Following the Environment Agency's comments, to assess sensitivity of the model response to 'filled' drains, the same methodology was applied to raise the bed level of the drains within the extended 2D model domain (2d_bc_hxe_ALDE_005_2VB_001_R) north of the railway line.

3.5.5 **Plate 3.16** for the baseline 100-year with 35% climate change scenario shows that, other than expected decrease in flood depths within the filled drains, the overall flood depths within the floodplain have not changed significantly. **Plate 3.17** shows an identical pattern for the with scheme 100-year with 35% climate change scenario.

3.5.6 There is a small localised increase in flood extent on the western floodplain upstream of the development, associated with reduced storage capacity. Despite a small increase in flood extent to the north, this is far from any development and remains within the floodplain and is therefore not considered significant. 1D results show no difference in flow or stage.

3.5.7 As shown in **Figure 6**, there is no additional flood risk posed by the development to the surrounding areas as a result of filling in the drains, as the difference between the with scheme and baseline scenarios remains unchanged from that which was reported in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] for the Application.

Plate 3.16: Difference in maximum flood depth – baseline 1 in 100-year event with 35% climate change allowance with filled drains

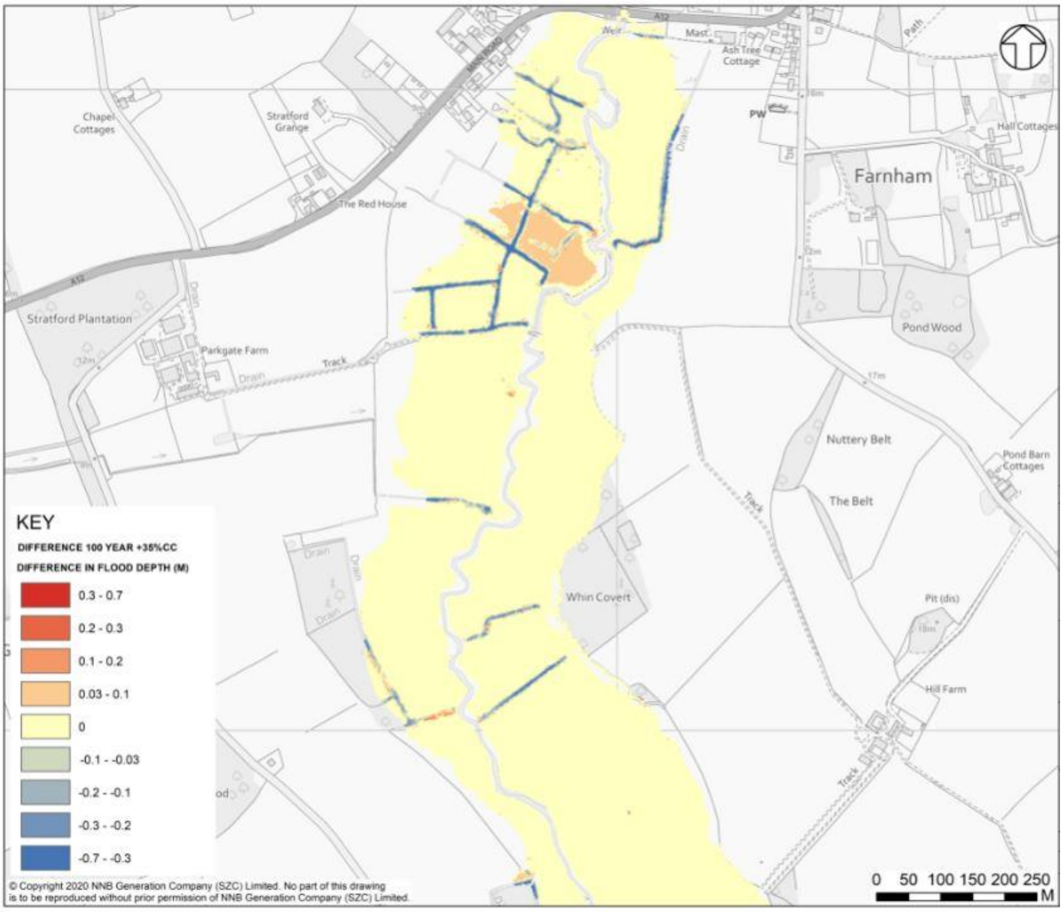
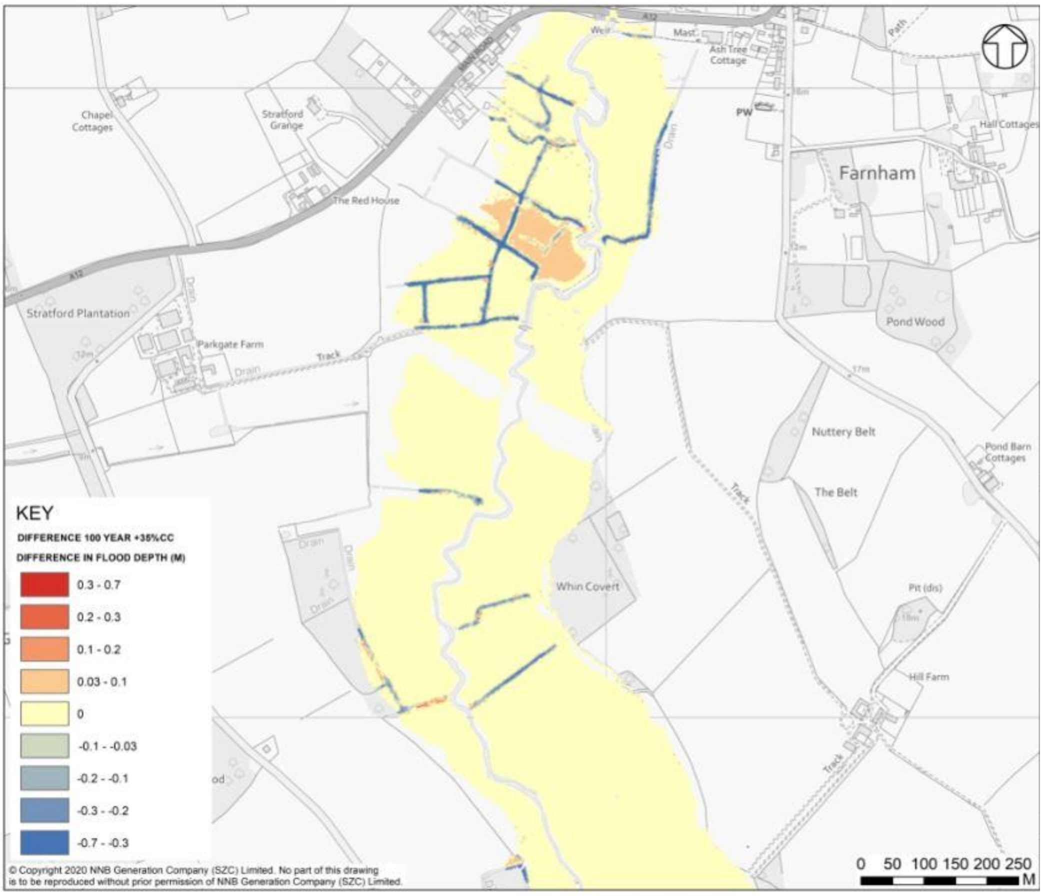


Plate 3.17: Difference in maximum flood depth – with scheme 1 in 100-year event with 35% climate change allowance with filled drains



3.6 Blockage assessment

3.6.1 The Environment Agency Comments (comment 9.7 in **Appendix B** of the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"A common residual risk posed by bridge crossings and culverts is the possibility of it becoming blocked by debris. This has not been discussed within the FRA. It is appreciated that the bridge and culverts are large, but the likelihood of this happening must be considered in the FRA."*

3.6.2 Sensitivity tests for blockage were not undertaken during the hydraulic modelling study for the Application due to the perceived low risk of the large watercourse bridge and flood plain culverts. In both sets of comments, the Environment Agency requested that a blockage assessment be carried out.

3.6.3 To address the comments and assess impact of blockage on flood risk to the development itself and impacts on flood risk off-site, additional model runs were carried out. The blockage was represented at the key structures by applying a 70% blockage ratio at the proposed crossing.

3.6.4 In the 1D Flood Modeller domain, a blockage unit was introduced between the junction south of the ALDE_06069 node and the crossing bridge unit (ALDE_06069bl shown in **Plate 3.1**), with a blockage factor of 0.7. In the 1D Estry domain, all culverts through the crossing embankment were blocked by a value of 70% in line with the 1D bridge unit.

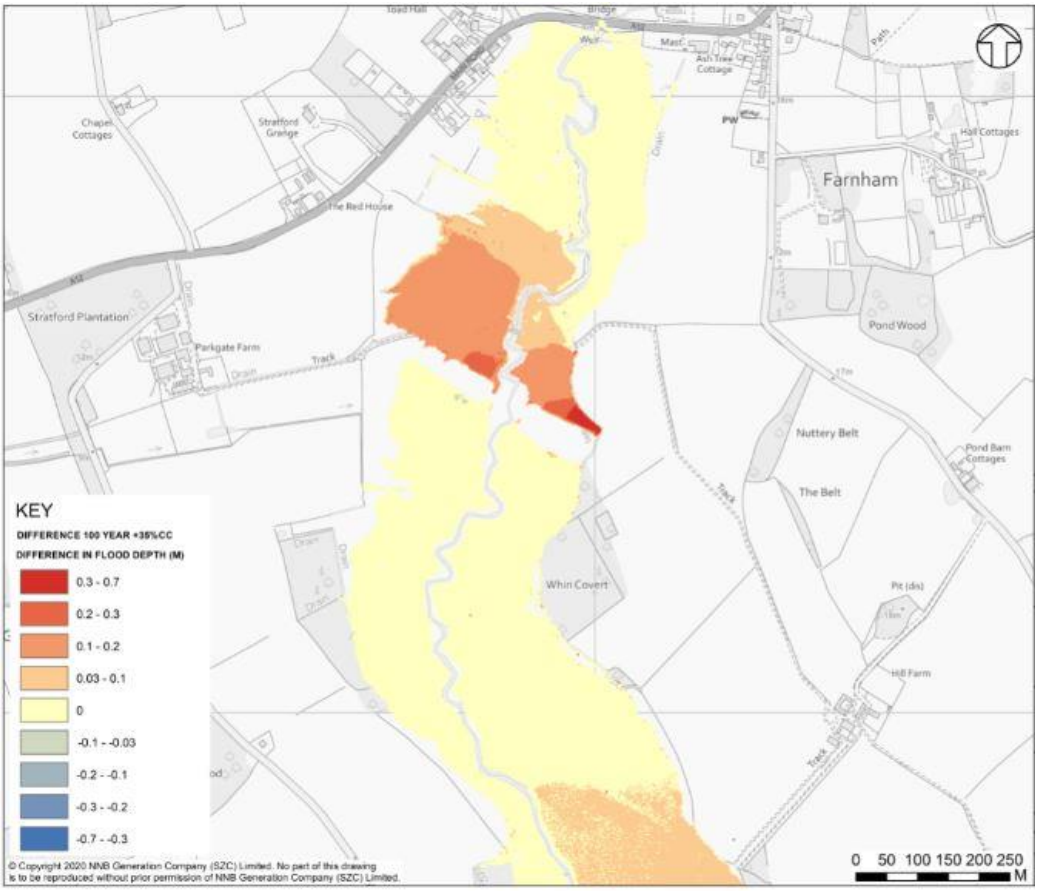
3.6.5 This blockage scenario was selected as it comprises a conservative approach (i.e. the simultaneous blockage of the bridge and all culverts). This was to ensure that the realistic worst case potential impact was appropriately assessed and to identify whether any impact would be localised in nature or could affect the road itself.

3.6.6 **Plate 3.18** shows that for the with scheme 100-year plus 35% climate change scenario, maximum flood depths increased as a result of the blockage by up to 0.45m on the eastern floodplain where a water backfilling effect extends up to 100m upstream of the development.

3.6.7 On the western floodplain this backfilling effect extends up to 200m with a maximum increase of 0.2m in flood depth immediately upstream of the embankment. Flood depths downstream of the development remained mostly unchanged, decreasing by 0.01 – 0.02m in places.

3.6.8 On the basis that the conservative approach to the blockage scenario results in limited localised change in the results of the modelling, it was not considered appropriate to carry out further testing of other climate change scenarios (i.e. 65% climate change scenario). This is supported by the results of the model runs for more extreme events i.e. 1,000-year scenario which show that maximum water levels are approximately 3m below the proposed bridge and road level.

Plate 3.18: Difference in with scheme maximum flood depth – 1 in 100-year event with 35% climate change allowance with blockage minus no blockage



3.6.9 As expected, results for the 1D Estry show significant changes to maximum flow and stage through the flood relief culverts within the crossing embankment. On the western floodplain, flow decreased substantially in both twin culverts, with increased level at both inlets. Increasing upstream water levels and decreasing flow results in an increase in flood depth within the relatively flat, low-lying floodplain terrain.

3.6.10 On the eastern floodplain, flow and stage increased in the flood relief culverts and the existing drain culvert. The most eastern culvert (one of the twin flood relief culverts, i.e. FRE2) is fed by an existing drain as an offshoot of the River Alde, meaning its flow increases due to combined effects of ponding floodplain water and a greater velocity with decreased area of the culvert inlet. This pattern is not reflected on the western floodplain where floodplain depths and culvert discharges were already high pre-blockage.

3.6.11 Summary of impact of blockage on the flow and water levels at the flood relief culverts is presented in **Table 3.2** and the locations of the associated nodes are illustrated in **Plate 3.19** below.

Plate 3.19: Location of the flood relief culverts

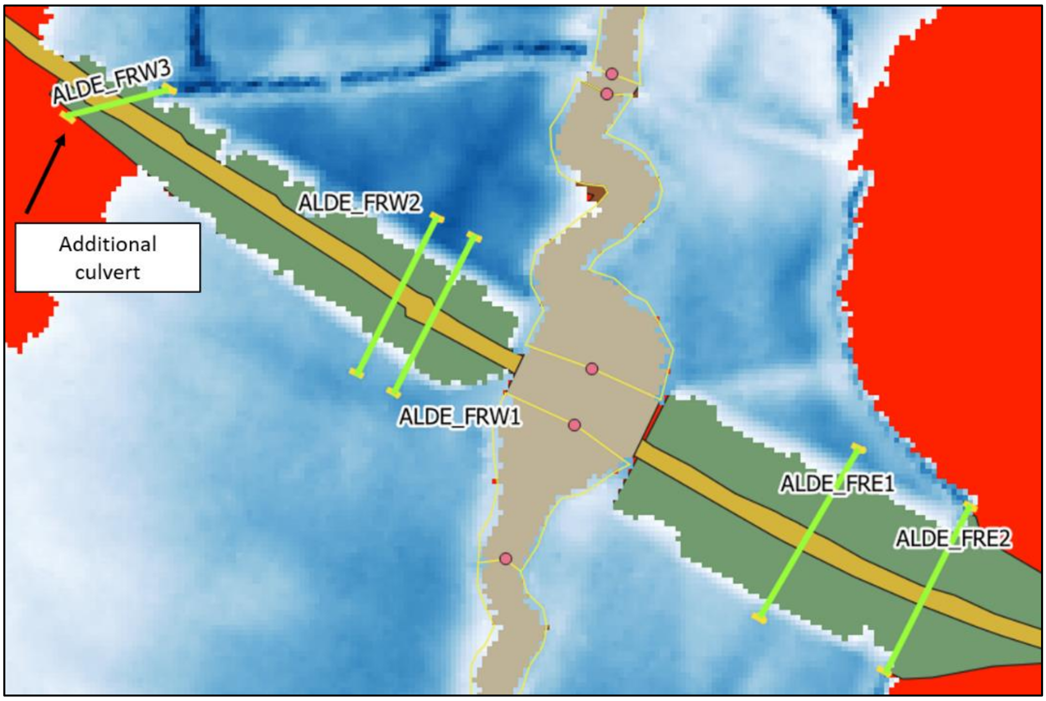


Table 3.2: Comparison of peak flow and stage values for with- and without-blockage scenarios at flood relief culverts (1D Estry)

	Flow (m^3/s)		Water Level (mAOD)		Change	
Culvert	No Blockage	With Blockage	No Blockage	With Blockage	Flow (m^3/s)	Water Level (m)
FRE1	2.07	3.01	4.86	5.22	+0.94	0.36
FRE2	0.76	1.45	4.81	5.22	+0.69	0.41
FRW1	3.58	2.10	5.13	5.42	-1.48	0.29
FRW2	3.70	2.41	5.15	5.43	-1.29	0.28

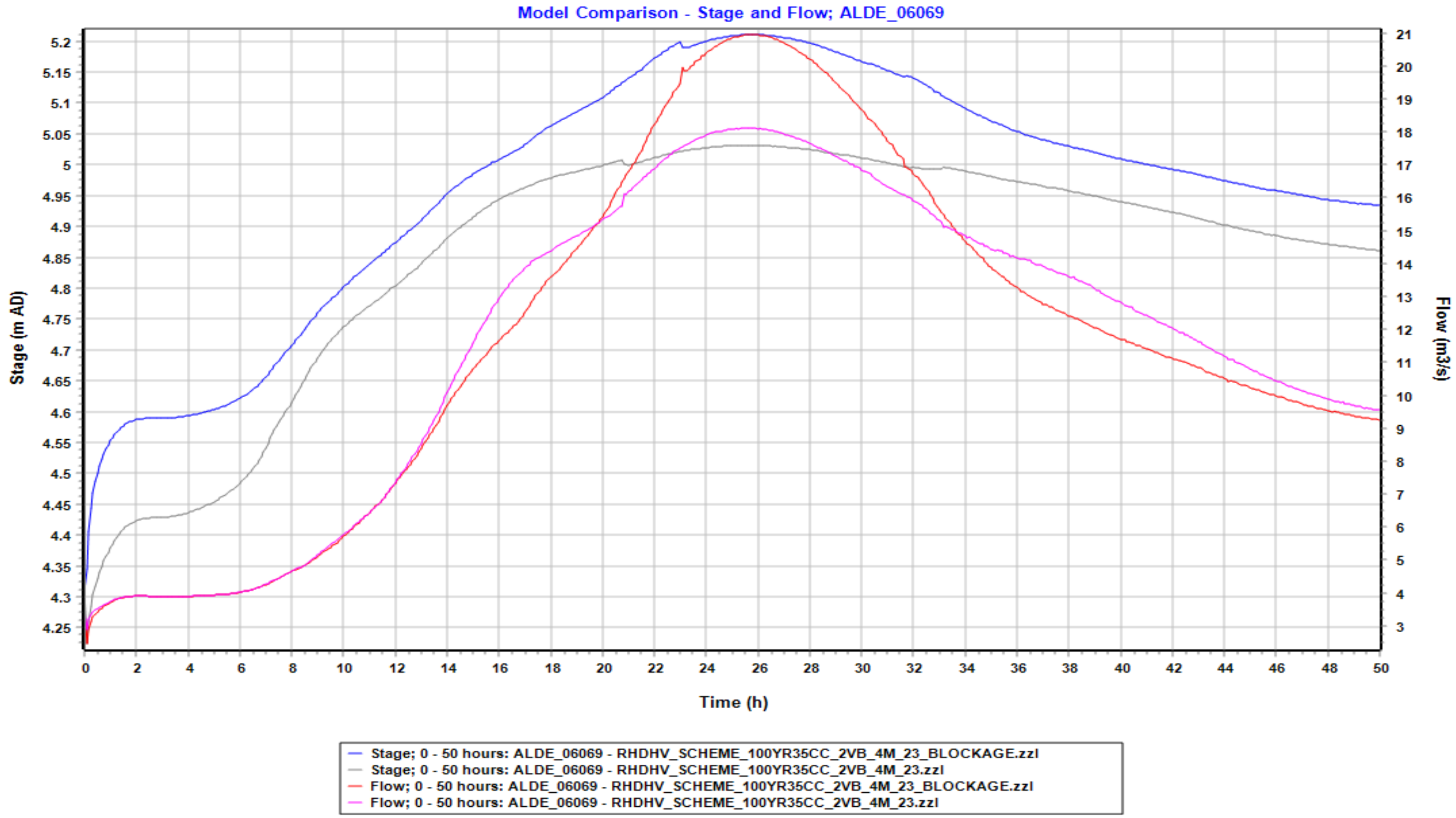
3.6.12 As expected, the 1D results show a significant effect of the blockage on flow and stage at, and upstream of, the proposed bridge unit. **Plate 3.20** shows time series of flow and stage at node ALDE_06069, where maximum flow increased by $3m^3/s$ and maximum stage increased by 0.15m. Location of the 1D model nodes is shown in **Plate 3.1** in **section 3.1** earlier in this report.

3.6.13 Flow and stage downstream of the development at node ALDE_03497u (north of the railway) and upstream of the development near Farnham gauging station (ALDE_07061u) show limited changes from the original model – effects of the blockage to the culverts are localised to the development. Location of the 1D model nodes in show in **Plate 3.1** in **section 3.1**.

3.6.14 **Figure 7** shows the impact of the scheme compared to baseline should a blockage occur, with flood depths locally increasing up to 0.45m just upstream of the crossing embankment.

3.6.15 Overall results show changes to flood depths as a result of blockage are within proximity of the development and do not extend beyond the original flood extent.

Plate 3.20: Comparison of flow (red and pink) and stage (blue and grey) at 1D model node ALDE_06069 for with scheme 1 in 100-year event with 35% climate change allowance for 70% blockage and no blockage scenarios



3.7 Additional culvert

3.7.1 The Environment Agency Comments (comment 3.7 in **Appendix B** of the **Two Village Bypass FRA Addendum**, Doc Ref. 5.5) state that:

> *"The existing culvert to the west of the River Alde crossing (Existing Watercourse Single Culvert) … is not represented in the proposed scenario modelling."*

3.7.2 For the Application the single portal culvert to the west of the River Alde Crossing (**Plate 3.19** in **section 3.6**) was not represented in the model on the basis that the purpose of the culvert was for a farm access track outside of the 100-year present day baseline flood extent. It was therefore acknowledged that within higher flow scenarios including climate change, where the flood extents and depths are much greater, this culvert may be important in the conveyance of the flood waters.

3.7.3 As the culvert is part of the development, the sensitivity test was run for the with scheme model schematisation only for the 1,000-year plus 35% climate change allowance, where it was expected that the flood extent might reach the culvert. Dimensions of the culvert were adopted the same as the portal culvert over the existing drain on the edge of the eastern floodplain, i.e. 5.4m wide and 3.0m high.

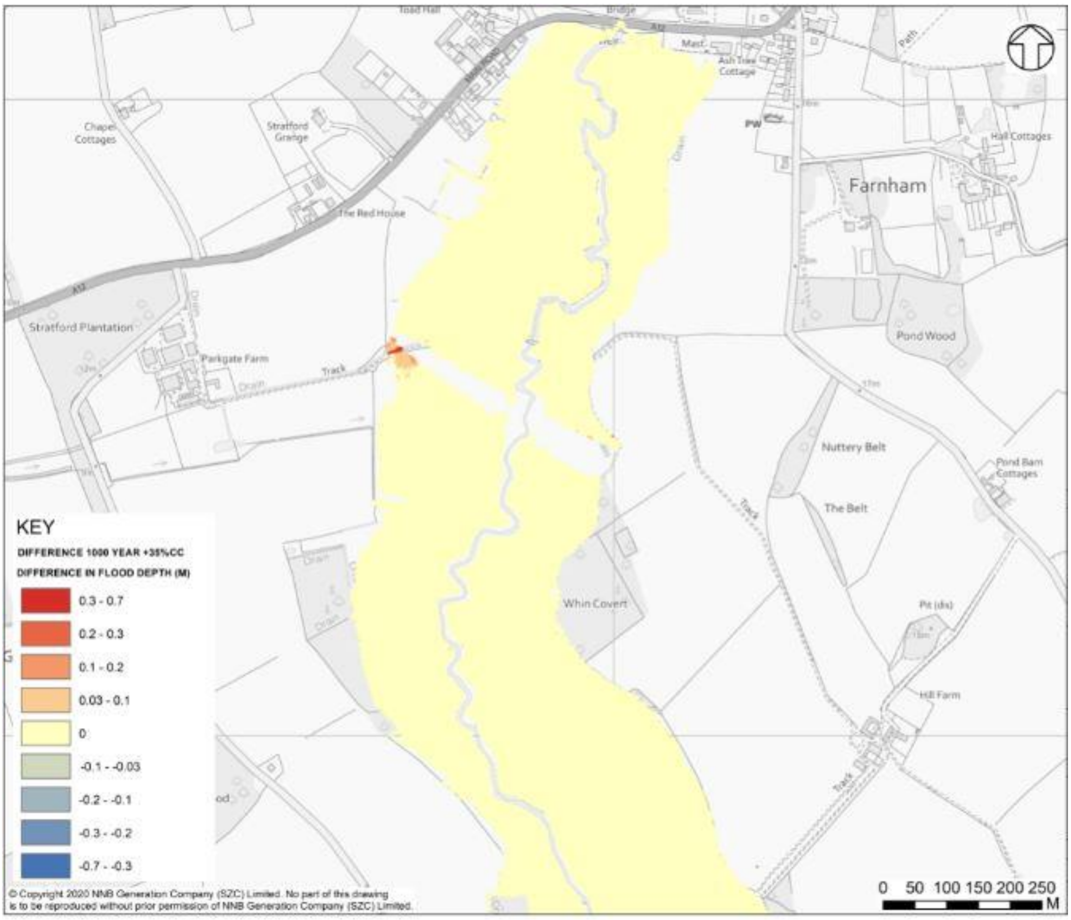
3.7.4 The model has some issues with instability, which were present when the model was obtained from the Environment Agency (Ref. 2). This instability relates to an error in the model at a node towards Gromford (a significant distance from the proposed development).

3.7.5 As a result, the plus 20% simulation stopped at 32 hours, however a review of the TUFLOW 2D Tmax grid showed that in the area of interest, at the proposed development and surrounding floodplain the results were a minimum of 7 hours passed their peak flood depth. It was therefore decided to use these truncated results given the unlikelihood of flood levels rising further in the simulation when inflows recede (results from other scenarios also show similar time of peak and generally one peak flood level).

3.7.6 **Plate 3.21** for the with scheme 1,000-year plus 35% climate change scenario, shows significant increases of up to 0.65m in the flood depths only in the particularly localised inlet area of the additional culvert. This is due to local increased flood extent as a result of the culvert passage.

3.7.7 Outside of the additional flood extent, flood depths remained unchanged.

Plate 3.21: Difference in maximum flood depth – 1 in 1,000-year event with 35% climate change allowance for additional culvert



3.7.8 The added existing culvert to the west of River Alde had a modelled peak flow of -0.679m^3/s, reflecting the flow from north of embankment to south of embankment, and a maximum flood level of 5.57mOD. For the 1D in-channel results in the vicinity of the crossing, the results showed no difference in flow or head.

3.7.9 Overall, results show no significant difference in maximum flood depth (2D) in the wider floodplain, or in the in-channel peak flow and stage (1D) as a result of the added culvert on the western embankment, as presented in **Figure 8**.

3.7.10 The difference between With Scheme and Baseline scenarios also remains unchanged from that which was reported in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] for the Application, showing overall the same localised impact of the proposed development.

4 IMPACT ON FARNHAM GAUGING STATION

4.1.1 Considering proximity of the Farnham gauging station to the proposed development and its importance in recording River Alde flow and level information, results of undertaken sensitivity tests were investigated to confirm potential impacts on the levels at the gauging station, these are summarised in **Table 4.1** for 1D model node Alde_07061u (located immediately upstream of the gauging station as shown in **Plate 3.1** in **section 3.1**).

Table 4.1: Difference in maximum stage at Alde_07061u between with scheme and baseline for the sensitivity tests

Sensitivity Test	Difference in max level (m)
Tidal Boundary Uplift 2030	-0.01
Tidal Boundary Uplift 2140	-0.01
20% Increased Roughness	-0.01
20% Decreased Roughness	-0.02
Stability Patch	-0.01
Filled Drains	-0.01
Blockage	0.00
Additional Culvert	0.00

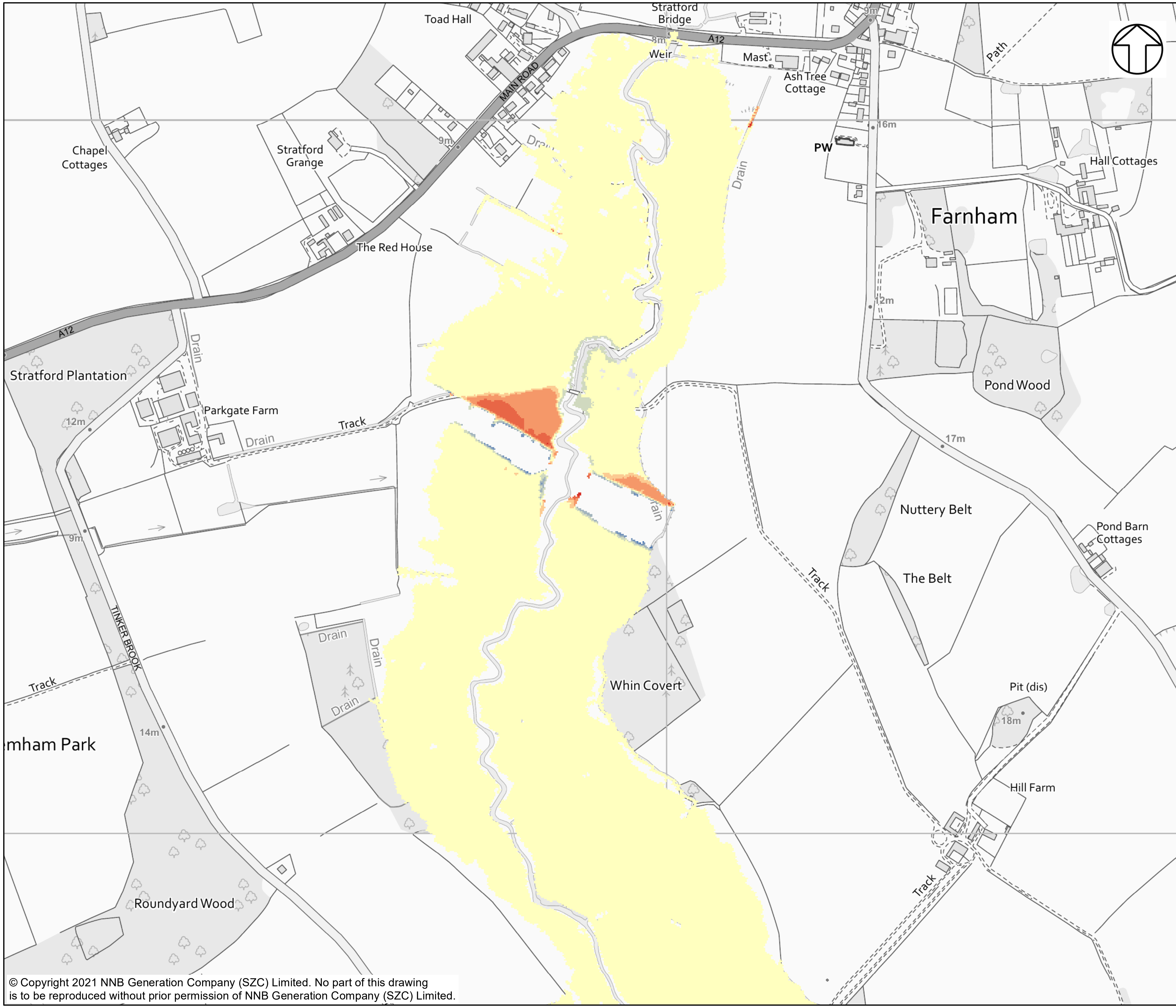
4.1.2 Results show that change in peak level at the Farnham gauging station is up to 0.07m which is in line with results presented in the Application in the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120] and is considered to be within model tolerance. The only scenario where the difference is greater is the decreased roughness test, however it should be noted that overall decreased roughness had quite a sizeable impact on the baseline results. The complexity of the weir structure (which behaves differently under lower and higher flow velocities) also contributes to the emphasized overall change in maximum flood levels at that location.

4.1.3 In line with the conclusion of the **Appendix A: Two Village Bypass Modelling Report** (Doc Ref. 5.5) [APP-120], the overall impact of the development on flood levels at the gauging station, with the sensitivity tests is considered negligible.

REFERENCES

1. Environment Agency – Flood Risk Assessments: Climate Change Allowances, July 2020. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#history

2. Environment Agency, Fluvial Alde, Ore and Fromus ISIS-TUFLOW model, Final Report. JBA. March 2012



NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
- 0.2 - 0.3
- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 25% CLIMATE CHANGE
2030 TIDAL BOUNDARY UPLIFTS

DRAWING NO:
FIGURE 1

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JAN 2021	E.H.	1:5,000 @A3	2.0

SCALE BAR
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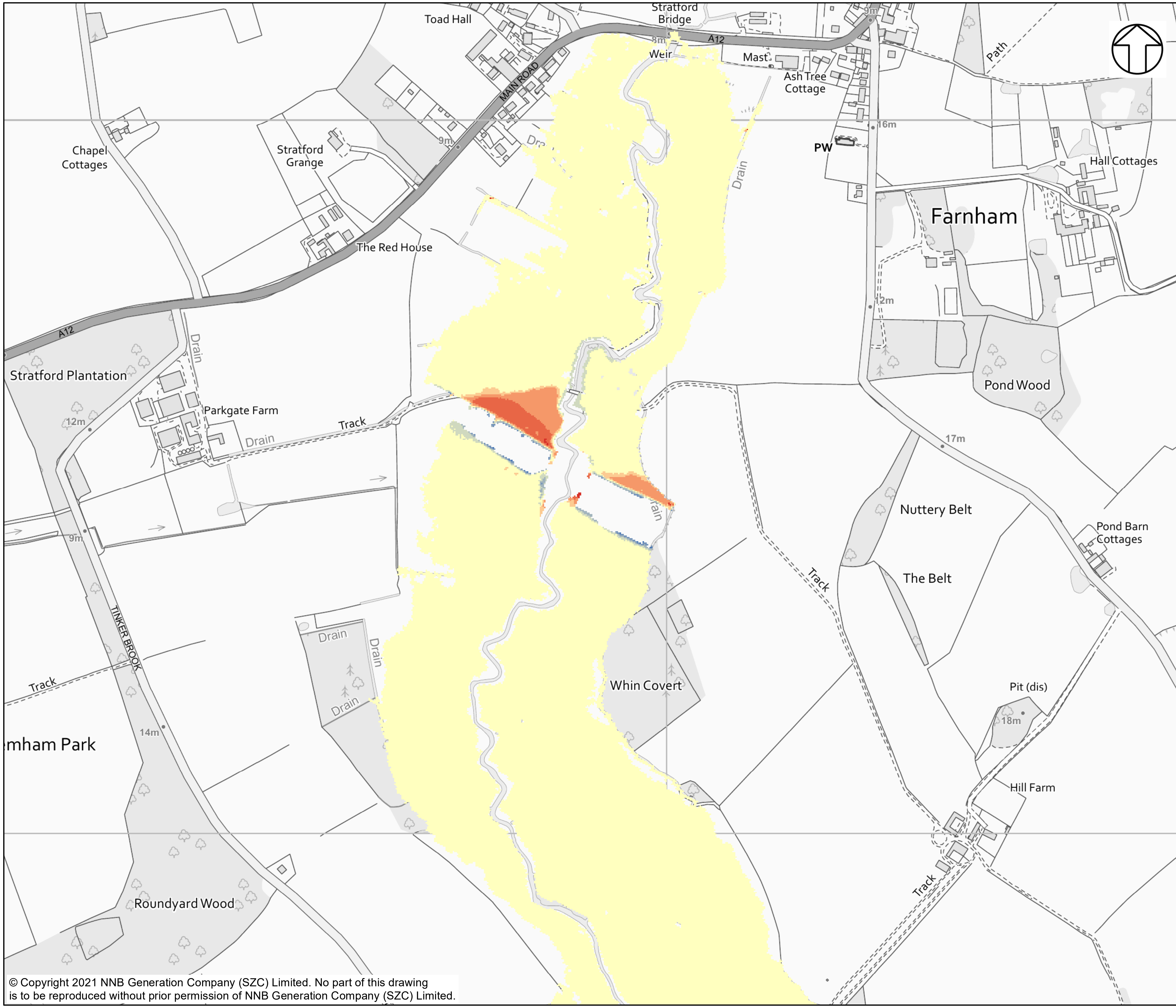

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
- 0.2 - 0.3
- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
2140 TIDAL BOUNDARY UPLIFTS

DRAWING NO:
FIGURE 2

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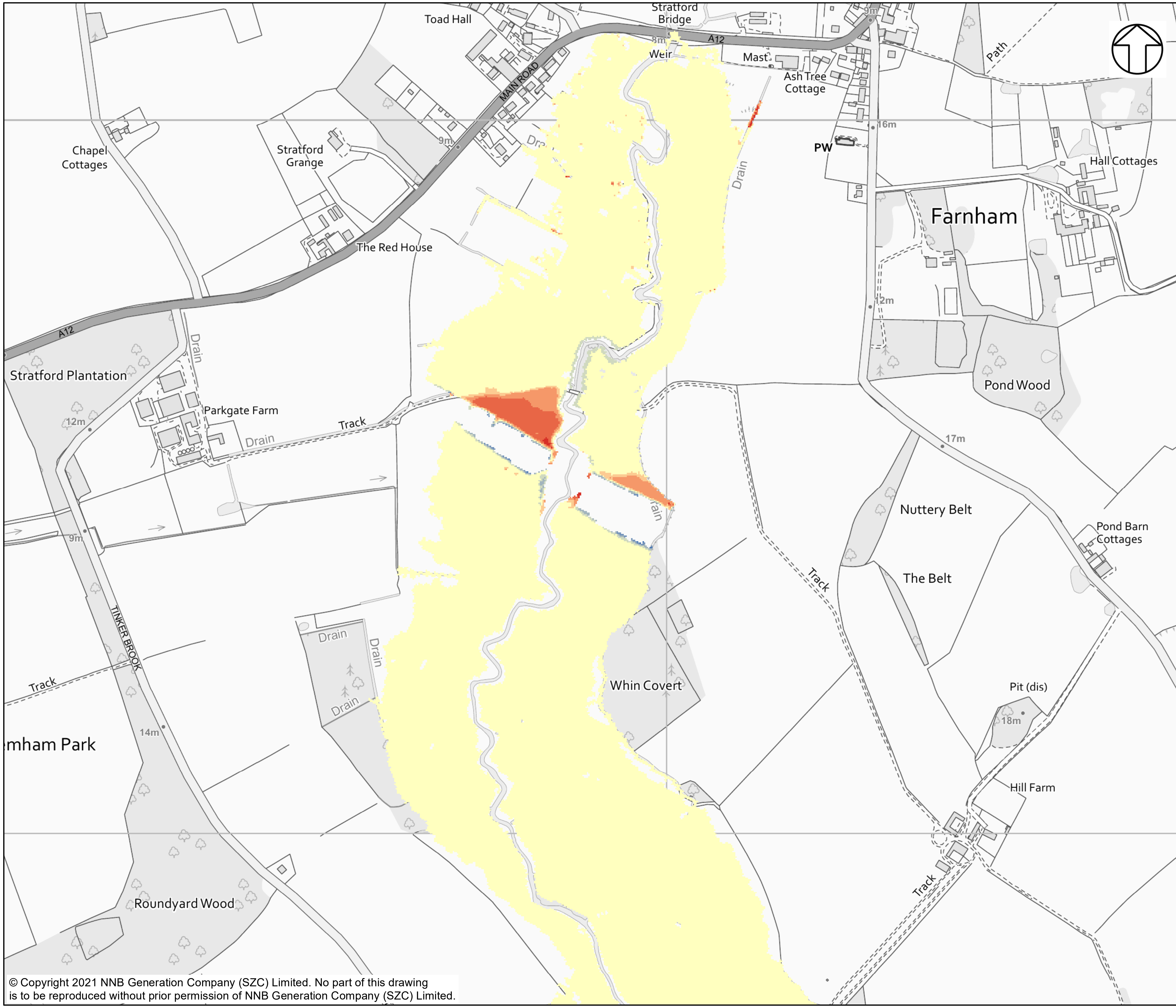

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
- 0.2 - 0.3
- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
MINUS 20% ROUGHNESS

DRAWING NO:
FIGURE 3

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	E.H.	1:5,000 @A3	2.0

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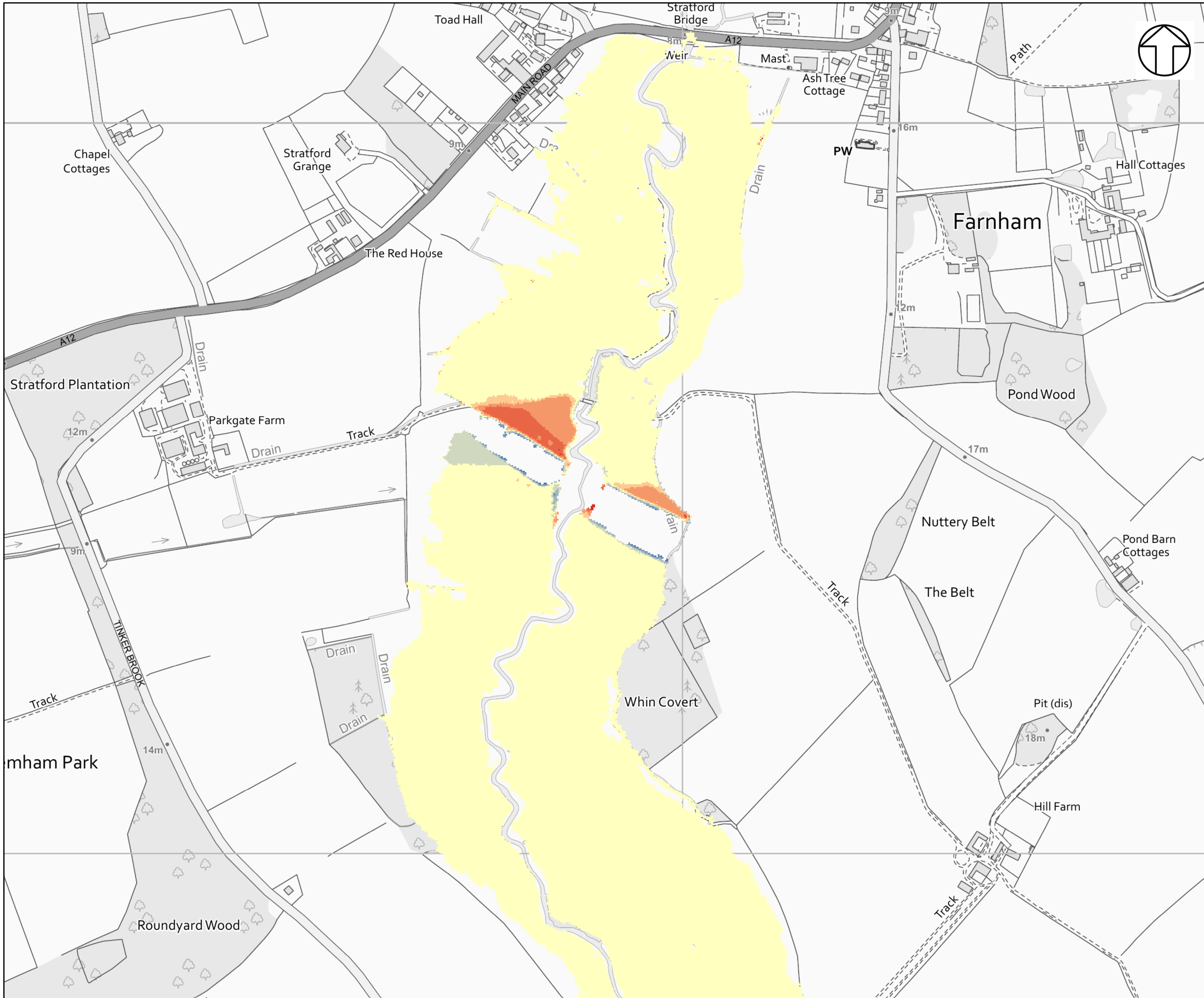

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
- 0.2 - 0.3
- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
PLUS 20% ROUGHNESS

DRAWING NO:
FIGURE 4

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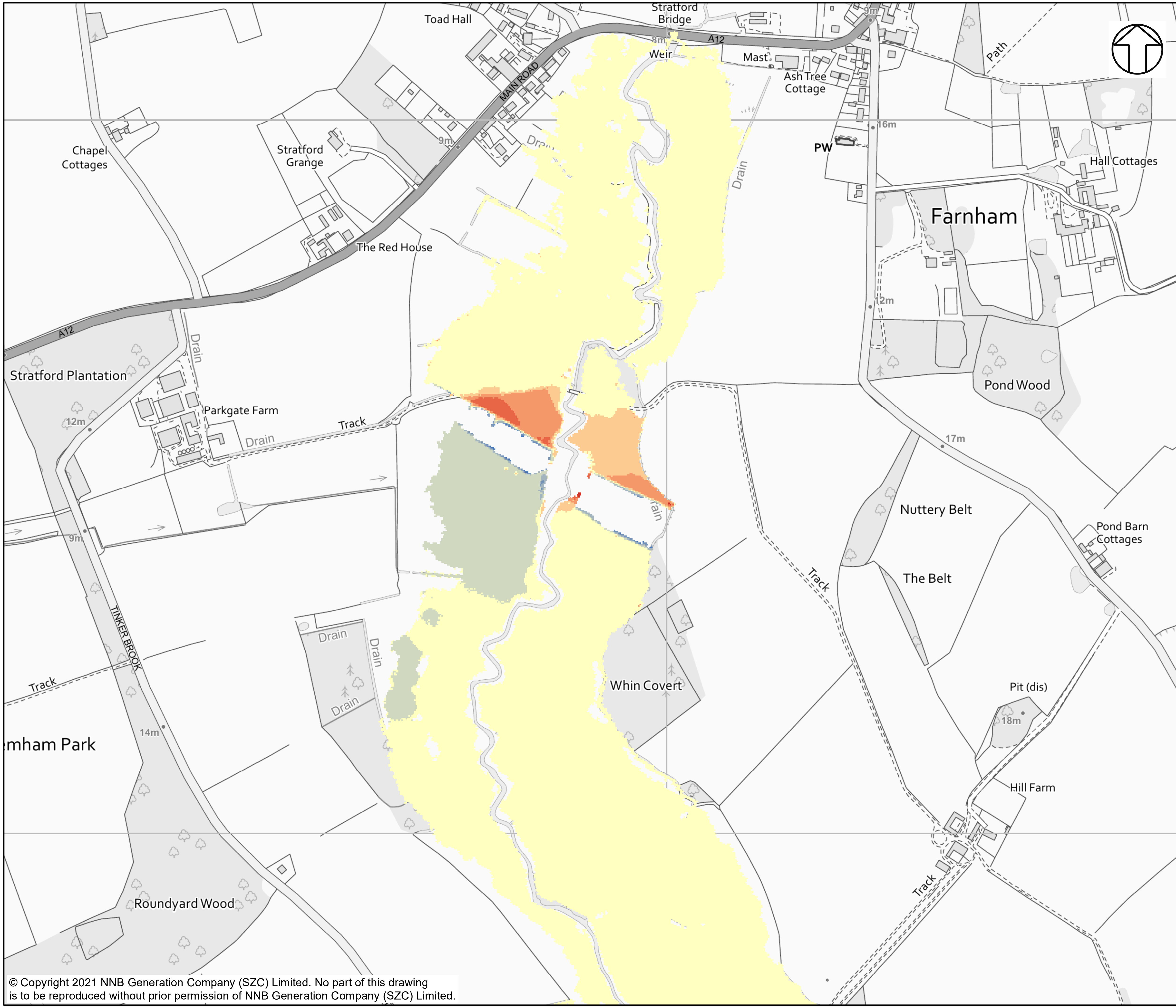

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

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- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
STABILITY PATCH

DRAWING NO:
FIGURE 5

DATE:	DRAWN:	SCALE :	REVISION:
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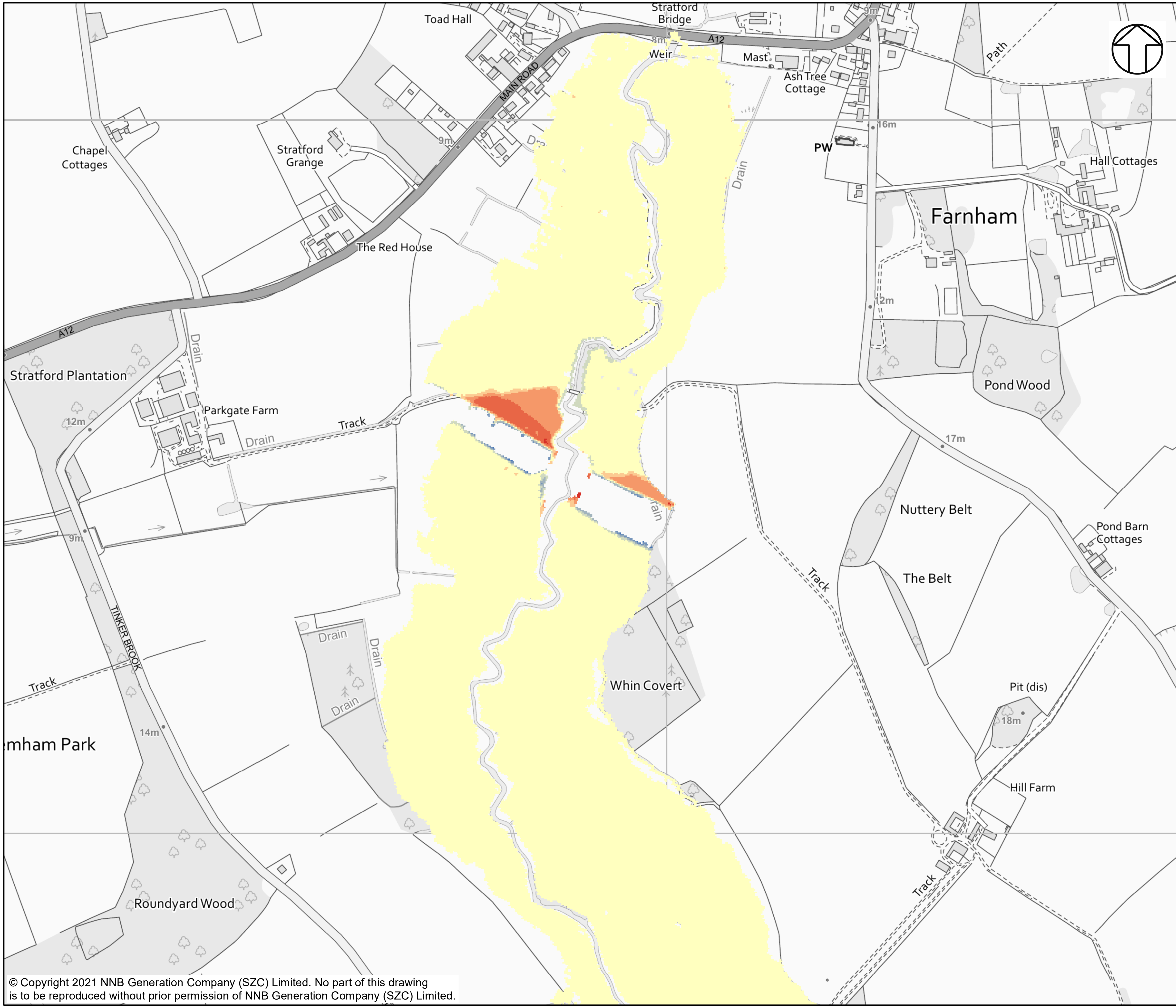

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

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- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
FILLED DRAINS

DRAWING NO:
FIGURE 6

DATE:	DRAWN:	SCALE :	REVISION:
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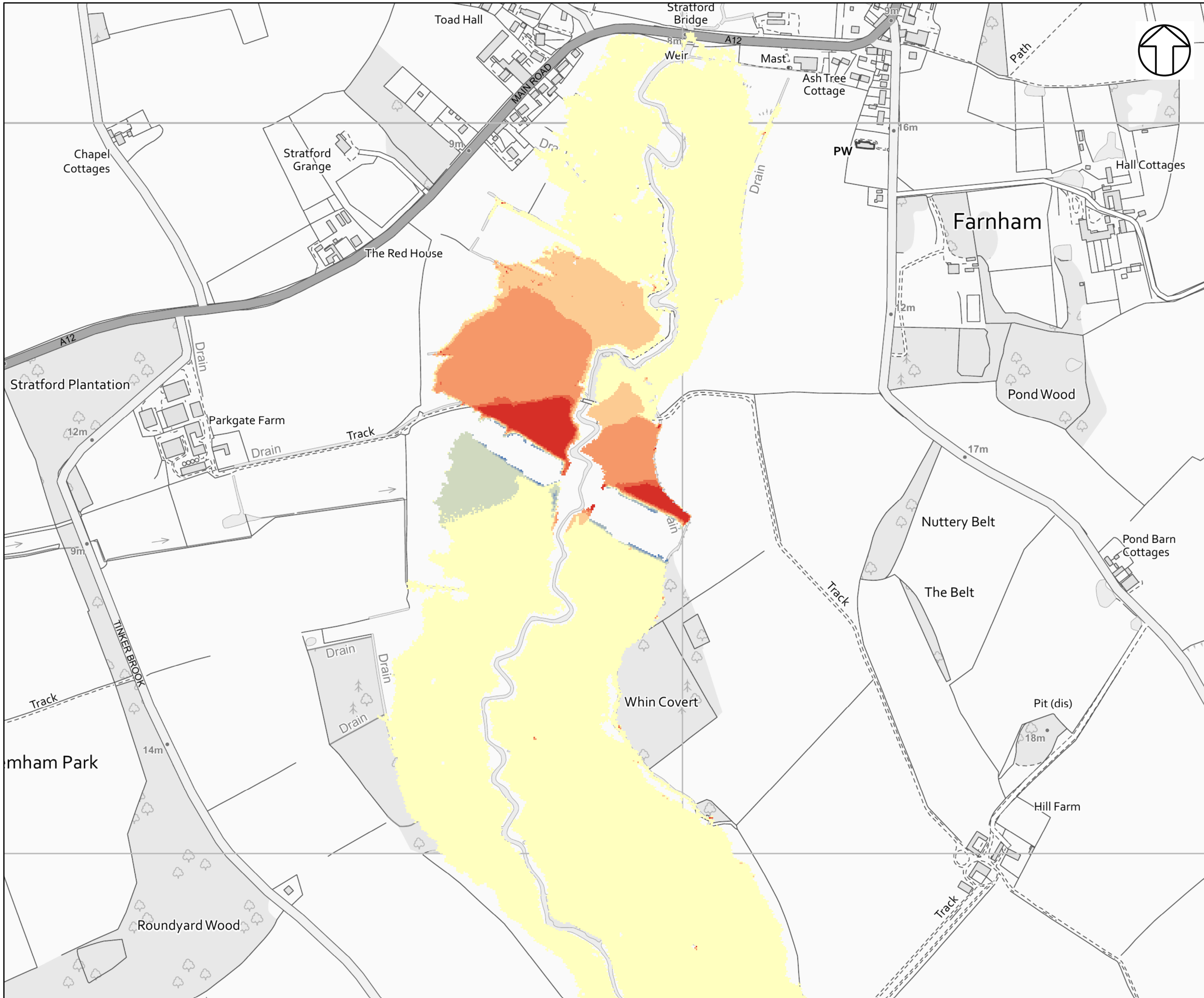

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
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- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

NOT PROTECTIVELY MARKED

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DOCUMENT:
SIZEWELL C
TWO VILLAGE BYPASS
MODELLING REPORT UDATE
BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 100 YEAR + 35% CLIMATE CHANGE
BLOCKAGE

DRAWING NO:
FIGURE 7

DATE:	DRAWN:	SCALE :	REVISION:
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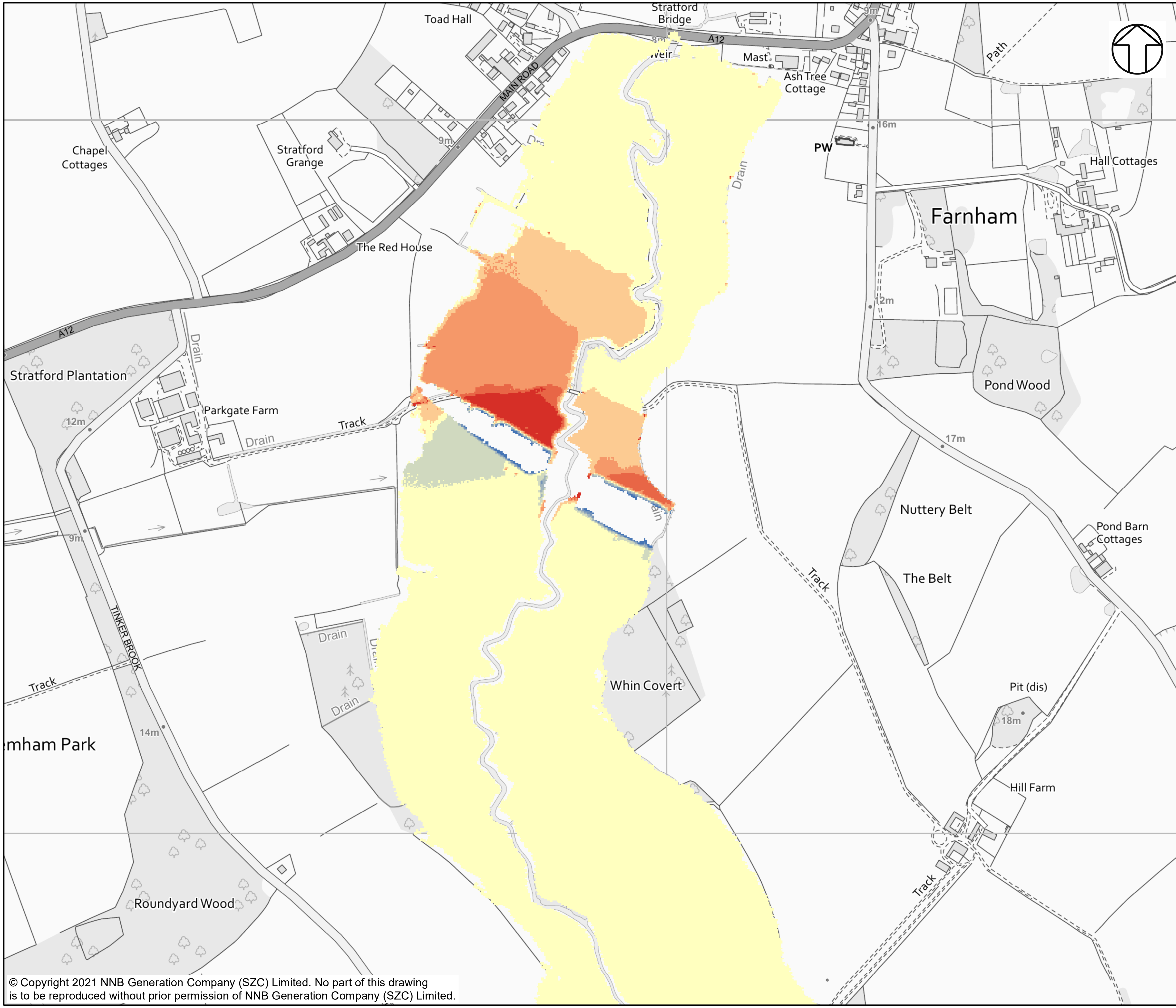

NOTES

KEY

DIFFERENCE IN FLOOD DEPTHS (M)

- 0.3 - 2
- 0.2 - 0.3
- 0.1 - 0.2
- 0.03 - 0.1
- 0
- -0.1 - -0.03
- -0.2 - -0.1
- -0.3 - -0.2
- -2.5 - -0.3

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BOOK 5 - 5.5
APPENDIX A
DIFFERENCE PLATES

DRAWING TITLE:
DIFFERENCE IN FLOOD DEPTHS (M)
FOR 1 IN 1000 YEAR + 35% CLIMATE CHANGE
ADDITIONAL CULVERT

DRAWING NO:
FIGURE 8

DATE:	DRAWN:	SCALE :	REVISION:
JAN 2021	E.H.	1:5,000 @A3	2.0

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APPENDIX D: TWO VILLAGE BYPASS FLOOD RISK EMERGENCY PLAN

CONTENTS

TABLES

PLATES

1 INTRODUCTION

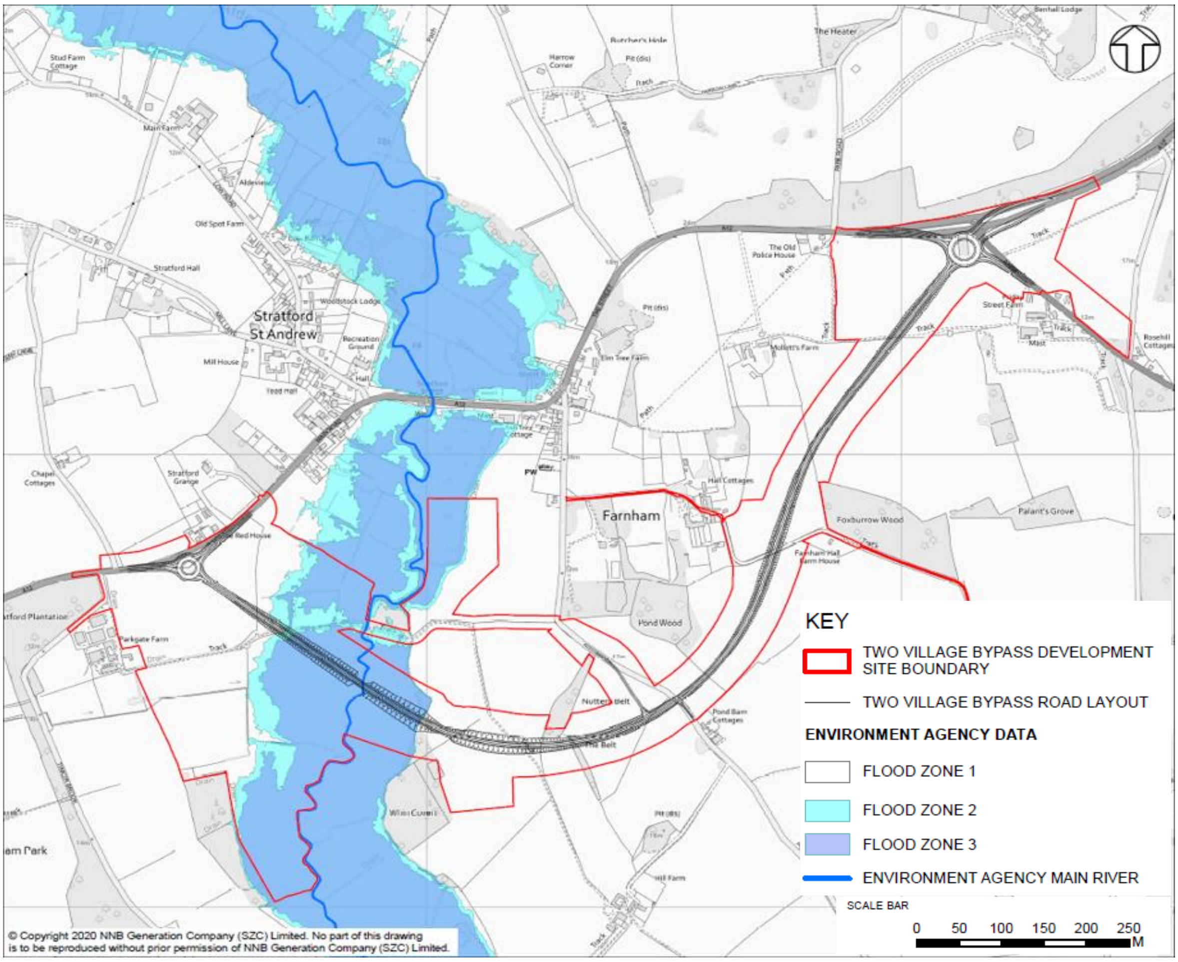
1.1 Background

1.1.1 The nature and scale of the Sizewell C Project (the 'Project') is such that the proposed development requires a number of associated development sites to facilitate the construction of the new nuclear power station.

1.1.2 One of the associated developments is the proposed two village bypass, which will be used during the construction phase of the Sizewell C main development site to facilitate the transport of construction workers and goods vehicles delivering freight to the Sizewell C main development site. Upon completion of the two village bypass it will also be open to the public for longer-term use.

1.1.3 The **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119] was submitted as part of the Development Consent Order application (the 'Application'). This assessment identified that, based on the Environment Agency Flood Map for Planning (Ref.1), parts of the proposed two village bypass are required to cross Flood Zone 2 and Flood Zone 3 as it passes over the River Alde (**Plate 1.1**).

Plate 1.1: Two Village Bypass with Environment Agency Flood Zone Map



1.2 Requirement for a Flood Risk Emergency Plan

a) Policy background

1.2.1 The National Planning Policy Framework (NPPF) (Ref.2) and associated Planning Practice Guidance (PPG) (Ref.3) note that there is a need for applicants to demonstrate that a proposed development will be safe and that people will not be exposed to hazardous flooding from any source.

1.2.2 A flood risk emergency plan (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.4) 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.

b) Site-specific requirement for a FREP

1.2.4 During the construction works for the proposed two village bypass there will be a need to work within Flood Zones 2 and 3 to facilitate the construction of the raised embankments across the floodplain and the bridge crossing over the River Alde. As this work will be taking place in areas at increased flood risk, a FREP is therefore required to manage residual flood risk and ensure the preparedness of construction personnel in the event of a flood emergency.

1.2.5 The **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119] noted that the future fluvial modelled water levels for the 1 in 100 year event with 65% climate change allowance is 5.08m AOD (metres above ordnance datum) and the 1 in 1,000-year event with 65% climate change allowance water level is 5.27m AOD. The proposed two village bypass has a minimum carriageway level of 9.7m AOD through the River Alde floodplain, rising to 12.2 – 12.6m AOD on the bridge crossing and continuing to rise to a higher elevation towards the east.

1.2.6 Based on the above, it is noted that the proposed two village bypass has been designed such that it is elevated above the River Alde and its adjacent floodplain, ensuring safe and dry access can be provided during flood events that occur once the road is operational. Therefore, a FREP for the operational phase is not required as flooding is unlikely to impact the two village bypass once construction is complete. This FREP will therefore focus on the construction phase only.

1.3 Aim of the FREP

1.3.1 The key aim of the FREP is to provide both the regulators and the construction contractor 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.4), 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; and
- every three months, to confirm all the information is still relevant.

1.4.3 The initial FREP should be approved by the Local Planning Authority. All subsequent updates and reviews of the FREP shall be documented and recorded and it will be the responsibility of the construction contractor to ensure that an up-to-date version of the FREP is available at all times during the construction phase.

1.4.4 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 proposed two village bypass would be located to the south of the villages of Stratford St Andrew and Farnham, effectively bypassing both, linking the A12 Main Road to the west with Friday Street to the east.

2.1.2 The proposed two village bypass would be located approximately 4km to the south of Saxmundham and approximately 11.5km to the west of the Sizewell C main development site.

2.1.3 The two village bypass would cross the River Alde via a 60m long bridge. Either side of the River Alde, the proposed two village bypass would cross over the floodplain of the River Alde, in Flood Zones 2 and 3, as shown in **Plate 1.1**.

2.2 Existing Environment

2.2.1 The proposed location of the two village bypass is predominately comprised of agricultural land. The route of the two village bypass would depart from the A12 to the south-west of Stratford St. Andrew before re-joining the A12 to the east of Farnham. Over the course of the route, from west to east, the proposed two village bypass would cross the River Alde and the associated floodplain and then an unnamed road to the north of Pond Barn Cottages. The proposed two village bypass would also cross four tracks.

2.2.2 From west to east, the route of the proposed two village bypass slopes from an elevation of approximately 10m AOD at the current A12 down towards the River Alde floodplain, where the lowest ground elevation is approximately 4.4m AOD.

2.2.3 The elevation then increases eastwards from the River Alde, reaching its maximum elevation of approximately 26m AOD at the crest of the hill, where the proposed route bends to the north.

2.2.4 The elevation along the proposed route then lowers to approximately 17m AOD, where the proposed roundabout would reconnect with the A12 and A1094.

2.3 Proposed Development

a) General description

2.3.1 The proposed two village bypass would create a new transport route around the south of Stratford St. Andrew and Farnham. Once constructed and operational it is proposed that the two village bypass would form a new permanent section of the A12 for long-term public use.

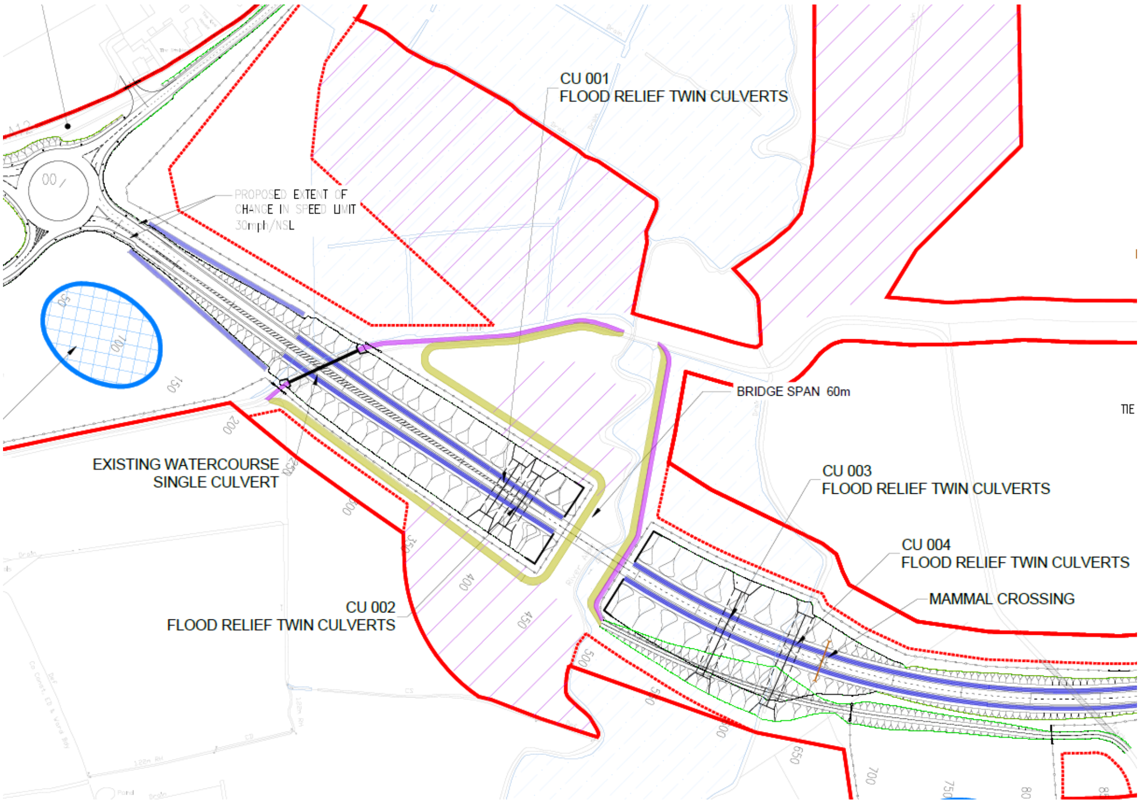
2.3.2 The proposed two village bypass would comprise a new single carriageway, approximately 2.4km in length and 7.3m in width, with additional 1m hard strips and 2.5m grassed verges. Swales approximately 3 – 3.5m wide are also proposed alongside the road for the length of the proposed two village bypass for highway drainage, excluding the extent passing over the River Alde.

2.3.3 The crossing of the River Alde by the proposed two village bypass has been designed to ensure that in-channel river flows, geomorphology and floodplain flows are not impeded.

2.3.4 The proposed two village bypass crosses the floodplain for the River Alde on a raised embankment. To facilitate the river crossing, a 60m bridge with two support pillars is proposed across the River Alde. Further to this, eight large culverts (5.4m wide by 3m high) are to be provided, four on each side of the River Alde to enable floodplain conveyance during a flood event (**Plate 2.1**).

2.3.5 There are no permanent buildings other than the road infrastructure proposed as part of the two village bypass.

Plate 2.1: Extract from EDF Energy Two Village Bypass Drawing: SZC-SZ0204-XX-000-DRW-100038 P19 Showing Bridge and Embankments



b) Temporary contractor compounds

2.3.6 It is envisaged that all construction works would be managed from a temporary contractor compound proposed at the eastern end of the bypass, west of the A12 / A1094 (Friday Street) roundabout. A secondary temporary contractor compound would act as a satellite compound at the western end of the proposed bypass, adjacent to the roundabout off the A12, to assist in the construction of the River Alde overbridge.

2.3.7 The temporary contractor compounds would be used as the base to manage works on the site, and depending on the nature and extent of the works, the temporary contractor compounds are likely to include:

- Office and welfare facilities for staff and operatives;
- Parking for staff and operatives;
- Secure storage of construction plant;
- Laydown and storage of materials and components prior to installation and use;

- Secure storage containers for weather-sensitive and high-value materials (e.g. signalling equipment); and
- Safe turning space for vehicles and plant.

2.3.8 The secondary compound at the western end of the bypass would primarily be used for storage of materials associated with the construction of the River Alde overbridge. It is likely to include satellite welfare facilities, as the main site facilities will be provided at the main, eastern compound.

2.3.9 The locations for both of the temporary contractor compounds are in Flood Zone 1 and therefore the risk of them being impacted by flooding is low.

c) Temporary access and crossing

2.3.10 A dedicated access track would be constructed to facilitate access to the construction works for the bridge crossing over the River Alde. The access track would provide connectivity for all areas of the structure to include abutments and piers. This access track would allow piling equipment and machinery to access all areas of the structure.

2.3.11 A temporary Bailey bridge would be installed to span the channel crossing. The temporary Bailey bridge would assist with the movement of materials and labour during construction, over the River Alde.

d) Construction sequencing and duration

2.3.12 It is expected that construction work for the proposed two village bypass would take up to 24 months to complete, during the early years of the construction of the Sizewell C Project. **Plate 2.2** illustrates the anticipated construction sequence.

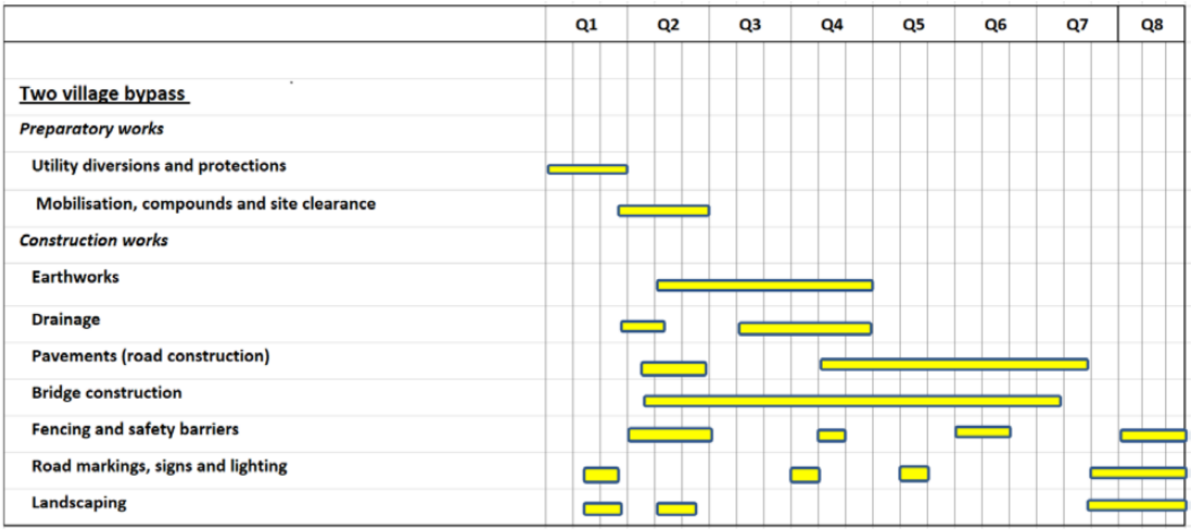
2.3.13 It is envisaged that the construction of the proposed two village bypass would start at the north eastern end of the bypass, at the A12 / A1094 (Friday Street) junction where a roundabout is proposed. It would then move in a south-westerly direction along the two village bypass route to the proposed roundabout north of Parkgate Farm.

2.3.14 The anticipated construction sequence would be:

- preparatory works: site set up and clearance, including trees and hedgerows, the erection of temporary fencing on land required for construction and the creation of alternative access arrangements and rights of way, setting up of the temporary contractor compounds including security, welfare facilities, and temporary utilities;

- construction works: earthworks, road construction and surfacing, breaking of hardstanding, construction of bridges and civil structures (including piling), utility and drainage installation, construction of pavements, kerbs, footways and paved areas, installation of permanent fencing, road signs and marking, and road lighting, permanent connections to existing road networks, and landscaping.

Plate 2.2: Anticipated Construction Sequence



2.3.15 It is anticipated that throughout the construction phase, access to the temporary contactor compounds would need to be maintained and there would be some periods of 24/7 working in order to deliver key activities within the construction programme.

2.3.16 In terms of phasing for the River Alde bridge crossing, it is anticipated that both abutments would be built simultaneously, with work crews alternating between the two abutments. Similarly, the piers would be constructed and completed prior to the completion of each abutment. It is anticipated that the road embankments would be constructed towards each of the abutments with the final tie-in to the abutment undertaken once the abutment construction is completed.

2.3.17 It is proposed that cranes and piling machinery would be used during construction and these would operate from the footprint of the river bank / adjacent land. The only requirement for access within the channel would be for a boat for emergency situations i.e. should a worker fall into the channel during construction. As such, it is anticipated that there would be no requirement for construction workers to be within the river channel.

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 proposed two village bypass and submitted as part of the DCO Application. The **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119] confirmed that whilst the two village bypass is generally at low risk of flooding from all sources, where the road is required to pass over the River Alde it is at risk of flooding from fluvial sources, comprising the River Alde and its associated floodplain.

3.1.2 As set out previously, the future modelled water levels for the 1 in 100-year event with 65% climate change allowance is 5.08m AOD and the 1 in 1,000-year event with 65% climate change allowance water level is 5.27m AOD.

b) Hazard mapping

3.1.3 A review of the flood risk in the vicinity of the River Alde and its associated floodplain was carried out within the **Two Village Bypass Flood Risk Assessment** (Doc Ref. 5.5) [APP-119]. This identified that modelled water depths for the baseline scenario were approximately 0.3m and 0.4m for the 1 in 100-year event with 35% and 65% climate change, respectively, and 0.6m for the 1 in 1,000-year event with 65% climate change.

3.1.4 For the with scheme scenario the modelled water depths, in the vicinity of the River Alde crossing, were modelled as being approximately 0.5m and 0.6m for the 1 in 100-year event with 35% and 65% climate change, respectively, and 0.9m for the 1 in 1,000-year event with 65% climate change respectively.

3.1.5 Flood hazard mapping has been derived for the 'with scheme' 1 in 100-year plus 35% for climate change (**Plate 3.1**) and the 1 in 1,000 year plus 35% for climate change (**Plate 3.2**) scenarios, respectively. 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 3.1: Flood Hazard Map for the 'with scheme' 1 in 100 year plus 35% climate change allowance

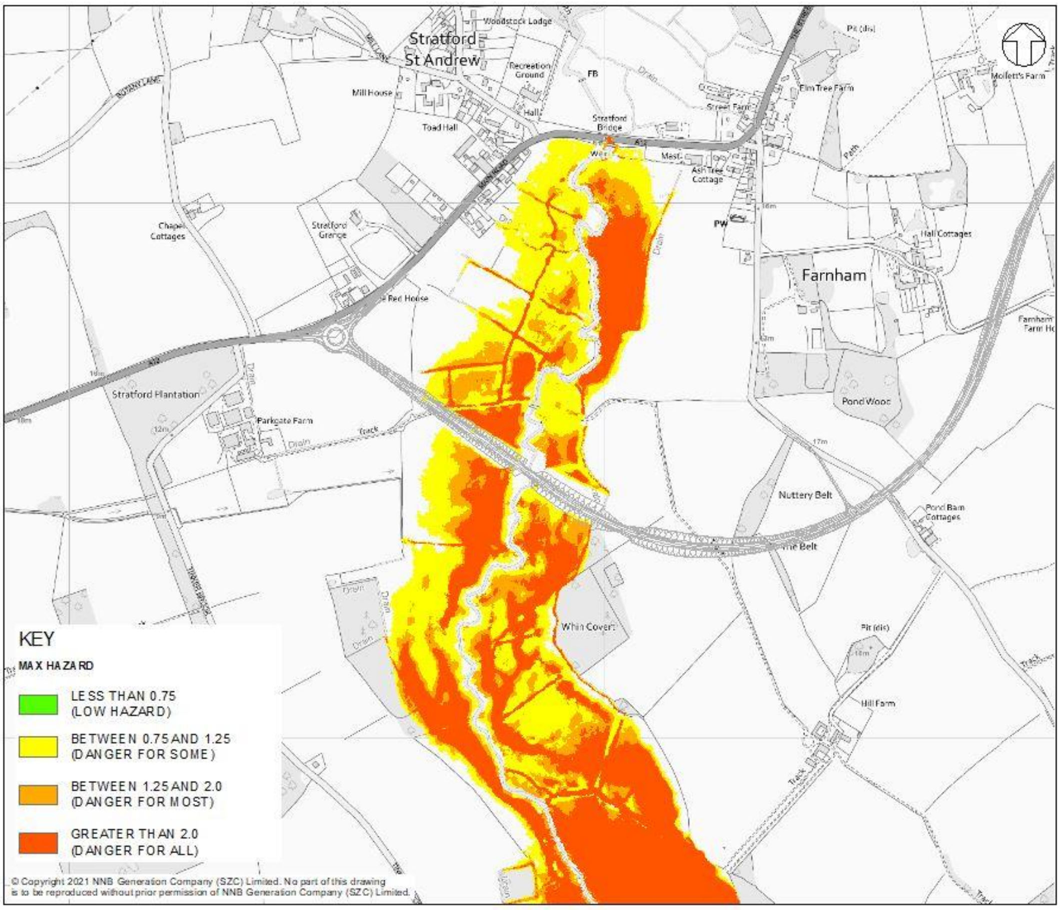
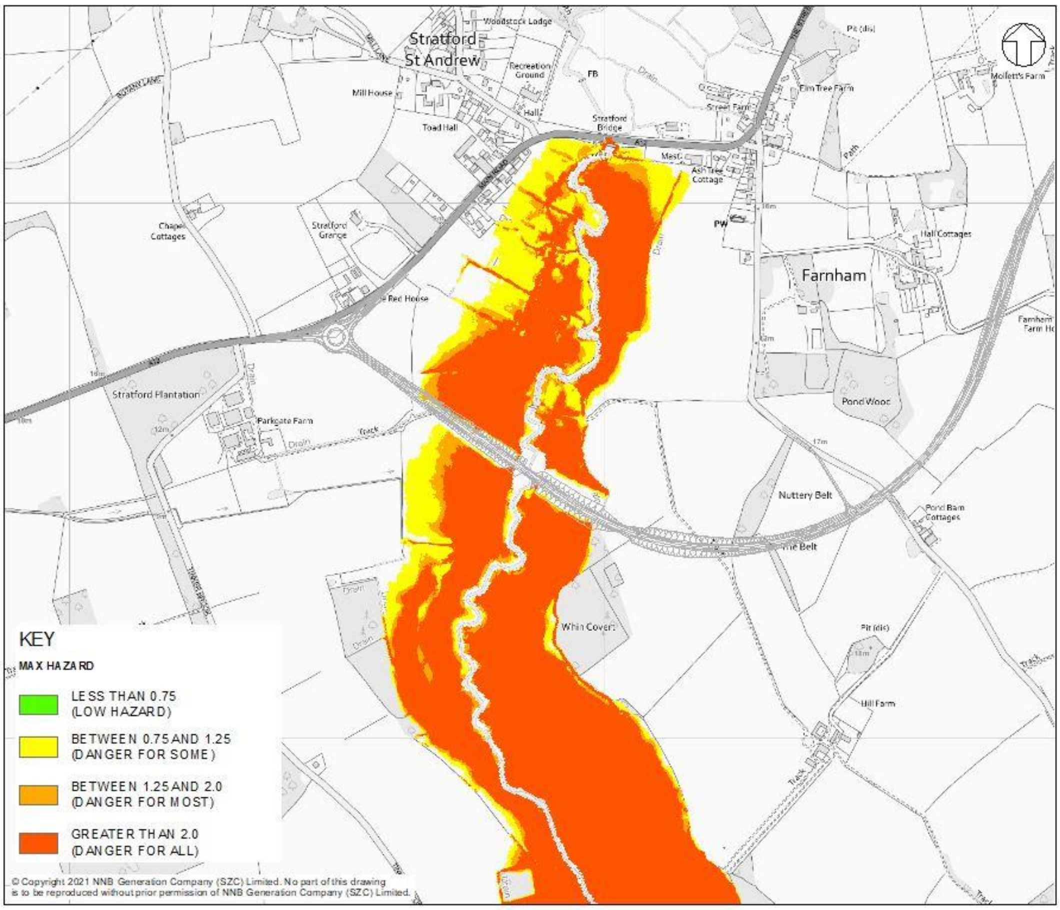


Plate 3.2: Flood Hazard Map for the 1 in 1,000 year plus 35% climate change allowance



3.1.6 Where the above scenarios include future climate change allowances, this comprises a conservative approach to the assessment of flood risk as construction works are scheduled to take up to 24 months, commencing early in the construction programme.

3.1.7 It is acknowledged that should a flood event occur the hazard mapping indicates that there is a risk to construction workers that ranges from 'Danger for Some' to locations in the floodplain where there is likely to be 'Danger for All'.

c) Embedded design measures

3.1.8 To avoid the potential risk of flooding to users in the future the design of the two village bypass has been developed such that it is elevated above the likely flood levels during an extreme flood event once operational.

3.1.9 During construction it is anticipated that works along the route of the two village bypass will be carried out primarily in Flood Zone 1. Where there is a requirement to work within Flood Zones 2 and 3, this is associated with the crossing over the River Alde and works will primarily be along the route of the proposed two village bypass and therefore will be elevated above potential flood levels, where possible.

3.1.10 To manage the impact of flood risk on the proposed development during the construction phase, measures to work outside the channel of the River Alde and outside the floodplain, where possible, have been identified.

3.1.11 There remains the potential for there to be a flood risk to construction workers during the construction phase when constructing the bridge crossing over the River Alde and the embankment for the two village bypass where it passes over the floodplain.

3.1.12 The remainder of this 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 two village bypass 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 bridge and 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 an appropriate designated evacuation point. The designated point should be located within Flood Zone 1.

3.3 Construction Phase: List of roles

a) Key Personnel

3.3.1 **Table 3-1** summaries 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
SZC Co. 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.
Contractor Construction Manager (prior to commencement of works)	This role is to ensure all the pre-occupation actions have been completed as well as to ensure that the FREP is reviewed and updated, ideally every three months.
Contractor 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. 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 the designated evacuation point location 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 proposed two village bypass 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 proposed two village bypass is located immediately upstream of a flood warning area, although just outside the area covered by the flood warning or flood alert. It is recommended that as the site for the bridge crossing over the River Alde is close to the boundary of this flood warning area, these warnings should be subscribed to and acted upon as appropriate, although the flood mechanism may differ to that at the construction site.

3.4.3 As there is a flood risk to the proposed construction works for the two village bypass it is acknowledged that they 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

3.4.4 In addition to the Environment Agency flood warning service it is recommended that the construction contractor 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

3.4.5 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, place staff on green alert (state of readiness) or issue a red alert (site evacuation).

d) Flood management and evacuation procedures

3.4.6 The proposed flood evacuation procedures are outlined in **Table 3.3**.

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 the River Alde or any other watercourse(s).
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. Review any temporary construction measures, both in the channel or on the floodplain e.g. cofferdams / sheet piles. Check the temporary flume pipes to ensure that flow can be maintained. 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.

Warning Trigger	Trigger Stage	Procedures
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.

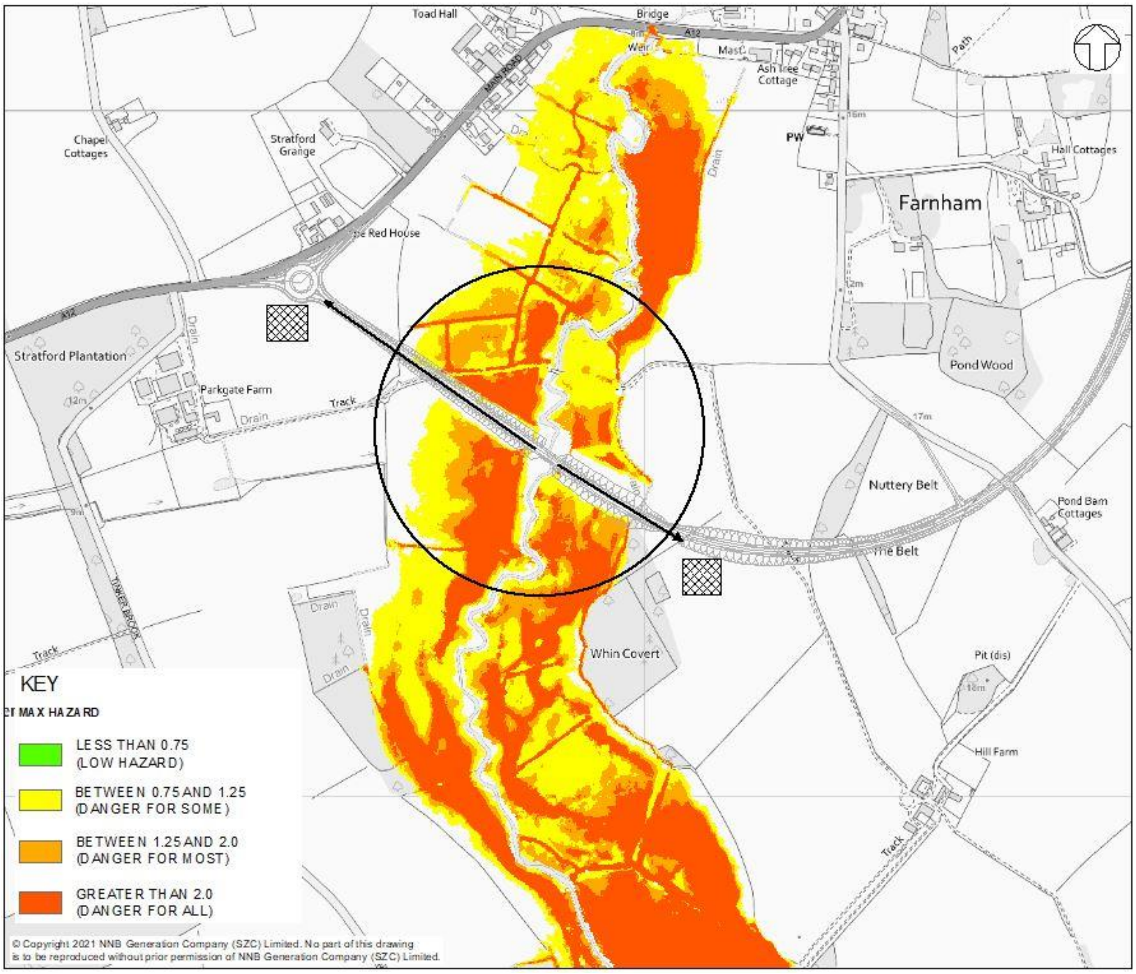
e) Evacuation routes and designated evacuation points

3.4.7 It is assumed that evacuation would be via the temporary access routes, along the route of the two village bypass, through Flood Zone 3 and 2 and into Flood Zone 1 away from the River Alde. Evacuation will be away from the watercourse towards two no. designated evacuation points at either the temporary contractor compound in Flood Zone 1 to the west or another appropriate location to the east of the River Alde.

3.4.8 Access and egress will be along the proposed carriageway, which will also act as the temporary access route, and is set above the modelled flood levels for the design event. Therefore, the road has been designed to provide safe and dry access. The temporary access route will be installed in the early stages of the construction of the River Alde crossing. The indicative evacuation route is shown in **Plate 3.3**.

3.4.9 These details will be confirmed with the construction contractor for the proposed two village bypass prior to commencement of construction.

Plate 3.3: Proposed evacuation route during a flooding event, based on flood hazard mapping for the 1 in 100 year plus 35% climate change allowance event



3.5 Construction Phase: Post-Event

3.5.1 In the event of a severe flood warning or a red weather warning and the construction works at the proposed two village bypass being put into Red Alert, the site will not be re-occupied until either the Environment Agency or other relevant emergency services confirm it is safe to do so.

3.5.2 Before the site can be reoccupied a full visual assessment of condition / stage of the River Alde and the adjacent banks will be undertaken by a suitably qualified engineer, familiar with watercourse behaviour and bank stability. Any post-event clear up will be carried out, prior to construction works recommencing. Once it has been confirmed by the Contractor Construction Manager that the site has been made safe, any construction works, plant and material can return to the construction site.

3.5.3 As the temporary contractor compound(s) are to be located in Flood Zone 1 there are no proposed buildings located in either Flood Zones 2 or 3. On this basis, there is no post-event clear up needed for these elements.

3.6 Construction Phase: Training

3.6.1 During the construction phase a Flood Manager would be appointed by the construction contractor. The Flood Manager will ensure that all construction personnel are aware of the potential flood risk and of how to respond in the event of a flooding emergency. The training for construction personnel would, as a minimum, cover:

- Requirements of the Flood Warning and Evacuation Plan;
- Confirmation of key roles, identifying the positions held, individual responsibilities, communication and chain of command;
- Evacuation routes and evacuation points;
- Staff safety during a flood event;
- Electrical systems emergency shut off procedures, where appropriate; and
- Operation of communication / public address system, signage and traffic management systems.

3.6.2 Training will be provided to all construction staff as part of the site induction process and regularly reviewed throughout the construction process, as part of Tool Box talks and pre-task talks.

REFERENCES

1. Environment Agency. Flood Map for Planning. 2020. (Online) Available from: https://flood-map-for-planning.service.gov.uk/confirm-location?easting=635612&northing=258249&placeOrPostcode=IP130BJ

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

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