

Great Yarmouth Third River Crossing Order 202[*]

Document NCC/GY3RC/EX/064: Response to Written Submissions made by the Environment Agency at Deadline 5

Planning Act 2008

Infrastructure Planning

The Infrastructure Planning (Examination Procedure) Rules 2010

Planning Inspectorate Reference Number: TR010043

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Foreword

The Response to Written Submissions made by the Environment Agency at Deadline 5 relates to an application ('the Application') submitted by Norfolk County Council ('the Council' / 'the Applicant') to the Secretary of State for a Development Consent Order ('DCO') under the Planning Act 2008.

If made by the Secretary of State, the DCO would grant development consent for the construction, operation and maintenance of a new bascule bridge highway crossing of the River Yare in Great Yarmouth, and which is referred to in the Application as the Great Yarmouth Third River Crossing (or 'the Scheme').

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Glossary of Abbreviations and Defined Terms

DCO	Development Consent Order
dDCO	Draft Development Consent Order
FRA	Flood Risk Assessment, Appendix 12B to the Environmental Statement (Document Reference 6.2, Planning Inspectorate Reference APP-135)
Outline CoCP	Outline Code of Construction Practice
OS	Ordnance Survey
SFRA	Strategic Flood Risk Assessment
The Applicant	Norfolk County Council (in its capacity as Highway Authority and promoter of the Scheme).

1 Introduction

1.1 Purpose of this Report

- 1.1.1 This report, submitted for Deadline 6 of the Examination, contains the Applicant's responses to Written Submission made by the Environment Agency (REP5-011) at Deadline 5, 14th January 2020.
- 1.1.2 The report provides the Applicant's response to the issues raised by the Environment Agency, thereby providing a reference document for all interested parties and the Planning Inspectorate.

2 Environment Agency Response to Deadline 5

2.1 Key Issues and Applicant's Response

Key Issue

Further Sensitivity Modelling Overview

- 2.1.1 This representation summarises the review of the revised flood models that were submitted to the Environment Agency and available to view as of 10th December 2019; and the Flood Risk Assessment (FRA) as submitted to the ExA Ref: 6.2-Environmental Statement Appendix 12B which was partially updated by the memorandum referenced GY3RC- Environment Agency Further Sensitivity Flood Modelling (additional review comments) dated 28 November 2019. The additional information submitted does not appear to be available to view on the National Infrastructure Planning Application webpage. Whilst many of the conclusions of the FRA are reasonable and adequately evidenced, there are some areas of concern that remain.

Applicant's Response

- 2.1.2 Following the submission of its application for development the Applicant has continued to work with the Environment Agency on matters relating to flood risk. In response to technical queries raised by the Environment Agency, the Applicant has undertaken further sensitivity testing relating to flood risk to address technical queries raised by the Environment Agency. This further sensitivity testing and a supporting memorandum were submitted to the Environment Agency for review on 21st and 22nd October 2019.
- 2.1.3 Following the Environment Agency's initial review of the further sensitivity testing and the supporting memorandum, two additional technical queries raised by the Environment Agency were received by the Applicant on 13th November 2019. The Applicant responded to these two queries on 28th and 29th November 2019 through the provision of further sensitivity testing and a supporting memorandum. The supporting memorandum is included as Appendix A for clarification purposes.
- 2.1.4 The further sensitivity testing was carried out to address the technical queries of the Environment Agency to give it confidence that the Applicant's conclusion, reported in the Flood Risk Assessment (FRA) (Document Reference 6.2, Planning Inspectorate Reference APP-135) are robust. Neither of the two pieces of further sensitivity testing, nor the two explanatory memorandums alter the conclusions as to the significance of effect drawn or the mitigation measures set out in the Applicant's FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) submitted in support of the

DCO application. The Applicant considers the information presented in the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) is sufficient and consequently, the Applicant does not consider it to be necessary or appropriate to update the FRA to reflect the sensitivity testing.

- 2.1.5 Since the Written Submission made by the Environment Agency (REP5-011) at Deadline 5 the Applicant has continued to engage with the Environment Agency. A record of the continued engagement is provided in Table 2.1 of the Statement of Common Ground with the Environment Agency submitted at Deadline 6 of the Examination (Document Reference NCC/GY3RC/EX/067).

Key Issue

Tidal Residual (Breach) Risk

- 2.1.6 The effects of the tidal residual (breach) risk impacts to the site and offsite impacts have not been assessed in the FRA. The consideration of tidal residual (breach) is an important element in an FRA because in the event of defences being breached, the Inundation characteristics to the land, dwelling, and businesses located behind the defences could be altered or increased and impacts changed when compared to the current baseline. It is important to be able to assess if the proposed structure will have an effect on the behaviour of flood waters if this situation were to occur so that the impacts on third parties may be properly understood. It is possible that neither risk nor hazard level changes in the event of breach but, this has not been demonstrated. It is standard practice to assess breach risk and the issue of breach modelling was first raised in our discussions with Applicant's representatives in October 2018.
- 2.1.7 To adequately assess breach risk the Applicant should assess a number of breach locations on both banks of the River Yare and including locations upstream and downstream of the proposed development. These locations should be used to assess both the depth and hazard in the event of breach and then any changes that would result from the proposed development.

Applicant's Response

- 2.1.8 In preparing the Environmental Statement, of which the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) forms part, the Applicant has had regard to the relevant legislation, policy (national and local) and guidance. In respect of flood risk, this is reported in Appendix 12A of the Environmental Statement (Document Reference 6.2, Planning Inspectorate Reference APP-134).
- 2.1.9 Scheme-specific breach analysis was not carried out for the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) however, it does present the results for the 0.5% annual exceedance probability (AEP) and

0.1% AEP flood events (the 1 in 200 year and 1 in 1000-year flood events respectively) which over-top the existing flood defences.

2.1.10 For site specific breach assessments, it is normal to determine the appropriate location likely to produce the maximum hazard within the Principal Application Site. This may be the shortest distance from the Scheme to the defence, or it may be some other location where the defence type, ground level, or other factor may result in a more significant breach. The left and right bank of the River Yare in the vicinity of the Scheme are an appropriate location where a sudden breach would put sensitive receptors at risk. The Great Yarmouth Strategic Flood Risk Assessment (SFRA), November 2017 includes such points (locations 2 and 3 in Figure 7-5 of the SFRA). The results show that significant areas of Great Yarmouth town, including the Principal Application Site for the Scheme, are at risk should the coastal defences breach.

2.1.11 The Applicant notes that two of the SFRA breaches are relatively close (breach locations 2 and 3 in Figure 7-5 of the SFRA) and that the outline of the 0.5% AEP baseline events (Figure 12.5 of the FRA (Document Reference 6.3, Planning Inspectorate Reference APP-169)) envelopes the breach extents given in the SFRA. The impact of the Scheme on flow paths and other pertinent variables can be deduced from the 0.5% AEP over-topping flood extent reported in the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-134) as the length of defence overtopped covers the breach location and the receptors at risk coincide. The baseline 0.5% AEP flood depth map (Figure 12.3 of the FRA (Document Reference 6.3, Planning Inspectorate Reference APP-169)) indicates that flood water overtops the left and right banks of the flood defences in the vicinity of locations 2 and 3 and Figure 12.3 of the FRA therefore gives a reasonable indication of the receptors that would be at risk following a breach in the defences.

2.1.12 The Applicant considers that the available information on the implications of the Scheme for flood risk is sufficient, taken as a whole, to suggest that breach modelling would be unlikely to change the overall conclusions of the FRA (Document Reference 6.3, Planning Inspectorate Reference APP-169), and so the Environmental Statement, but the Applicant is prepared to consider the issue further with the Environment Agency to see if a common position can be reached.

2.1.13 The Applicant has included measures in the draft DCO (Document Reference NCC/GY3RC/EX/068) to manage flood risk during the construction and operation of the Scheme.

2.1.14 With regard to construction, Requirement 5 of the draft DCO (Document Reference NCC/GY3RC/EX/068) ensures that no part of the authorised construction activities will begin until the Flood Management Plan and the

Emergency Preparedness and Response Plan have been prepared in accordance with the Outline Code of Construction Practice (Outline CoCP) (Document Reference NCC/GY3RC/EX/073). The plans must be developed in consultation with Great Yarmouth Borough Council, the Lead Local Flood Authority, the Internal Drainage Board and the Environment Agency. The plans would be approved in writing by NCC as County Planning Authority.

- 2.1.15** With regard to operation, no part of the Scheme is to be opened to the public until an operational Emergency Preparedness and Response Plan, which includes guidance on how to prepare for and respond to a flood event, has been developed in consultation with Great Yarmouth Borough Council, Norfolk County Council, and the Environment Agency. The Plan would be approved in writing by the County Planning Authority. The Emergency Preparedness and Response Plan is pursuant to Requirement 10 of the draft DCO (Document Reference NCC/GY3RC/EX/068).

Key Issue

Identification of Flood Risk Receptors

- 2.1.16** Figure 12B.1 of the Appendix shows the flood risk receptors identified within the assessment study area. We have concerns that this figure appears to be missing a substantial amount of receptors that are relevant to the site. It is likely that a significant number of these missing receptors are dwelling properties. This issue was raised with the Applicant in April 2019. If this figure is showing the receptors that have been used in the FRA, then the Applicant will at least need to account for why significant numbers of receptors in areas close to the scheme are not accounted for and it may be necessary to re-assess those receptors.

Applicant's Response

- 2.1.17** As stated in section 6.2.24 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) receptors within Great Yarmouth have been classified using Ordnance Survey (OS) Address Base Data. This database classifies all properties based on the Local Land and Property Gazetteers and OS large-scale data. A summary of the receptors identified within the study area for this assessment is provided in Table 6.6 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).
- 2.1.18** Tables 6.10 and 6.12 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) give the significance of the impact at specific receptors and show that the Applicant has considered all residential properties within the study area.
- 2.1.19** The Applicant acknowledges the erratum in Figure 12B.1 in that it does not contain all receptors as noted by the Environment Agency. The Applicant can

confirm that all receptors contained in the OS Address Base Data were included in the modelling which underpins the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).

- 2.1.20 A corrected version of Figure 12B.1 without the erratum is included as Appendix B to this Written Submission.

Key Issues

Identification of Flood Risk to Dwellings

- 2.1.21 Notwithstanding the concerns regarding the identification of receptors, Sections 7.2.2 highlights that flood risk is increased to two properties by 0.13 metres depth in the present day 0.5% (1 in 200) annual exceedance probability event and by 0.07 metres depth in the 0.5% (1 in 200) annual exceedance probability, plus climate change event. Section 7.2.3 then states that it is impractical to provide mitigation to these properties. It states that the baseline flood depths in the area of these two properties is 0.5 metres deep and so would be flooding internally already and that the scheme does not increase the flood hazard to any properties.

Applicant's Response

- 2.1.22 The Applicant notes the Environment Agency's comments which are consistent with the findings of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135). The Applicant can confirm that the two properties in question are on Queen Anne's Drive. The sensitivity testing carried out by the Applicant (see Table 6.10 of the memorandum dated 28th November 2019 in Appendix A to this report) confirms the results of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) in terms of the overall significance of effect to these receptors.

Key Issues

Supporting Information in the Flood Risk Assessment

- 2.1.23 The FRA was submitted to the ExA before the additional modelling and sensitivity testing was undertaken. It is unknown whether the figures supporting the FRA referenced at the beginning of the response are still correct and applicable for use in determining the flood risk to the site and the surrounding off-site impacts. We have concerns as this memo covering the updated modelling shows changes in flood level and the memo states that "There are localised increases of 10mm compared to the values given in the Flood Risk Assessment".

Applicant's Response

- 2.1.24** The Applicant is satisfied, subject to the erratum correction to Figure 12B.1 discussed above, that the figures supporting the FRA I give an accurate representation of flood risk, which has been tested through the further sensitivity testing reported in Appendix A to this report.
- 2.1.25** The only differences arising from the sensitivity testing noted by the Applicant are to the north of the Scheme where the model domain was extended to respond to the queries raised by the Environment Agency. However, as noted in the memorandum issued to the Environment Agency 21st and 22nd October 2019 this did not alter the conclusions as to the significance of effects drawn in Section 6 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).
- 2.1.26** With regards to the localised in-channel increases of 10 mm just south of the Scheme, as noted in the further memorandum issued to the Environment Agency on 28th and 29th November 2019, this is as a result of the extended domain requested by the Environment Agency. The in-channel increase would result in the magnitude of the impact changing from negligible adverse to minor adverse and thus the significance of the effects would increase from neutral to slight (insignificant). The extended model domain tested does not alter the conclusions as to the significance of effect drawn in Section 6.2, as the effect remains not significant, or the mitigation set out in Section 7.2 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).

Key Issue

Safety Critical Operation of the Proposal in an Emergency Event

- 2.1.27** The FRA has assessed that the proposed development is deemed as "Safety Critical" and so should remain open / operational in an emergency event, as stated in section 3.1.4 of the FRA. However, section 7.2.7 of the FRA states that this is not achievable due to flooding of the access roads. Section 7.2.7 proposes that no part of the scheme is to be opened to the public during a tidal flood event, until an emergency preparedness and response plan is developed and approved.

Applicant's Response

- 2.1.28** The FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) reports that whilst the bridge deck is above the 0.1% AEP climate change flood level, the west and east approach roads to the bridge are predicted to flood during each of the climate change events modelled. The Applicant would comment that large parts of the town would be inundated for larger flood events such as 1 in 200 year and 1 in 1000-year flood events. This is not due to the Scheme as the Baseline flood depths already range

between 2.5m and 3m as stated in section 6.2.48 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).

2.1.29 Paragraph 7.2.7 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) discusses the need to seek the approval of the County Planning Authority, following consultation with the relevant bodies, of an emergency preparedness and response plan, before the Scheme is opened for public use, which is secured through requirement 10 of the draft DCO (Document Reference NCC/GY3RC/EX/068). The emergency preparedness and response plan is required to include provisions as to the actions and measures to be taken in relation to the authorised development to prepare for and respond to flood, fire or other security threats. The requirement ensures that procedures are in place to prepare and respond to such events, and, as is noted in paragraph 7.2.7 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135), as the major risk of flooding in Great Yarmouth is from tidal sources, which can be predicted 24 to 48 hours in advance, there would be time for event specific appropriate action to be taken to reduce risk to life and property.

Key Issue

Flood Management Plan

2.1.30 Section 8.1.3 states that a flood management plan specific to the construction phase will need to be prepared to ensure that measures are in place to minimise flood damage during a tidal flood event. We note that this is referenced in the Code of Construction Practice section 7 and that the DCO identifies that the Environment Agency is to be consulted on this document.

Applicant's Response

2.1.31 The appropriate flood risk mitigation measures are included Section 7.2 of the Outline CoCP (Document Reference NCC/GY3RC/EX/069), compliance with which is secured through Requirement 6 of the draft DCO (Document Reference NCC/GY3RC/EX/068).

2.1.32 One of these mitigation measures is the preparation of a flood management plan by the Contractor. This plan will include:

- A list of important contacts, including Floodline (or an equivalent system which provides real-time flooding information and preparation advice), Flood Risk Management Authorities, building services, suppliers and evacuation contacts for staff;
- A description or map showing locations of key property, protective materials and service shut-off points;
- Basic strategies for protecting property, preventing business disruption and assisting recovery; and

- Checklists of procedures that can be quickly accessed by staff during a flood.

2.1.33 Furthermore, during the operational phase of the Scheme:

- Requirement 10 of the draft DCO (Document Reference NCC/GY3RC/EX/068), as discussed above secures the preparation and implementation of an emergency preparedness and response plan to flood events (amongst other serious threats) before the Scheme is opened for public use.
- Requirement 11 of the draft DCO (Document Reference NCC/GY3RC/EX/068) requires a surface water drainage system, in general accordance with the Drainage Strategy, Environmental Statement - Appendix 12C (Document Reference 6.2, Planning Inspectorate Reference APP-136) to be approved by the county planning authority, following consultation with Great Yarmouth Borough Council, the Lead Local Flood Authority, Anglian Water (in respect of its sewerage undertaker functions) and the Internal Drainage Board.

Key Issue

Summary of Actual Risk – Present Day

2.1.34 The memo updates table 6.9, which changes the information detailed in section 6.2.33 of the FRA. In the present day in-channel 5% (1 in 20) annual exceedance probability (AEP) event, the memo details increases in the flood level by 0.04 metres depth to the south of the site and decreases in the flood level by 0.10 metres depth to the north of the site.

2.1.35 Section 6.2.35 of the FRA states that these in-channel changes for the present day 5% AEP event have no impact on the floodplain as all the flood water is retained in the channel.

2.1.36 The memo updates table 6.9, which changes the information detailed in section 6.2.34 of the FRA. In the present day in-channel 0.5% (1 in 200) annual exceedance probability event the memo details increases in the flood level by 0.04 metres depth to the south of the site and decreases in the flood level by 0.13 metres depth to the north of the site.

2.1.37 The FRA (section 6.2.36 & 6.2.37) states that these in-channel changes for the present day 0.5% AEP event have impacts on the flood level / depth in the floodplain and the receptors impacted are detailed in Table 6.10. Table 6.10 is updated in the memo and the key points are detailed below:

- An unknown number of more vulnerable residential properties on the West bank of the River Yare South of the scheme (Queen Anne's Road) would flood by 0.22 metres depth and post scheme would flood by an additional 0.071 metres depth.

For the South of the scheme on the West Bank, section 6.2.38 of the FRA states “the areas shown as ‘Danger for some’ and Danger for most’ increase slightly but no properties are impacted by this”.

- An unknown number of more vulnerable residential properties on the East bank of the River Yare North of the scheme (between Sutton Road and Alma Road) would flood between 0.21 & 0.47 metres depth and post scheme would flood by an additional 0.01 metres depth.

For the North of the scheme, section 6.2.39 of the FRA states “the water levels are predicted to reduce for the 0.5% AEP present day event with the Scheme in place compared to the Baseline scenario, the flood hazard rating improves for a number of properties with some being moved to a lower hazard category with the Scheme in place”.

- An unknown number of less vulnerable commercial properties on the West bank of the River Yare south of the scheme would flood by 0.17 metres depth and post scheme would flood by an additional 0.024 metres depth.

For the south of the scheme on the West Bank, section 6.2.38 of the FRA states “the areas shown as ‘Danger for some’ and Danger for most’ increase slightly but no properties are impacted by this”.

- An unknown number of less vulnerable commercial properties on the East bank of the River Yare North of the scheme (between Sutton Road and Alma Road) would flood between 0.18 & 0.34 metres depth and post scheme would flood by an additional 0.02 metres depth.

For the North of the scheme, section 6.2.39 of the FRA states “the water levels are predicted to reduce for the 0.5% AEP present day event with the Scheme in place compared to the Baseline scenario, the flood hazard rating improves for a number of properties with some being moved to a lower hazard category with the Scheme in place”.

- An unknown number of water compatible commercial properties on the West bank of the River Yare south of the scheme (within port area) would flood between 0.22 & 0.45 metres depth and post scheme would flood by an additional 0.042 metres depth.

For the south of the scheme on the West Bank, section 6.2.38 of the FRA states “the areas shown as ‘Danger for some’ and Danger for most’ increase slightly but no properties are impacted by this”.

2.1.38 The memo updates table 6.9, which changes the information detailed in section 6.2.34 of the FRA. In the present day in-channel 0.1% (1 in 1000) annual exceedance probability event the memo details increases in the flood level by 0.07 metres depth to the south of the site and decreases in the flood level by 0.07 metres depth to the north of the site.

Applicant's Response

- 2.1.39** As previously noted, the Applicant has undertaken further sensitivity testing (reported in Appendix A to this report) to address the technical queries raised by the Environment Agency and to confirm the robustness of the assessment reported in the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135).
- 2.1.40** The Applicant notes that the further sensitivity testing indicates that with respect to more vulnerable residential properties on west bank of River Yare to south of Scheme (Queen Anne's Road) there is an increase in depth of 0.03 metres for the 0.05% (200 year) AEP event at two properties.
- 2.1.41** For the South of the scheme on the West Bank, the further sensitivity testing confirms that Section 6.2.38 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) which states "the areas shown as 'Danger for some' and 'Danger for most' increases slightly but no properties are impacted by this".
- 2.1.42** The Applicant notes that the further sensitive testing confirms that vulnerable residential properties East bank of the River Yare North of the Scheme (between Sutton Road and Alma Road) would flood between 0.21 and 0.47 metres depth and post Scheme would flood by an additional 0.01 metres depth.
- 2.1.43** The sensitivity results confirm the findings of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) that the flood hazard rating improves for a number of properties with some being moved to a lower hazard category with the Scheme in place.
- 2.1.44** The Applicant notes that the results of the sensitivity testing indicate that less vulnerable commercial properties on the West bank of the River Yare south of the scheme would flood by 0.14 metres depth and post Scheme would flood by an additional 0.074 metres depth.
- 2.1.45** For the south of the Scheme on the West Bank, the further sensitivity testing confirms that "the areas shown as 'Danger for some' and 'Danger for most' increase slightly but no properties are impacted by this".
- 2.1.46** The Applicant notes that the further sensitivity testing confirms that less vulnerable commercial properties on the East bank of the River Yare North of the Scheme (between Sutton Road and Alma Road) would flood between 0.18 and 0.34 metres depth and post Scheme would flood by an additional 0.02 metres depth.

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- 2.1.47 The sensitivity testing confirms that for the North of the Scheme the flood hazard rating improves for a number of properties with some being moved to a lower hazard category with the Scheme in place.
- 2.1.48 The Applicant confirms that the results of the further sensitivity testing confirm that water compatible commercial properties on the West bank of the River Yare south of the Scheme (within port area) are flooded to depths of between 0.22 and 0.45 metres and post Scheme would flood by an additional 0.042 metres depth.
- 2.1.49 The results of the sensitivity testing confirm that for the south of the Scheme on the West Bank the areas shown as 'Danger for some' and 'Danger for most' increase slightly but no properties are impacted by this.

Key Issue

Summary of Actual Risk – Climate Change

- 2.1.50 In the in-channel 5% (1 in 20) annual exceedance probability (AEP) plus climate change event, the FRA (section 6.2.43) details increases in the flood level by 0.12 metres depth to the south of the site and minor decreases in the flood level by 0.04 metres depth to the north of the site.
- 2.1.51 Section 6.2.45 of the FRA states that these in-channel changes for the 5% (1 in 20) AEP plus climate change event have less impact on the floodplain than the changes in the current day event. However, figure 12.8 shows that the baseline 5% (1 in 20) + AEP plus climate change event is flooding the floodplain, when the current day 5% (1 in 20) AEP event shows that the floodwater remains in channel. No figure has been provided showing the change in flood level or hazard on the floodplain for the 5% (1 in 20) AEP plus climate change event, so any change in risk in the floodplain is unknown.
- 2.1.52 In the in-channel 0.5% (1 in 200) annual exceedance probability (AEP) plus climate change event, the FRA (Table 6.11) details increases in the flood level by 0.10 metres depth to the south of the site and minor decreases in the flood level by 0.06 metres depth to the north of the site.
- 2.1.53 Section 6.2.45 of the FRA states that these in-channel changes for the 0.5% (1 in 200) AEP plus climate change event have less impact on the floodplain than the current day event. Figure 12.9 shows that to the south scheme there are increase in flood risk of up to 0.3 metres depth, and also shows that to the north of the scheme that there are small areas with an increase to flood risk of over 0.3 metres depth.
- 2.1.54 Table 6.12 details the impacts on receptors from the 0.5% (1 in 200) AEP plus climate change event. Table 6.12 is updated in the memo and the key points are detailed below:

- An unknown number of more vulnerable residential properties on the West bank of the River Yare South of the scheme (Queen Anne's Road) would flood by 3 metres depth and post scheme would flood by an additional 0.07 metres depth in this climate change event.
- An unknown number of less vulnerable commercial properties on the West bank of the River Yare south of the scheme would flood by 3 metres depth and post scheme would flood by an additional 0.05 metres depth in this climate change event.
- An unknown number of water compatible commercial properties on the West bank of the River Yare south of the scheme (within port area) would flood between 2 & 3.2 metres depth and post scheme would flood by an additional 0.07 metres depth in this climate change event.

2.1.55 In the in-channel 0.1% (1 in 1000) annual exceedance probability (AEP) plus climate change event, the FRA (Table 6.11) details increases in the flood level by 0.02 metres depth to the south of the site and minor decreases in the flood level by 0.05 metres depth to the north of the site. Section 6.2.45 of the FRA states that these in-channel changes for the 0.1% (1 in 1000) AEP plus climate change event have less impact on the floodplain than the changes in the current day event.

Applicant's Response

2.1.56 The Applicant notes that the Environment Agency's interpretation of section 6.2.45 is not correct as the statement applies to all events not just the 5% AEP plus climate change. Figure 12.8 (Document Reference 6.3, Planning Inspectorate Reference APP-169) does confirm that the floodplain is inundated when climate change is added to all events. The depth and hazard maps are provided for the 0.5% and 0.5% plus climate change events with Document Reference 6.3, Planning Inspectorate Reference APP-169.

2.1.57 A set of figures showing the impact on flood risk for the 5% AEP event have been extracted from the hydraulic model and are presented in Appendix C. This set of figures has been requested by the Environment Agency. These figures show that the 5% AEP flows remain within the flood defences and that the scheme does not impact on the water levels. Therefore, they do not change the conclusions of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) and are provided for clarification purposes only.

2.1.58 The Applicant confirms that the Environment Agency's interpretation of Table 6.11 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) is correct. The table gives the details of the impact of the Scheme for the 0.5% AEP plus climate change event and shows an increase in the

flood level of 0.10 metres depth to the south of the site and minor decreases in the flood level by 0.06 metres depth to the north of the Scheme.

- 2.1.59** The Applicant would comment that the statement made in section 6.2.45 is broadly correct. The localised areas of higher impact shown in Figure 12.9 (Document Reference 6.3, Planning Inspectorate Reference APP-69) are associated with a model anomaly to the north of the Scheme at the outlet to Breydon Water and an area that is inundated in the baseline west of Fenner Road.
- 2.1.60** The Applicant agrees with the Environment Agency's interpretation of Table 6.12 of the memorandum which states that the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) states that in-channel changes for the 0.5% (1 in 200) AEP plus climate change event have less impact on the floodplain than the current day event and that to the south scheme there are increases in flood risk of up to 0.3 metres depth, and also shows that to the north of the scheme that there are small areas with an increase to flood risk of over 0.3 metres depth. However, the Applicant notes that with respect to the impact on the West bank of the River Yare South of the Scheme (Queen Anne's Road) the Environment Agency should refer to Section 7.2.2 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) which confirms that the increased flood risk is associated with two properties on Queen Anne's Road.
- 2.1.61** The Applicant agrees with the interpretation of Section 6.2.45 and Table 6.11 of the FRA (Document Reference 6.2, Planning Inspectorate Reference APP-135) with respect to the increased flood risk associated with the 0.1% AEP plus climate change event.

Appendix A

MEMO

TO	Environment Agency	FROM	GYTRC Project Team
DATE	28 November 2019	CONFIDENTIALITY	Confidential
SUBJECT	GYTRC – Environment Agency – Further Sensitivity Flood Modelling (Additional Review Comments)		

This memo addresses the queries raised in the Environment Agency's letter of 13th November and the associated spreadsheet titled 'GY3BC outstanding comments.xlsx'. The referenced letter was produced by the Environment Agency following their review of the further sensitivity modelling submitted on the 21st and 22nd October 2019.

The letter noted two modelling queries, included on rows 6 and 13 of the associated spreadsheet titled 'GY3BC outstanding comments.xlsx' that require further action.

Row 6: The 'existing bridge' modelled in 2D doesn't appear to be surveyed (and is not in the Halcrow 2011 model)

In the Applicant's memorandum to the Environment Agency, submitted with the further sensitivity modelling on the 21st and 22nd of October 2019, noted that the Bridge Inspection Report¹ included several scaled drawings but that levels were not included on the drawings. As such the Applicant, measured the deck level of the existing bridge from the scale drawing and also checked levels against lidar data of the adjoining road.

The Environment Agency responded on the 13th November that they did not have a copy of the Bridge Inspection Report, but the source of the dimensions has been identified. Therefore, the comment remained open.

As requested, on the 15th November 2019 the Applicant provided the Bridge Inspection Report to the Environment Agency.

Row 13: 2D domain is too small as it impacts tidal inundation from the north and the south (i.e. blue arrows in below image), especially at higher tidal events

In April the Environment Agency directed the Applicant to:

"Make the 2D domain larger. As a guide, the smallest 2D domain should be roughly the same size as Halcrow 2011, particularly on the sea facing side. If expanding the model domain, make sure any additional structures (e.g. bridges, culverts, subways etc) are included in new domain."

This was submitted by the Applicant, as part of the further sensitivity modelling on the 21st and 22nd of October for the T200 event for the extended baseline.

In November, the Environment Agency noted that the model had been re-run for all scenarios with the revised domain. However, results were only supplied for the T200 event for the modified baseline and that the modified scheme model the T1000 results are not complete. They requested full results along with versions of *tables 9 and 10 from the report*, so that an up to date comparison can be made (the tables are included in Chapter 6 of the Flood Risk Assessment (Document Reference 6.2, Planning Inspectorate Reference APP-135) and numbered Table 6.9 and 6.10).

As requested the Applicant has now undertaken all runs and these accompany this memorandum.

In addition, as requested, the Applicant has provided below updated versions of Tables 6.9 and 6.10 from the Flood Risk Assessment for clarification purposes.

¹ Principal Inspection Report, Haven Bridge, Great Yarmouth Port Authority, September 2006.

Table 6.9: Present Day Hydraulic Modelling Results

Present Day	Baseline (m AOD ²)			Scheme (m AOD)			Difference (Scheme – Baseline) (m)		
Point ³	5%	0.50%	0.10%	5%	0.50%	0.10%	5%	0.50%	0.10%
US1	2.06	2.60	2.91	2.00	2.52	2.88	-0.05	-0.07	-0.03
US2	2.22	2.78	3.12	2.13	2.68	3.07	-0.08	-0.10	-0.06
US3	2.31	2.87	3.19	2.22	2.76	3.14	-0.09	-0.11	-0.06
US4	2.37	2.93	3.26	2.28	2.81	3.20	-0.09	-0.12	-0.06
US5	2.44	3.00	3.34	2.34	2.88	3.28	-0.10	-0.12	-0.06
USW	2.48	3.05	3.39	2.38	2.92	3.33	-0.10	-0.13	-0.06
USE	2.48	3.05	3.39	2.38	2.92	3.33	-0.10	-0.13	-0.06
C1	2.50	3.08	3.42	2.40	2.94	3.35	-0.10	-0.13	-0.07
C2	2.52	3.09	3.44	2.55	3.12	3.50	0.03	0.03	0.07
C3	2.54	3.11	3.46	2.57	3.15	3.52	0.04	0.04	0.06
DSW	2.56	3.14	3.49	2.59	3.18	3.55	0.03	0.03	0.05
DSE	2.56	3.14	3.49	2.59	3.18	3.55	0.03	0.03	0.05
DS5	2.60	3.20	3.57	2.62	3.23	3.62	0.03	0.03	0.04
DS4	2.64	3.26	3.66	2.66	3.28	3.69	0.02	0.02	0.03
DS3	2.70	3.33	3.77	2.71	3.35	3.80	0.02	0.01	0.02
DS2	2.77	3.41	3.90	2.78	3.42	3.91	0.01	0.01	0.01
DS1	2.82	3.48	4.00	2.82	3.48	4.00	0.00	0.00	0.00

These results confirm that the general effect of the Scheme in the channel is to increase water levels south of the Scheme and decrease them to the north due to an in-channel constriction caused by the knuckles used to support the Scheme.

There are localised increases of 10mm compared to the values given in the Flood Risk Assessment just south of the Scheme (at the locations shaded in red in Table 6.9 above). Consequently, as a result of the extended domain the magnitude of the impact would change from negligible adverse to minor adverse and thus the significance of the effects would increase from neutral to slight (insignificant). This does not alter the conclusions as to the significance of effect drawn in Section 6.2, as the effect remains not significant, or the mitigation set out in Section 7.2 of the Flood Risk Assessment.

² Above Ordnance Datum (height relative to the average sea level at Newlyn, Cornwall UK).

³ As show on Figure 12.4 of the Environmental Statement (Document Reference 6.3, Planning Inspectorate Reference APP-169).

Table 6.10 lists the receptors within the study area (shown on Figure 12B.1 of the Environmental Statement (Document Reference 6.3, Planning Inspectorate Reference APP-169) predicted by the hydraulic model to be flooded for the 0.5% AEP Present Day event and details the change in flood depth between the baseline and Scheme scenarios for this event. The updated table is presented below for clarification purposes.

Table 6.10: Impact of Scheme on Flooding to Receptors during 0.5% AEP Present Day Scenario

Receptor ⁴	Sensitivity	Baseline Flood Depth (m)	Change in Flood depth Scheme-Baseline (m)	Significance of Change in Flood Risk
Police Investigation Centre, Thamesfield Way (Emergency / Rescue Service)	Highly Vulnerable (assumed required to be operational during flooding)	0.0	N/A (Not flooded in baseline & Scheme)	Neutral
Great Yarmouth Fire Station (Northern Fire Station)	Highly Vulnerable	0.0	N/A (Not flooded in baseline & Scheme)	Neutral
Residential Properties on the West Bank of the River Yare to the South of Scheme (Queen Anne's Road)	More Vulnerable	0.22	0.071	Slight or Moderate Adverse
Residential Properties to the North of Scheme (Southtown area on west bank and between Sutton Road and Alma Road on east bank of River Yare)	More Vulnerable	West bank: between 0.05 & 0.12 East bank: between 0.21 & 0.47	West Bank: No flooding to properties in Scheme East Bank: Up to 0.01 (flooded in both baseline & Scheme)	West Bank: Neutral East Bank: Slight Adverse
Commercial Properties on the West Bank of River Yare to the South of Scheme	Less Vulnerable	0.17	0.024	Slight Adverse
Commercial Properties to the North of the Scheme (Southtown area on west bank and between Sutton Road and Alma Road on east bank of River Yare)	Less Vulnerable	West bank: between 0.05 & 0.12 East bank: between 0.18 & 0.34	West Bank: -0.12 (No flooding in Scheme) East Bank: Up to 0.02	West Bank: Moderate Beneficial East Bank: Slight Adverse
Water Compatible Commercial Properties to the South of the Scheme on East Bank of River Yare (within port area)	Water compatible	Between 0.22 and 0.45	Up to 0.042	Slight Adverse
Water Compatible Commercial Properties to the South of the Scheme on West Bank of River Yare (within port area)	Water compatible	0.0	N/A (Not flooded in baseline & Scheme)	Neutral

These results confirm that the general effects of the Scheme do not exceed 'Slight or Moderate Adverse' at any of the receptors identified in the Flood Risk Assessment. The effects highlighted in red in Table 6.10 are where an adverse effect has changed due to the further modelling requested by the Environment Agency. It should be acknowledged that the maximum effect recorded prior to the further modelling was 'Moderate Adverse' which in Table 6.10 reduces to 'Slight or Moderate Adverse'. This does not alter the conclusions as to the significance of effects drawn in Section 6.2 of the Flood Risk Assessment, as the effect remain significant at the residential properties on the West Bank of River

⁴ As show on Figure 12B.1 of the Flood Risk Assessment (Document Reference 6.3, Planning Inspectorate Reference APP-169).

Yare (to the South of Scheme) and not significant at all other receptors. Therefore, the mitigation set out in Section 7.2 of the Flood Risk Assessment remains as presented.

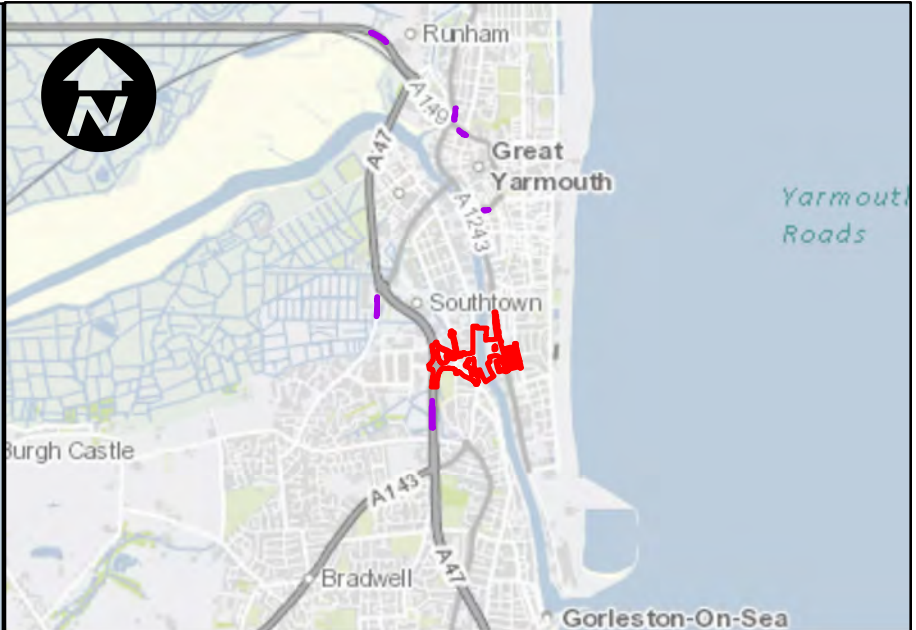
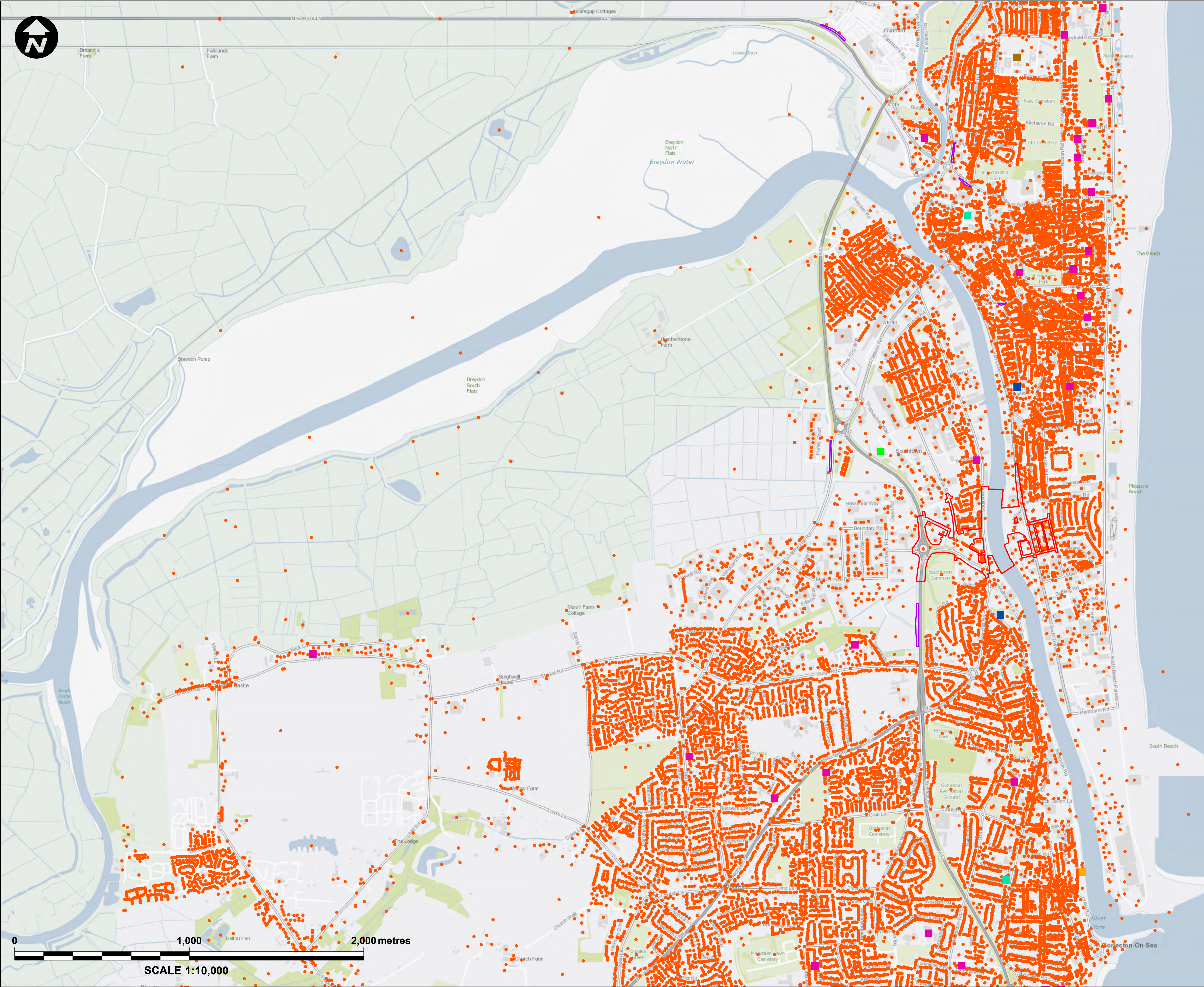
Fitness of Purpose of Modelling

It is acknowledged that the Environment Agency has not carried out a full assessment of the fitness of purpose of the model and cannot and can accept no liability for any errors or inadequacies in the model.

Other Sources of Flooding

The Applicant acknowledge that the Environment Agency have not considered other sources of flooding in detail (e.g. surface water, sewers, reservoirs and groundwater). The Flood Risk Assessment assess all sources of flood risk including rivers and sea; surface water; sewers; groundwater; and artificial sources. The approach to surface water flood risk has been further discussed in the response to the Local Impact Report, as submitted at Deadline 3.

Appendix B



- Key:**
- Principal Application Site
 - Satellite Application Sites
 - Properties
- Sensitive Receptors**
- Hospital
 - Emergency Rescue Service
 - Police Transport
 - Fire Station
 - Coastguard Rescue
 - Nursing Home

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PROJECT TITLE

GREAT YARMOUTH THIRD RIVER CROSSING

DRAWING TITLE

FIGURE 12B.1
FLOOD RISK RECEPTORS IDENTIFIED
WITHIN ASSESSMENT STUDY AREA
(REGULATION 5(2)(e))

DRAWING STATUS

FOR DCO APPLICATION

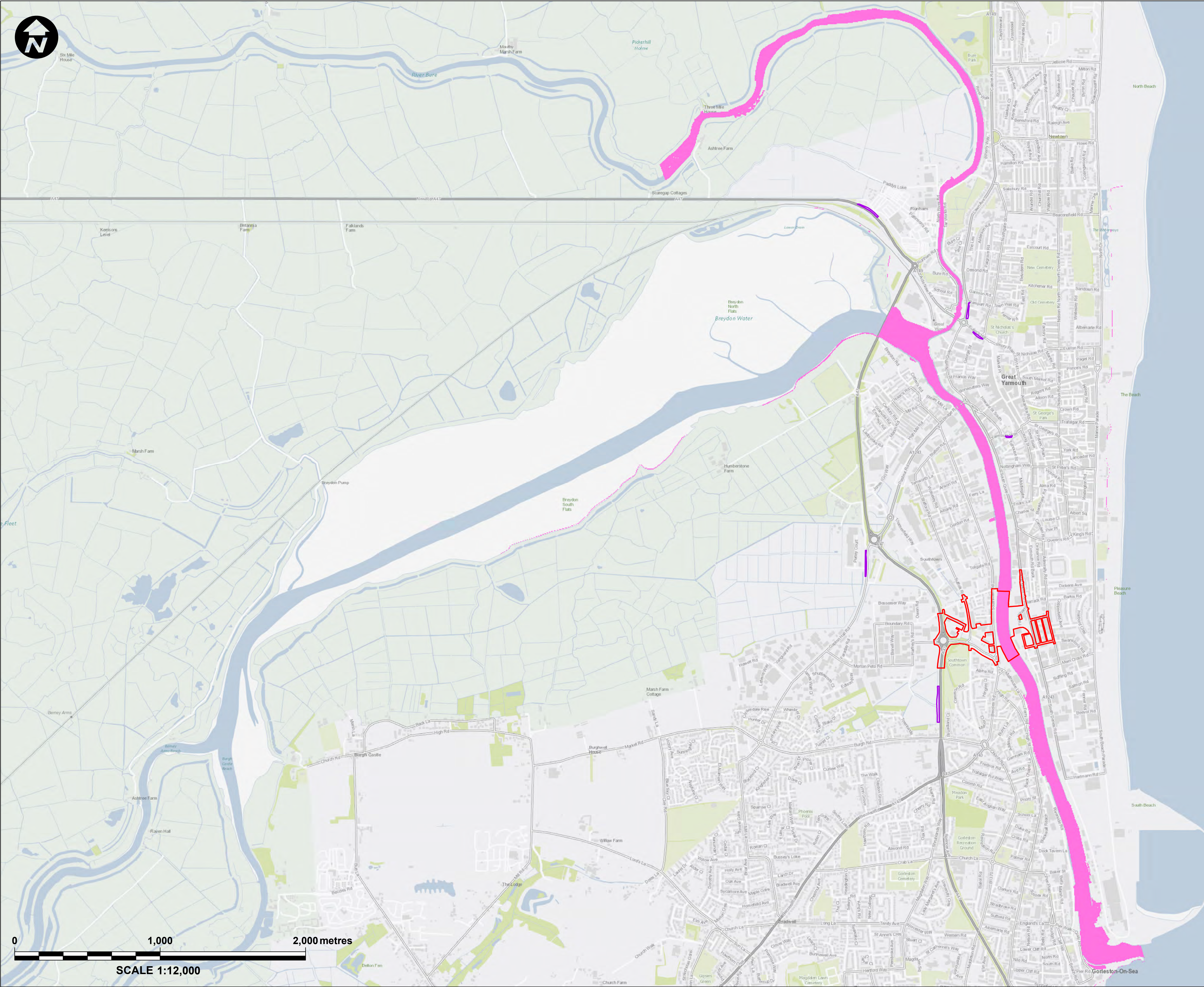
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Appendix C



Key:

- Principal Application Site
- Satellite Application Sites
- 5% Annual Exceedance Probability (AEP) Event

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GREAT YARMOUTH THIRD RIVER CROSSING

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FIGURE 1 BASELINE PRESENT DAY - 5% AEP MODELLLED FLOOD EXTENTS (REGULATION 5(2)(a))

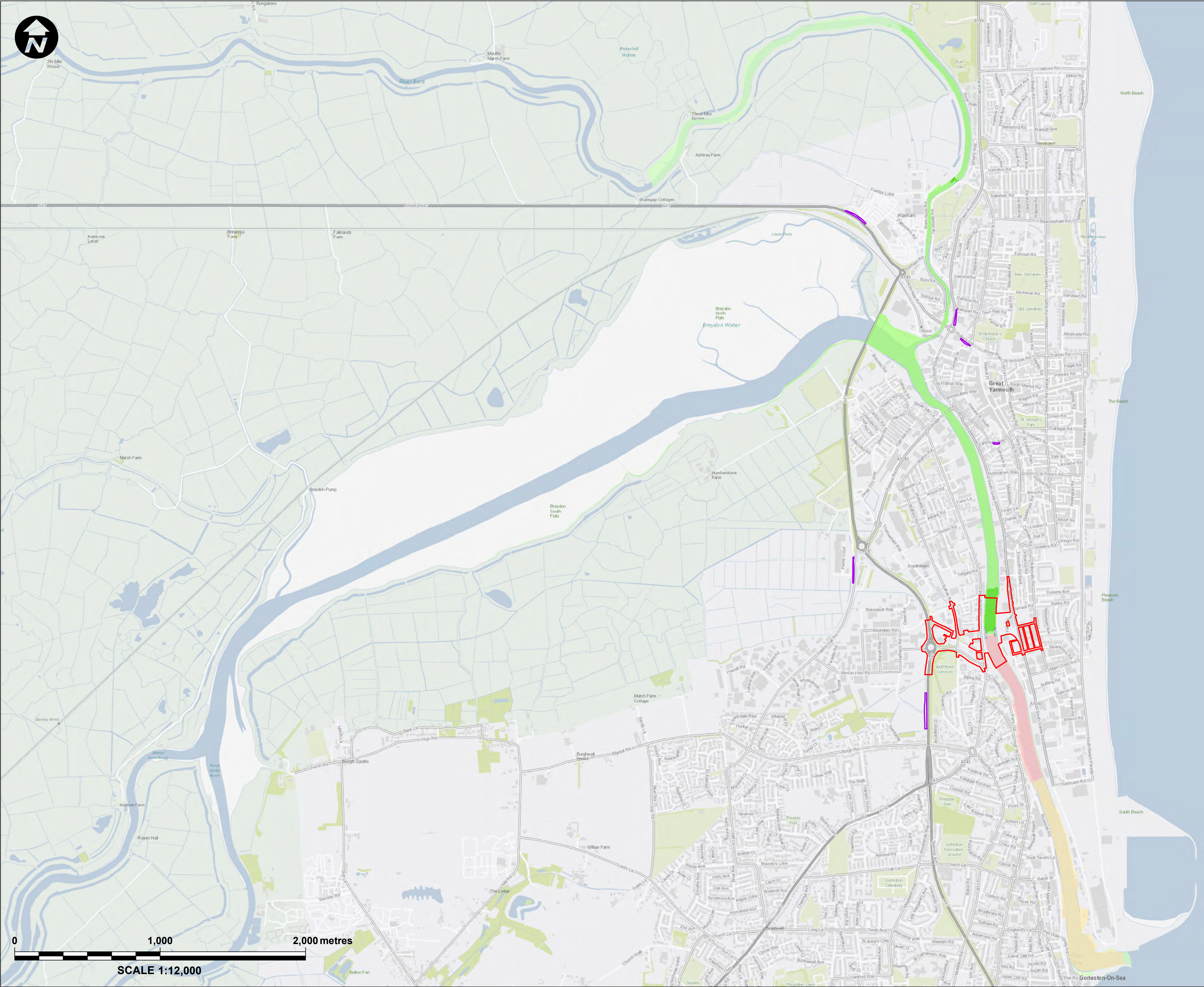
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NCC/GY3RC/EX/064 - Figure 1



Key:

- Principal Application Site
- Satellite Application Sites

Change in flood depth (m)

- Greater than -0.3
- 0.1 to -0.3
- 0.02 to -0.1
- 0 to -0.02
- 0
- 0 - 0.02
- 0.02 - 0.1
- 0.1 - 0.3
- Greater than 0.3

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**GREAT YARMOUTH
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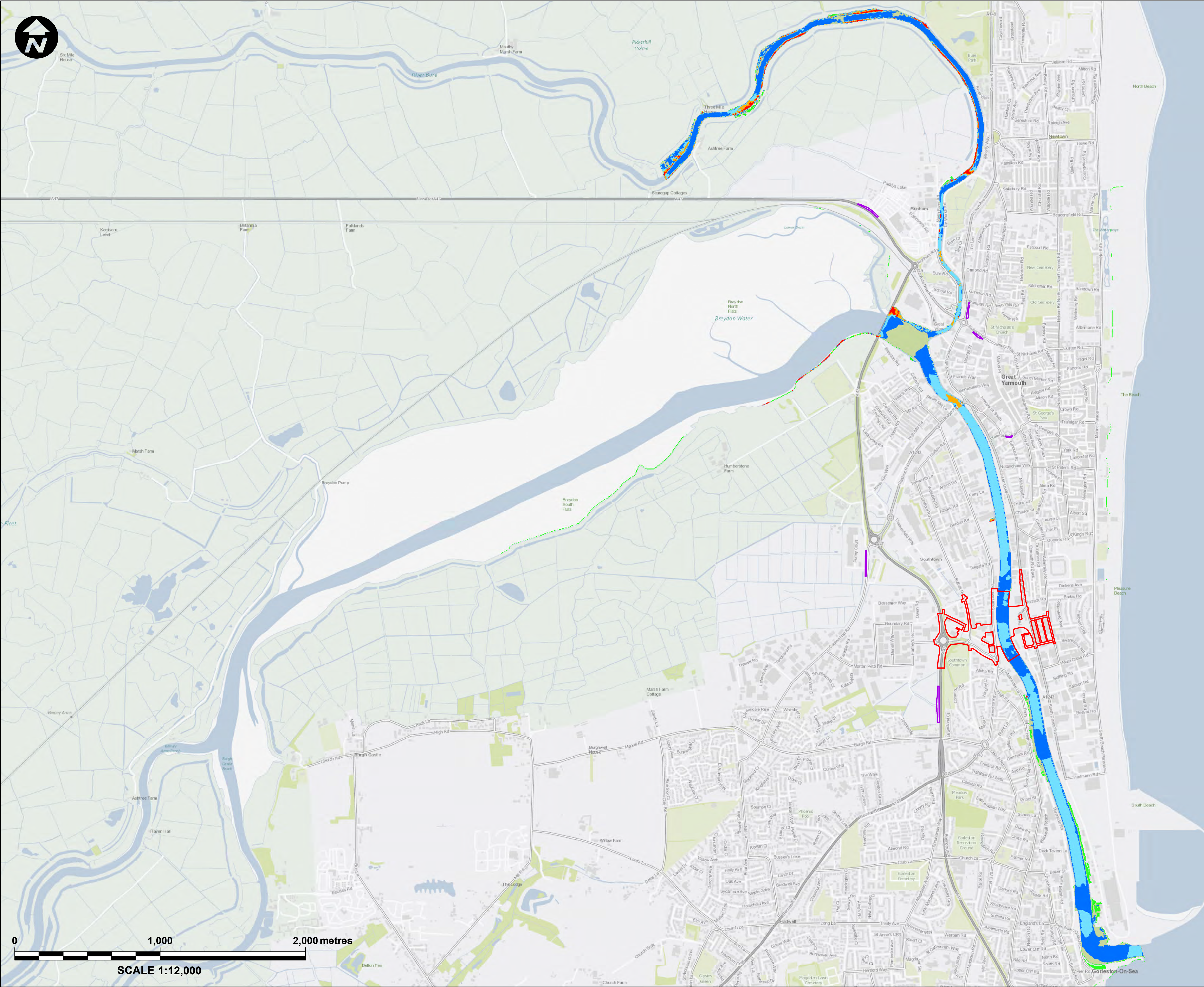
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**FIGURE 2
SCHEME - BASELINE COMPARISON,
5% AEP PRESENT DAY EVENT
(REGULATION 5(2)(a))**

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NCC/GY3RC/EX/064 - Figure 2



Key:

Principal Application Site

Satellite Application Sites

Velocity (m/s)

0 - 0.1

0.11 - 0.3

0.31 - 0.5

0.51 - 0.8

0.81 - 1.2

> 1.2

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GREAT YARMOUTH THIRD RIVER CROSSING

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FIGURE 3
VELOCITY MAP - BASELINE
5% AEP PRESENT DAY EVENT

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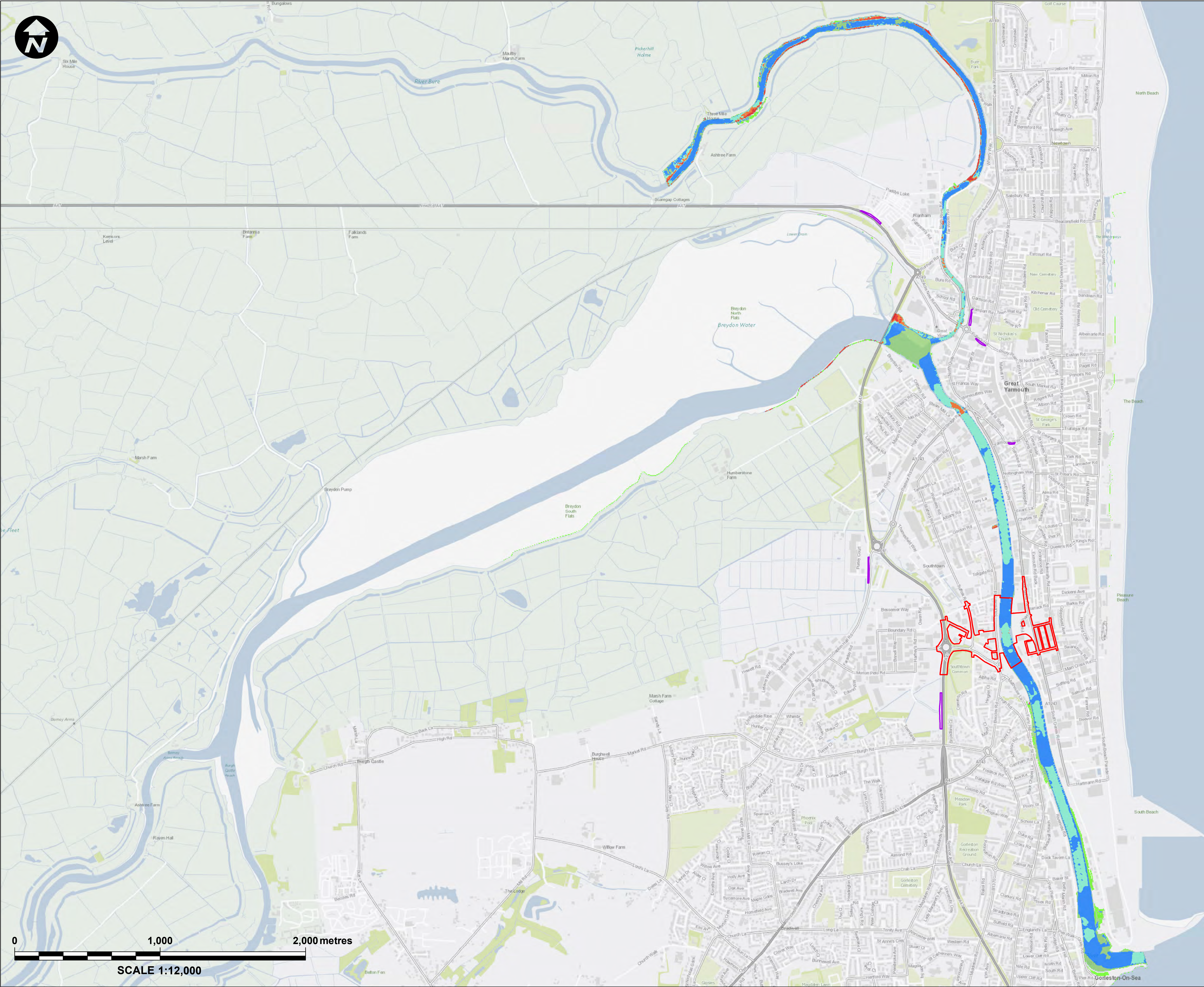
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NCC/GY3RC/EX/064 - Figure 3



Key:

Principal Application Site

Satellite Application Sites

Velocity (m/s)

0 - 0.1

0.1 - 0.3

0.3 - 0.5

0.5 - 0.8

0.8 - 1.2

>1.2

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FIGURE 4 VELOCITY MAP - SCHEME 5% AEP PRESENT DAY EVENT

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NCC/GY3RC/EX/064 - Figure 4