

**Site Specific Flood Risk Assessment for
Proposed New Residential Development at
Land West of Luck Lane,
Luck Lane, Preston,
East Riding of Yorkshire HU12 8TE**

**On behalf of Mr Mally Fortnum, 17 Main Street, Preston,
East Riding of Yorkshire, HU12 8UB**

December 2022

Prepared by:-

*A & F Consulting Engineers LLP
Halcyon House
Landing Lane
Newport
Brough
East Yorkshire
HU15 2RU
Tel No 01430 441765*

Ref:- Job No. 3898

CONTENTS

Executive Summary

1 Introduction

2 Policy and Guidance

- 2.1 Flood Risk Assessments
- 2.2 East Riding Policy
- 2.3 Glossary

3 Proposed Development

- 3.1 Outline Description
- 3.2 Surveys
- 3.3 Vulnerability Classification

4 Description of Study Area

- 4.1 Watercourses
- 4.2 Study Area Setting
- 4.3 Flood Zone Classification
- 4.4 Historic Flooding
- 4.5 Flood Risk Management Infrastructure

5 Hydraulic Modelling and Hydrology

- 5.1 Hydraulic Modelling
- 5.2 Hydrology

6 Assessment of Flood Risk

- 6.1 Initial Desk Top Study
- 6.2 Historical Research
- 6.3 Findings of Research
- 6.4 Identification of Flood Risk
- 6.5 River Humber Overtopping
- 6.6 River Humber Breach
- 6.7 Open Channel Overtopping or Breach
- 6.8 Surface Water Flooding
- 6.9 Overland Flooding
- 6.10 Groundwater Flooding
- 6.11 Effects of Development on Existing Flood Defence Protection
- 6.12 Sustainability of Existing Flood Defence Protection
- 6.13 Climate Change

7 Management of Flood Risk

- 7.1 Flood Alleviation Measures Currently in Place
- 7.2 Residual Risk
- 7.3 Residual Risk Management
- 7.4 Safe Means of Escape in the event of a Flood Event

- 8 Sequential and Exception Tests**
 - 8.1 Sequential Test
 - 8.2 Exception Test
- 9 Surface Water Management**
- 10 Feedback from Consultees**
 - 10.1 Environment Agency
 - 10.2 Internal Drainage Board
 - 10.3 Strategic Flood Risk Assessment (Lead Local Flood Authority)
 - 10.4 Flood Risk Investigations (Lead Local Flood Authority)
 - 10.5 Yorkshire Water
 - 10.6 Additional Flood Protection Requirement and Sustainability
- 11 Summary & Conclusions**
- 12 Recommendations (Proposed Development - Ground Floor Level)**

APPENDICES

Appendix A – Location Plan

Appendix B – Site Photographs

Appendix C – Other Plans

- Plan No 1 online SFRA2021 Strategy Update
- Plan No 2 online SFRA2022 Proposed Update
- Plan No 3 online SFRA2016 Development & Allocations
- Plan No 4 online SFRA2019 Flood Risk (ERYC Flood Data)
- Plan No 5 online SFRA2019 Watercourses (ERYC Flood Data)
- Plan No 6 online SFRA2019 Historic Flooding (ERYC Flood Data)
- Plan No 7 online SFRA2019 Groundwater (ERYC Flood Data)
- Plan No 8 online SFRA2019 Flood Defences (ERYC Flood Data)
- Plan No 9 online SFRA2019 HNB Tidal Climate Change (ERYC Flood Data)
- Plan No 10 online SFRA2019 Future Risk (ERYC Flood Data)
- Plan No 11 online SFRA2019 EA Flood Defences (ERYC Flood Data)
- Plan No 12 online SFRA2019 Flood Alert (ERYC Flood Data)
- Plan No 13 online SFRA2019 Surface Water Risks (ERYC Flood Data)
- Plan No 14 online SFRA2019 Future Surface Water Risks (ERYC Flood Data)
- Plan No 15 SFRA Appendix K (FRA Requirements – ERYC)
- Plan No 16 Site Level Plan (with proposals)

Appendix D - Copyright

Appendix E – EA product 4 data

Appendix F – Schedule of Flood Proofing

Executive Summary

Mr Mally Fortnum, 17 Main Street, Preston, East Riding of Yorkshire, HU12 8UB, instructed us to prepare a site specific flood risk assessment for the proposed residential development to land west of Luck Lane, Preston, East Yorkshire.

This report has been prepared with reference to the ERYC SFRA's Appendix L Flood Risk Assessment Template and the National Planning Policy Framework, and utilises current guidance. Given that the site is currently located in Flood Zone 3 a Flood Risk Assessment is required for residential development. The proposals meet with National and Local Policies, and all proposed development is appropriate. This document provides consultation information with the Environment Agency, East Riding of Yorkshire Council, the South Holderness Internal Drainage Board and Yorkshire Water. This report includes the full allowance for climate change and the implications of the EA Product 4 data with associated current modelling.

The proposed development of land will comprise of a new residential development of a single storey dwelling, on behalf of Mr Mally Fortnum, 17 Main Street, Preston, East Riding of Yorkshire, HU12 8UB. The site area is 4,090m², with the building footprint of 169m², with the existing site use as agricultural fields and an outbuilding, all with site access. The existing site is located on flat land, and is located in the lowest area of flood risk within the curtilage (slightly higher land). Further details can be found in the appendices of this report and the accompanying planning application.

Average site ground levels are +2.8mAODN. The average Road level along Luck Lane is +2.7mAODN. The proposed dwelling has a finished floor level of +3.5mAODN. Adjacent levels are comparable to the existing sites levels.

The development classification falls within the "More Vulnerable" category (Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.).

The development site is away from most coast and coastal sources of flooding, and has a single recorded instance of flooding in 2007. The site is located in the Humber flood plain, on the north bank. The Humber flood plain is a large tract of landscape, similar to the Somerset Levels and Moors, the Fens and the Netherlands. Naturally drainage took place through a delta system, whereby a complex and dynamic series of channels discharged water into the North Sea via the River Ouse and Humber. The land is naturally marshland with islands of higher land where settlements are located.

The *Flood Map for Planning* indicates that the site and access is located on land in Flood Zone 3. The ERYC SFRA allocates the site as Flood Zone 3 High Probability¹, including the whole of the site and surrounding area. Emergency evacuation to higher land north and east (Preston ~600m) are generally located in Flood Zone 1 and offers a safe refuge. The areas to the east are accessible via normal access if required.

The riparian open channels and IDB drains combined with EA main rivers all serve in draining the surrounding area. Generally the IDB and EA infrastructure is

¹ The East Riding's Strategic Flood Risk Assessment – see Appendix C

maintained to a high standard, and local riparian channels, where seen were in fair or good condition. There is no other Flood Risk Management infrastructure present on or adjacent to the proposed development site.

No site specific modelling has been undertaken. We understand that the current SFRA has used some modelling. The implications of the modelling results can be found in section 5.1.

The site is located on the Flamborough Chalk Formation – Chalk which is generally permeable to water; overlaid with glacial deposits which may be permeable to water.

The whole site is located in Flood Zone 3 "Zone 3 – High Probability" that benefits from flood defences, and as such there is an identified combined flood risk, corresponding to 0.5% or more than probability of flooding. The combined flood risk from rivers and sea is cited at *gov.uk*, supports this assertion. Surface water flood risks are identified as low to medium, less than 3.3%. The cited flood risk is corroborated by other sources of data. Owing to climate changes the risk of flooding will increase as time passes. The site benefits from a flood alert area and a programme of flood and coastal risk management works and strategies within the East Riding.

The River Humber is tidal and is subject to a range in height of water levels caused by a combination of variable fluvial flows and/or high tides and/or storm surges, as such overtopping or breach of the embankments is possible, and combined with climate changes present a residual risk (this includes overland flow flood risks). Surface water flood risks exist to some areas in Preston, with risks on site being medium to low. Groundwater flood risks are thought to be very low. There is no reservoir or related flood risk. No ground water springs are located on the site. Climate changes could also make flooding more likely.

Residual risks are addressed by the following:

- The dwelling constructed with Finished Floor Levels more than 600mm above adjacent ground levels (this addresses the residual flood risks and climate changes) - +3.4mAODN.
- Flood proofing scheme to +3.85mAODN (1050mm above ground levels) (this above all 0.5% modelled flood outlines)
- No ground floor sleeping proposed below +4.0mAODN.
- Safe place of refuge above +5.7mAODN.
- A robust Flood Warning and Evacuation Plan.

A safe means of escape during flooding can be provided in the upper floor of the proposed development (greater than +5.7 mAODN). The site access (Luck Lane) is located in Flood Zone 3, which connects with Staithes Road (partially in Flood Zone 1), ~600m east in Preston. A Flood Warning and Evacuation Plan is recommended.

The Sequential test is outside the scope of this report. The exception test is covered throughout this report and appendices and is met. The outline design and information on surface water drainage is provided by means of a proposed soakaway with suitable test and design. Foul water will be to a treatment digester.

The Environment Agency, Strategic Flood Risk Assessment and Flood Risk Investigations have been consulted with, and an assessment of additional flood protection requirement and sustainability undertaken.

Historically the site lies within the historical Humber flood plain which probably flooded occasionally in the past, prior to embanking of the River Humber. The site is located at approximately +2.8mAODN and is away from any normal tidal inundation, due to flood defences and adjacent low farmland. The Flood Map for Planning (section 6.1) shows the site benefitting from defences and in Flood Zone 3, there are substantial flood walls and embankments present maintained by the EA. Combined flood risks exist from the River Humber and pluvial effects show the site as at risk from overtopping, breach, riparian watercourses and surface water. The site is also benefits from drainage via the South Holderness IDB. The residual flood risks are required to be addressed and form part of the recommendations. Pluvial risks are mitigated by sustainable drainage systems (soakaway).

The development will have no effect, other than adding to the amount of development in the area, regarding flood risk. There is a single recorded flood event which indicated isolated flooding in 2007.

We therefore conclude that the site is suitable for the development as proposed, provided adequate mitigation of flood risk is included in the as built dwellings.

The site is located at approximately +2.8mAOD. The average road level along Luck Lane is +2.7mAODN. The existing outbuildings have finished floor levels of ~+2.9mAODN. The extreme combined flood level for a 1 in 200 year event is likely to be more than this level on the site (+3.78mAODN). Climate changes and other uncertainties indicate some additional flood risk; we therefore recommend that the minimum floor level should be at around +3.4mAODN. The Environment Agency/ERYC normally requests 600mm above average ground or adjacent road levels (whichever is the greater).

We would also recommend that flood resilience measures are built into the development, in accordance with EA guidance (located 300mm above FFL), with all electrical sockets and electrical connections located a minimum of 450mm above the finished floor level (see Appendix F) – (equivalent to 1050mm above the average site level).

i.e. a minimum ground floor level of +3.4 mAOD

It would also be worth considering other flood mitigation measures in the building construction; these can be found in Appendix F. The 0.5% flood outline gives a maximum flood depth of +3.78mAODN.

A suitable surface water drainage scheme is required.

Safe refuge is provided on the upper floor being higher than +5.5mAODN (proposed upper floor level +5.7mAODN). Emergency evacuation to higher land east along Staithes Road may also be available (Flood Zone 1). A Flood Warning and

Evacuation Plan is recommended.

With climate changes over 100 years increased peak rainfall will increase.

With climate changes over 100 years Humber overtopping presents "No Danger "; a breach presents "No Danger".

1 Introduction

1.1 Preamble

Mr Mally Fortnum, 17 Main Street, Preston, East Riding of Yorkshire, HU12 8UB, instructed us to prepare a site specific flood risk assessment for the proposed residential development to land west of Luck Lane, Preston, East Yorkshire.

This report has been prepared with reference to the ERYC SFRA's Appendix L Flood Risk Assessment Template. This document provides consultation information with the Environment Agency, East Riding of Yorkshire Council, the South Holderness Internal Drainage Board and Yorkshire Water.

This report includes the full allowance for climate change and the implications of the EA Product 4 data with associated current modelling.

Hedon Haven on the north bank of the Humber serves as a main river draining the surrounding area, including Lezley Drain (north of the site draining into Preston New Drain) and Reedsmere Drain (south of the site). All IDB watercourses are maintained and the Humber has flood walls and embankments present. There are several riparian open channels to the north and east of the property, with a culvert access necessary for site access. There is no other Flood Risk Management infrastructure present on or adjacent to the proposed development site. The site is not near any other significant watercourses, and is within an area administered by the South Holderness Internal Drainage Board.

2 Policy and Guidance

2.1 Flood Risk Assessments

Flood risk assessments may be required under certain low lying sites in accordance with NPPF, which was revised in July 2021. Given that the site is currently located in part in Flood Zone 3 a Flood Risk Assessment is required for residential development.

The National Planning Policy Framework was substantially similar to the previous planning policy guidance notes which were developed as a result of the ever increasing demand on development of low lying areas of the UK, following severe flooding events in the year 2000. Extensive flooding in 2007 resulted in the Flood and Water Management Act 2010. Extracts from the NPPF are cited below:-

43. The right information is crucial to good decision-making, particularly where formal assessments are required (such as Environmental Impact Assessment, Habitats Regulations assessment and flood risk assessment). To avoid delay, applicants should discuss what information is needed with the local planning authority and expert bodies as early as possible.

Planning and flood risk

159. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

160. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

161. All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a. applying the sequential test and then, if necessary, the exception test as set out below;

b. safeguarding land from development that is required, or likely to be required, for current or future flood management;

c. using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding (making as much use as possible of natural flood management techniques as part of an integral approach to flood risk management); and

d. where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking

opportunities to relocate development, including housing, to more sustainable locations.

162. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

163. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

164. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:

a. the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b. the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

165. Both elements of the exception test should be satisfied for development to be allocated or permitted.

166. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment⁵⁵. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a. within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

- b. the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;*
- c. it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- d. any residual risk can be safely managed; and*
- e. safe access and escape routes are included where appropriate, as part of an agreed emergency plan.*

168. Applications for some minor development and changes of use⁵⁶ should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

55 A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

56 This includes householder development, small non-residential extensions (with a footprint of less than 250m²) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

2.2 East Riding Policy

The Government has published a National Planning Policy Framework (NPPF), which relates to Development and includes Flood Risk, as well as the East Riding of Yorkshire Council's (ERYC) Strategic Flood Risk Assessment (SFRA). The ERYC has published the East Riding Local Plan Flood Risk Note for the Planning Application Process October 2017 (updated July 2018), where appropriate reference is made to the Flood Risk Note. The new ERYC SFRA (issued November 2019) has been studied and all relevant Appendices support the comments made in this report.

Both the SFRA and the NPPF identified a risk-based sequential approach for proposals for development in or affecting flood risk areas. The approach identifies a continuum from virtually no risk of flooding to a high risk, with the aim of directing development to areas with a lower probability of flooding (see Table 1 'Flood Risk Vulnerability' below). The guidance identifies which types of development may or may not be appropriate in different flood risk areas. It also states where development may need to be of a design and with an appropriate level of protection to ensure that the risk of damage from flooding is minimised.

The SFRA and the NPPF also introduces an 'exception test'. If, following the consideration of the sequential approach, it is not possible for the development to be located in zones of lower probability of flooding. NPPF states that the exception test can be applied. For the exception test to be passed it must be demonstrated that:

1. The development provides wider sustainability benefits to the community that outweigh flood risk. These may relate the need to avoid social and economic blight or because of restrictive national designations such as landscape, heritage or nature conservation designations, which prevent development on, lower risk sites.
2. The development is on previously developed land or if not that there are no developable previously developed sites available, and
3. The development will be safe, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall. This must be demonstrated through a site flood risk assessment.
4. That all potential risks of flooding are investigated, through early engagement and consultation with key stakeholders.

Table 1 Flood Risk Vulnerability

Low Probability	(Zone 1)
Medium Probability	(Zone 2)
High Probability	(Zone 3a)
Functional Flood Plain	(Zone 3b)

The ERYC Policy also makes reference to:

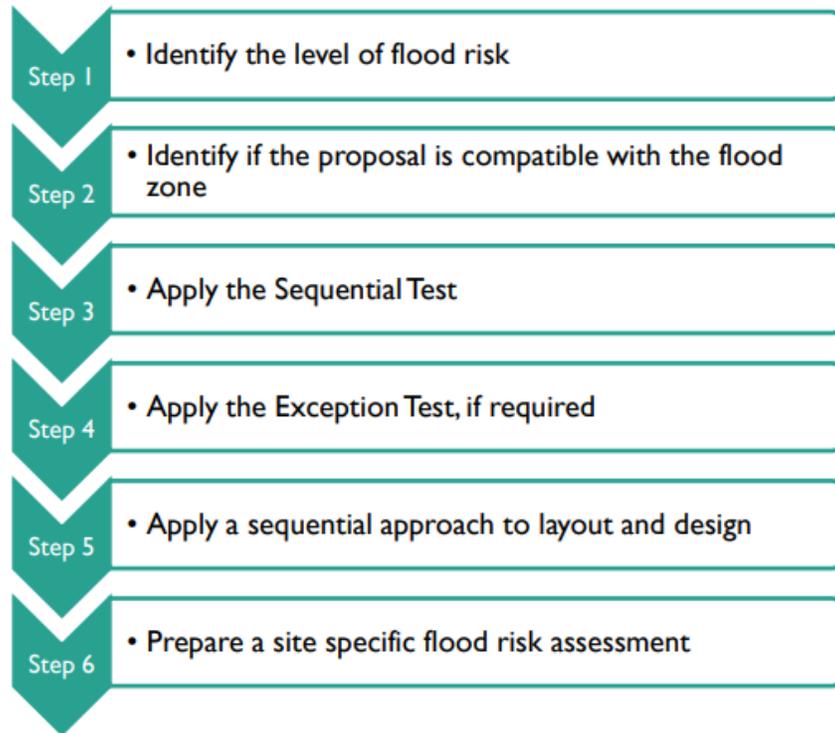
- Planning Practice Guidance Flood Risk and Coastal Change
- Non-statutory Technical Standards for Sustainable Drainage Systems
- The SuDS Manual, CIRIA
- East Riding Local Plan
- Level 1 Strategic Flood Risk Assessment (SFRA) and, where available, Level 2 SFRA
- East Riding Local Flood Risk Management Strategy and Standing Advice
- East Riding Flood Risk Guidance and SuDS

All these documents are considered where applicable in this report.

Figure 1 ERYC Flood Risk Note Guidance (extract)

Introduction

Figure 1: Considering the flood risk process - step by step



2.3 Glossary

To aid understanding, an explanation of engineering and other terminology is provided:-

- AODN Above Ordnance Datum Newlyn
- Benchmark Accurately fixed level used for levelling
- Channel A cut into the land which allows water to pass through
- EA Environment Agency
- ERYC East Riding of Yorkshire Council
- FRA Flood Risk Assessment (site specific)
- IDB Internal Drainage Board
- Main River Watercourse managed by the EA
- Sluice or Clough Allows water to drain away in a controlled fashion
- Bank or Jetty An embankment built to prevent flooding
- Tidal Surge A combination of high tide and storm surge (very high water level)
- Mere/Marr A natural pond or lake (several hectares in extent)
- SFRA Strategic Flood Risk Assessment (ERYC)

3 Proposed Development

3.1 Outline Description

The proposed development of land will comprise of a new residential development of a single storey dwelling, on behalf of Mr Mally Fortnum, 17 Main Street, Preston, East Riding of Yorkshire, HU12 8UB. The site area is 4,090m², with the building footprint of 169m², with the existing site use as agricultural fields and an outbuilding, all with site access. The existing site is located on flat land, and is located in the lowest area of flood risk within the curtilage (slightly higher land). Further details can be found in the appendices of this report and the accompanying planning application.

3.2 Surveys

A location plan is presented in Appendix A; site plan incorporating site levels Appendix C. Average site ground levels are +2.8mAODN. The average Road level along Luck Lane is +2.7mAODN. The proposed dwelling has a finished floor level of +3.5mAODN. The access to the site is via Luck Lane and Staithes Road. Adjacent levels are comparable to the existing sites levels.

A site survey by ourselves was undertaken on Thursday 8th December 2022 for the preparation of this report, a selection of photographs were taken. Appendix B includes a selection of site photographs.

The adjacent land uses were noted and the Humber Estuary and Hedon Haven with flood wall, embankment and sea defences were also photographed and studied.

Work in Preston has been completed previously, this work included surveys and records of previous flooding. This archive material has been used in the production of this report.

3.3 Vulnerability Classification

The development classification falls within the "More Vulnerable" category (Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.).

4 Description of Study Area

4.1 Watercourses

The proposed site is adjacent to two watercourses, both riparian open channels. These riparian open channels drain into the Preston part of the South Holderness IDB's drains; Reedsmere Drain (water level controlled, gravity/clough drainage to Humber via Hedon Haven), other significant watercourses are:

- The River Humber (tidal at this location).
- Other riparian/IDB open channels (gravity/clough drainage)

4.2 Study Area Setting

The site is away from coast and coastal sources of flooding, and was not directly impacted by the 2013 tidal surge, although the ERYC SFRA indicates some historic flooding in 2007. The site is located in the Humber flood plain. The Humber flood plain is a large tract of landscape, similar to the Somerset Levels and Moors, the Fens and the Netherlands. Naturally drainage took place through a delta system, whereby a complex and dynamic series of channels discharged water into the North Sea via the River Humber. This location was typically selected, for farmland on the edge of a higher ground adjacent to the River Humber and between Hedon and Kingston upon Hull. Naturally, low land flooding would occur during the highest tides and would provide rich sediments for high crop yields after subsequent proper drainage and embanking. The land is typically alluvium and boulder clay. A variety of banks / walls for flood protection, have been constructed, these banks / walls have been progressively modernised and extended to date.

The site is located approximately halfway along, on the northern side of the Humber Estuary, roughly 8 km east of the city centre of Hull and 3.5km north east of the Saltend works. The site, is situated on partially developed land, protected from tidal inundation by existing flood embankments along the Humber Estuary, which also protect the Saltend works and Hull's docklands.

The site is located on the Flamborough Chalk Formation - Chalk. Sedimentary bedrock formed between 86.3 and 72.1 million years ago during the Cretaceous period. Chalk which is generally permeable to water; overlaid with Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period; glacial deposits which may be permeable to water. Local environment previously dominated by ice age conditions. The site is located on Soilscape 18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils; Texture: Loamy; Drainage: Impeded Drainage; Drains to: Stream Network; Water protection: Main risks are associated with overland flow from compacted or poached fields. Organic slurry, dirty water, fertiliser, pathogens and fine sediment can all move in suspension or solution with overland flow or drain water².

² <http://www.landis.org.uk/soilscapes/>

4.3 Flood Zone Classification

The *Flood Map for Planning* indicates that the site and access is located on land in Flood Zone 3. The ERYC SFRA allocates the site as Flood Zone 3 High Probability³, including substantial parts of Preston and the surrounding area.

The Flood Map for Planning shows the site located in Flood Zone 3. Land to the north and east (Preston ~600m) are generally located in Flood Zone 1 and offers a safe refuge. The areas to the east are accessible via normal access if required.

4.4 Historic Flooding

There is no recorded historic flooding on the site. The 2013 flood event and more recent flood records did not flood the site. This includes all historic flood events listed on the ERYC's SFRA interactive map, except in 2007.

All studied Ordnance Survey maps indicated that this part of the flood plain was consistently embanked and drained farmland, and not marsh, with scattered residential development for more than 150 years.

Our own archive records indicate that the 2013 tidal surge and 2007 pluvial events affected significant parts of East Yorkshire, and photographs near the proposed development were taken during the flooding. No historic breaches of the flood embankments have been recorded affecting this part of Preston.

In 1910, 1947, 1953, 2000, 2004, 2007*, 2009, 2011, 2012, 2013, 2014 and 2015, the region saw extensive flooding, and floodwaters threatened to flood parts of the adjacent land within 10km of the site, although no known flooding occurred on this site (*ERYC SFRA indicates some flooding in 2007, although this may be either temporary or associated with conveyancing issues – see IDB remarks later).

No other direct references were found concerning any flooding on the site, although other areas generally have been referred to suffer from periodic flooding, and were naturally marshland. The internet revealed extensive historic records concerning Hedon, Preston and the surrounding areas. Other instances of recorded flooding were remote from the site.

It is therefore conceivable that some flooding could occur during an extreme rainfall flood event or catastrophic failure of Clough or from a breach or overtopping of the flood wall or associated causes. Additional historic research is found in section 6.2 of this report.

³ The East Riding's Strategic Flood Risk Assessment – see Appendix C

4.5 Flood Risk Management Infrastructure

The riparian open channels and IDB drains combined with EA main rivers all serve in draining the surrounding area. Generally the IDB and EA infrastructure is maintained to a high standard, and local riparian channels, where seen were in fair or good condition. There is no other Flood Risk Management infrastructure present on or adjacent to the proposed development site. Access for maintenance to the riparian open channels adjacent to the site are maintained. The proposal does not impact any Flood Risk Management infrastructure.

5 Hydraulic Modelling and Hydrology

5.1 Hydraulic Modelling

No site specific modelling has been undertaken. We understand that the current SFRA has used some modelling. In the recent past several models have been used to provide a variety of flood outlines for different scenarios. These models have been included for completeness and reflect the inherent uncertainty of modelling.

A review of our archives revealed numerous modelling flood outlines for a variety of flood events including fluvial and tidal. Appendix C considers modelling and flood extents with climate changes. Other modelling results are not included here.

Summary of Models considered

Model Name	Date	Range of Events	Site implications
gov.uk Flood Map for Planning	2022	1%/0.5%, 0.1% (includes defence protection)	Site located in Flood Zone 3
ERYC SFRA	2019	3.3%/4% (uses above models), 1%, 0.5%+CC, 0.1%+CC	Confirms site is located in Flood Zone 3a.
EA Humber Estuary 2014 Interim Water Levels	2014	100%, 10%, 2%, 1% 0.5%, 0.2% & 0.1%	H120 (Saltend) max flood level +5.83mAODN (0.1%) MD 3.0m (0.1% at Saltend)
EA 2015 Humber Hull Frontages	2015	5%, 2%, 1%, 1.33% & 0.5%	Site is located in 2% flood outline. MD 0.8m +3.78mAODN (0.5% on site)
EA 2015 Burstwick Drain	2015	2%, 1% & 0.1%	Site and access is located away from all flood outlines.
EA 2020 Old Fleet Model (+CC)	2020	5%, 4%, 2%, 1%, 1.33% 0.5% & 0.1%	Site and access is located away from all flood outlines.
EA 2015 & 2014 River Humber North Bank Tidal	2015 & 2014	0.5%	Site and access is located away from all flood outlines.

MD = Maximum Depth

5.2 Hydrology

The site is located on the Flamborough Chalk Formation - Chalk. Sedimentary bedrock formed between 86.3 and 72.1 million years ago during the Cretaceous period. Chalk which is generally permeable to water; overlaid with Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period; glacial deposits which may be permeable to water.

6 Assessment of Flood Risk

6.1 Initial Desk Top Study

Initially a desktop study was carried out in accordance with the NPPF, following a prospective planning application for residential development. The *Flood Map for Planning* indicates that the site is located on land in Flood Zone 3, and benefits from the presence of flood defences. The ERYC SFRA allocates the site as Flood Zone 3 High Probability⁴, including significant parts of “Preston”.



© Environment Agency copyright and / or database rights 2021. All rights reserved. © Crown Copyright and database right 2021. Ordnance Survey licence number 100024198.

Courtesy of flood-map-for-planning.service.gov.uk website (27 October 2022)

Further Internet perusal and searches of the gov.uk’s website⁵ publicised that:-

- Flood Risk from rivers and sea is low (less than 1%)
- There is no identified risk of flooding from a reservoir
- There is a medium or low risk of flooding from surface water (less than 3.3%), although some adjacent areas show low risk

The site benefits from a flood alert area and a programme of flood and coastal risk management works and strategies within the East Riding.

Further examination of the ERYC SFRA indicates that the site is away from the functional flood plain. Flood risks are thought to comprise only of those already identified.

⁴ The East Riding’s Strategic Flood Risk Assessment – see Appendix C

⁵ This information is not suitable for use in land-use planning (information found earlier in this report is to be used). It is only provided as part of an exhaustive flood risk search.

6.2 Historical Research

The historical research consisted of an internet surf and visits to archives. Historic archive research includes previous relevant Flood Risk Assessments, and other related FCERM work.

The Internet surf of the gov.uk website revealed that the development area is located in Flood Zone 3, and has a high probability of flooding. The implied flood risks provided by defences inform us that the site may be subject to inundation by the sea (flood risk of 0.5% or 1 in 200 years event), or from a river by a flood that has a 1% (1 in 100) flood risk.

A single direct reference was found concerning any flooding on the site, which allegedly occurred in 2007 (see IDB comments), although parts of Hull and East Riding have flooded previously, with other areas generally been referred to suffer from periodic flooding, and were naturally marshland. On occasion the River Humber has been known to overtop; no incidents of over topping and/or breach have been recorded near the site.

Other websites indicated Ordnance Survey Mapping 1852, with low resolution aerial photography. The internet revealed extensive historic records concerning Preston.

The Humber Flood Plain is a tract of land extending from York to the River Humber. It is bounded by high land to the north and east and by rivers to the west and south. Typically this area consisted of distinct types of land use, as follows: Higher land, land always dry; intermediate land, land which periodically flooded or was water-logged for part of the year; marshland, land which was always water-logged or flooded; and the extensive network of natural drainage channels.

There is no clearly defined period when drainage works began, since the area was controlled by a large number of interests. Other drainage and flood protection works began as early as the 11th Century and continued through the 20th Century, creating the drained area typical of today's landscape.

Beverley Archives and library had historic information on Hull, Hedon and Preston. The Ordnance Surveys identified typical grounds levels and historic land use.

Old Fleet Drain (~2km west of the site) presumably naturally formed a small section of the Humber's delta system, and certainly formed the lower reaches of Sproatley and Wyton drains, discharging into the Humber via a Sluice, mentioned late 14th century, later called Lord's clough and maintained by the lord of Preston Manor until the 20th century. The drainage of Preston was the responsibility of the 'Court of Sewers for the East Parts of the East Riding' from the 16th century until 1943, when Preston Drainage Board was formed and later became part of the South Holderness Internal Drainage Board.

Historically Hedon was located on the Humber Estuary and was the main port on the north of the river, later the docklands in Hull, became established, following siltation and inadequate channel width at Hedon. Various land reclamation projects, embanking and new channels have pushed the edge of the estuary southwards by up to a mile in

places. This is most clearly indicated by the Saltend petrochemical works site, which is constructed on salt marsh and mud flats.

Following construction of the Hull to Withernsea Railway (1852), effectively a low level embankment was constructed to the south of the site. Later the railway was disused (after 1963) and the track removed. The old rail route is now used as a cycle path.

6.3 Findings of Research

The site and surrounding area originally formed part of the Humber Estuary Flood Plain, part of a complex delta system several hundred square kilometres in extent. It was not known exactly when the first embankments were constructed along this section of the Humber, references as early as the 11th century indicate that the area was embanked and farmed, but with inadequate drainage provision, however no details of the height or thickness of any embankment were discovered.

Earliest information indicates that settlements were located on the higher ground. Settlements have been formally recorded in 1086, which suggests that some raising of embankments had begun prior to this period. The shape of the River Humber was slightly different historically. Effective embanking along the River Humber had occurred prior to the 14th Century following land reclamation and new manmade channels. The drainage of Preston was the responsibility of the 'Court of Sewers for the East Parts of the East Riding' from the 16th century until 1943. The IDB main drain known as New Fleet (Preston New Drain) passes west of the site and along the southern part of Staithes Road. New Fleet is a manmade channel constructed in the 17th century, which is connected to the Humber Estuary, via a Sluice called Pollard Clough.

This location was typically selected, for farmland on the edge of a higher ground adjacent to the River Humber and between Hedon and Kingston upon Hull. Naturally, low land flooding would occur during the highest tides and would provide rich sediments for high crop yields after subsequent proper drainage and embanking. The land is typically alluvium and boulder clay.

Current adjacent developments include agricultural development (immediately north, and west), woodland (east) and mixed development (dwellings, outbuildings, etc. - south), and further away extensive industrial areas (including the Saltend petrochemical works) and Preston and Hedon (large suburbs of Hull) and isolated farms scattered around arable farmland.

The site is located approximately halfway along, on the northern side of the Humber Estuary, roughly 8 km east of the city centre of Hull and 3.5km north east of the Saltend works. The site is situated on partially developed land, protected from tidal inundation by existing flood embankments along the Humber Estuary (4km south west), which also protect the Saltend works and Hull's docklands. Various features such as old railway embankments, highways (A1033), Hull's Docklands and Saltend also offer some additional site protection from flooding.

Historically Hedon was located on the Humber Estuary and was the main port on the north of the river, later the docklands in Hull, became established, following siltation and inadequate channel width at Hedon. Various land reclamation projects, embanking and new channels have pushed the edge of the estuary southwards by up to a mile in places. This is most clearly indicated by the Saltend petrochemical works site, which is constructed on salt marsh and mud flats.

Following construction of the Hull to Withernsea Railway (1852), effectively a low level embankment was constructed to the south of the site. Later the railway was disused (after 1963) and the track removed. The old rail route is now used as a cycle path.

Ordnance Surveys were studied and none indicated any ponds, watercourses, areas subject to flood, marshland or other indications of concern on the proposed development plot.

Previous analysis of tidal data at Ferriby Sluice indicates that typical high water is around +3.88mAODN and the 1953 tidal surge event was around +5.2mAODN.

From these references and other researched information discovered, it is deduced that before draining and embanking of the area, the site may flood during flood events. Although the site was not natural marshland, adjacent areas almost certainly were. The construction and maintenance of the IDB Drains and the two outfalls into the Humber and flood embankments all compliment to the reduction of flood risk at the site. No major flood events have been recorded on the site or on the adjacent land (except isolated flooding in 2007). The extensive flooding in 2000 also failed to include the site among its victims.

In 1910, 1947, 1953, 2000, 2004, 2007*, 2009, 2011, 2012, 2013, 2014 and 2015 the region saw extensive flooding, and floodwaters have previously threatened to flood parts of the East Riding, with a single instance of known flooding occurred on this site in 2007. From IDB and SFRA evidence the flooding was isolated, hence likely caused by poor riparian drain management.

From these references and other researched information discovered, it is deduced that before draining and embanking of the area, the area of the site could flood during extreme flood events. Although the site was not natural marshland, nearby areas were. The construction and maintenance of the River Humber's embankments (and their tributaries) and the outfalls into the EA main rivers and other flood embankments all compliment to the reduction of flood risk at the site. Although a flood risk for the site exists, the risk of flooding in extreme events with flood defences in place is around 1 in a 100 year or 1% annual probability or less. The lowest garden areas of the site could temporarily flood during extreme flood events allowing for climate changes. The whole site and access is located in Flood Zone 3.

6.4 Identification of Flood Risk

The whole site is located in Flood Zone 3 "Zone 3 – High Probability" the most significant, and as such there is an identified combined flood risk, corresponding to 0.5% or more than probability of flooding. The combined flood risk from rivers and

sea is cited at *gov.uk* as supports this assertion. Surface water flood risks are identified as medium to low less than 3.3%. The cited flood risk is corroborated by other sources of data. Owing to climate changes the risk of flooding will increase as time passes.

6.5 River Humber Overtopping

The River Humber is tidal and is subject to a range in height of water levels caused by a combination of variable fluvial flows and/or high tides and/or storm surges. The distance from the embankments limits the impact of this scenario. Furthermore the site is located ~4km from the River Humber, and is also behind an old railway embankment and the A1033, both of which would act as additional flood defence barriers.

The EA's 2015 Hull Humber Frontages Model indicates flood depths of up to 0.8m during the 0.5% flood outline.

The 2013 Tidal Surge did cause overtopping of the Humber Estuary embankments at multiple locations. All associated flooding was remote from the site.

6.6 River Humber Breach (Embankment Failure)

Historically there is no reference to embankment failure. It is unlikely that these flood embankments would fail, due to the high quality of construction protecting this intensive land use area. Adjacent areas also enjoy adequate embankment protection.

Historically we have found no reference to embankment failure in the vicinity of the site. The embankments have been improved over the years, by various authorities, now known as the Environment Agency; the EA maintains these banks in a very good condition.

If a breach did occur the effects would be severely limited due to the proximity of adjacent lower land, which would act as a storage area until the breach was repaired. The estimated time for site impacts would be 36 hours after a breach had occurred at Saltend.

6.7 Open Channel Overtopping or Breach

Breaches would have no impact as all drains are lower than ground levels. Historically there are local references to conveyance issues associated with riparian open channels. Riparian open channels where seen were typically in fair condition, but without regular maintenance could present a future problem. Open channel overtopping or exceedance combined with surface water presents the most likely flood risk. A residual flood risk exists.

6.8 Surface Water Flooding

Known surface water issues in Preston are scattered rather than widespread, and are typically present along open channels. Both the ERYC SFRA and the *gov.uk* website which is more detailed, but should not be used for planning purposes, indicates that the land where the building is to be located is at low to medium risk. Climate changes would undoubtedly increase flood risks. Surface water flood risks are connected with open channels (above 6.7). A residual flood risk exists.

6.9 Overland Flooding

Historically there are general references to flooding and waterlogging in the Humber floodplain, although there is no single reference to overland flooding specific to the site. There are no known ground water flood risks affecting the site. Some overtopping and breaches or surface water could affect the site, but would readily drain away to flood the lower level farmland via the open channel watercourses. It is therefore very unlikely that this area could suffer flooding via overland flow.

6.10 Groundwater Flooding

In view of the site's elevation in relation to large areas of land more than 0.5m lower, and no recorded instance of groundwater flooding, groundwater flooding is unlikely to occur. The ERYC SFRA indicates that the site falls outside an area susceptible to groundwater flooding. There are no known or historic springs in the area. The IDB and EA watercourses would all assist in preventing ground water levels from increasing the flood level. Groundwater flooding would be restricted to the lowest land, which would readily flow into the existing open channel watercourses.

6.11 Effects of Development on Existing Flood Defence Protection

The development does not encroach onto any drainage channels. No import of additional fill material is required, so the development will have no effect on the existing flood defence structures or levels of current protection.

6.12 Sustainability of Existing Flood Defence Protection

The Environment Agency and South Holderness Internal Drainage Board currently maintains the existing flood protection, with various improvements and maintenance works being carried out from time to time. Some of these flood embankments and drains have been in place, in some form, for at least 500 years and there is no suggestion that the maintenance will cease. It is very unlikely that 'a future policy of *do nothing* or *retreat the line*' will occur at this location in the next 50 years.

6.13 Climate Change

Climate change was considered in accordance with the latest Department for Environment, Food and Rural Affairs (DEFRA) and Environment Agency guidance. Yorkshire & Humber's key adaptation to climate change issues include:

- Flooding - many major settlements, e.g. York, Leeds and Hull, are at risk from river, coastal and surface water flooding
- Coastal erosion - as sea levels rise
- Excess heat, particularly in the main urban areas
- Biodiversity - major upland peat areas and other internationally important habitats will be under threat from a changing climate.

The updated guidance <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> has been used to ensure the FRA demonstrates the development is safe for the lifetime of the development and therefore is critical in determining

mitigation within the main body of the FRA.

There is no doubt that average temperatures in the world have raised over the last 100 years or so, and this has mainly resulted in a slight increase in water levels as a result of melting of ice caps, but actually more significantly, is the volumetric change of the existing oceans as a result of the higher temperatures. Increased storminess and rainfall may also be experienced, which will also cause more flooding.

The government policy of upgrading flood defences in line with any anticipated climate change will, even in the worse scenario, have no effect of the practical maintenance of these defences, for the foreseeable future and certainly none over the next 100 years.

Climate change is an uncertain science; the proposals over the next 100 years will have no effect on the defences in the area, other than to increase the chances of upgrading these to accommodate any climate change.

Consideration of climate changes has been considered throughout this document. All identified residual risks are exacerbated by climate changes. The necessary surface water drainage design, the elevated finished floor level, and the provision of safe refuge of the proposed dwelling will address these residual risks. Climate changes are considered in detail in Appendices C.

7 Management of Flood Risk

7.2 Flood Alleviation Measures Currently in Place

Due to the site's elevation and the presence of flood defences and distance from the Humber, the site is protected from tidal and fluvial flooding arising from coastal or Main River over topping and breaches. Surface water drainage will be by soakaway, if suitable. The site and the main site access are located on land located in Flood Zone 3, which we consider requires mitigation to this residual risk. There are no flood alleviation measures on the site, or which impact existing flood risk management infrastructure and no intention to construct future schemes in the vicinity. These proposals do not seek to alter ground levels therefore no impacts are possible.

7.3 Residual Risks

There are five outlying residual risks:

- a) From overtopping of River Humber; and
- b) From a breach of River Humber; and
- c) From overtopping of a riparian watercourse; and
- d) From surface water flooding; and
- e) From overland flow flooding;

Risks arising from the Humber even including possible future climate changes are estimated as low 100 years hence. Risks arising from well maintained riparian watercourses, combined with surface water risks, and overland flow risks, including possible future climate changes, and are estimated as medium 100 years hence. Ground water risks are considered to be negligible, with no recorded flooding in Preston. No ground water springs are located on the site. All risks are likely to increase with climate changes, and all mitigations measures include likely climate changes or worst case climate changes.

7.4 Residual Risk Management

Residual risks are addressed by the following:

- The dwelling constructed with Finished Floor Levels more than 600mm above adjacent ground levels (this addresses the residual flood risks and climate changes) - +3.4mAODN.
- Flood proofing scheme to +3.85mAODN (1050mm above ground levels) (this above all 0.5% modelled flood outlines)
- No ground floor sleeping proposed below +4.0mAODN.
- Safe place of refuge above +5.7mAODN.
- A robust Flood Warning and Evacuation Plan.

7.5 Safe Means of Escape in the event of a Flood Event

A safe means of escape during flooding can be provided in the upper floor of the proposed development (greater than +5.7 mAODN).

The site access (Staithes Road) is located in Flood Zone 3, which connects with parts located in Flood Zone 1, ~600m east in Preston. Emergency evacuation to higher land south along Staithes Road is available (Flood Zone 1). A Flood Warning and Evacuation Plan is required. Typically the site or access would not be affected with 36 hours of a Humber breach.

8 Sequential and Exception Tests

8.1 Sequential Test

The Sequential test is outside the scope of this report.

8.2 Exception Test

The Exception test is required for the proposed dwellings located in Flood Zone 3a. The existing site is a field with an existing access. This FRA demonstrates that the site will be safe for use.

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓
2	✓	Exception Test required	✓	✓	✓
3a	Exception Test required*	X	Exception Test required	✓	✓
3b	Exception Test required**	X	X	X	✓**

This *Flood Risk Assessment* that accompanies the Application confirms that the development proposal is located in the area of lowest flood risk, will be safe in the event of a flood event, residual risks are mitigated, safe locations for use during a flood are available and the proposal will not cause flooding elsewhere. All criteria of the Exception Test are therefore considered to be passed.

9 Surface Water Management

The key information is:

- The site area is 4,090m²
- The total impermeable area of the site is a dwelling 169m².
- All surface water rainfall run-off will be to a soakaway following determination/testing of suitability.
- Soakaway systems inspected annually and maintained as required.

10 Feedback from Consultees

10.1 Environment Agency

The Environment Agency's website has been extensively consulted; the findings are presented and discussed in this report. Since the development is a new dwelling, and all residual flood risks are fully mitigated, it is unlikely to attract any objections.

10.2 Internal Drainage Board

The site is located in a local drainage board, the South Holderness Internal Drainage Board. According to the Clerk Mr R Ward, flooding has never occurred on the site, although poor management of riparian watercourses has caused conveyancing problems to the west side of Luck Lane. Riparian watercourses are expected to be unmodified, maintained, and have suitable access.

10.3 Strategic Flood Risk Assessment (Lead Local Flood Authority)

The Lead Local Flood Authority is the Planning Authority (the East Riding of Yorkshire Council), and as such has been fully consulted with via the internet.

Extracts from SFRA Level 1 are presented in Appendix C and throughout this report.

10.4 Flood Risk Investigations (Lead Local Flood Authority)

There have been no flood events affecting Preston directly or in the immediate area and therefore no specific Flood Investigation Report has been completed. None of the flood events reported on the ERYC website affected the site or adjacent areas (search includes Winter 2015-16 and Hurricane Bertha). The 2013 tidal surge affected some parts of the East Riding and was included s19 reporting.

10.5 Yorkshire Water Services Limited

Surface water is to be disposed of sustainably by soakaway if possible. Foul water to a treatment digester.

10.6 Additional Flood Protection Requirement and Sustainability

There is no additional flood protection requirement resulting from the proposed development. Following climate changes there will be flood risks associated with increased storminess or overtopping or breach. This report considers the residual flood risks. As long as runoff is properly controlled, there will be no effect from the development on neighbouring locations. No additional fill material will be imported. The social consequences of the works will result in the improvement of the development for the area.

11 Summary and Conclusions

Historically the site lies within the historical Humber flood plain which probably flooded occasionally in the past, prior to embanking of the River Humber. The site is located at approximately +2.8mAODN and is away from any normal tidal inundation, due to flood defences and adjacent low farmland. The Flood Map for Planning (section 6.1) shows the site benefitting from defences and in Flood Zone 3, there are substantial flood walls and embankments present maintained by the EA. Combined flood risks exist from the River Humber and pluvial effects show the site as at risk from overtopping, breach, riparian watercourses and surface water. The site is also benefits from drainage via the South Holderness IDB. The residual flood risks are required to be addressed and form part of the recommendations. Pluvial risks are mitigated by sustainable drainage systems (soakaway).

The proposals meet with National and Local Policies.

There is a potential for overtopping or breaches from the River Humber. Flood risks are thought to be currently low, but increasing due to climate changes, on the site.

There is a potential for inundation via open channels or surface water. Flood risks are thought to be medium to low on the site.

The development will have no effect, other than adding to the amount of development in the area, regarding flood risk. There is no known serious flood events affecting this part of Preston, even allowing for the twelve events in the last 100 years, i.e. in 1910, 1947, 1953, 2000, 2004, 2007*, 2009, 2011, 2012, 2013, 2014 and 2015, with no known instance of flooding occurred on this site (*some isolated flooding occurred in 2007 which corresponds to pluvial/surface water risks, the depth and duration of flooding is unknown). In addition the proposed development is of sufficient elevation, which offers refuge on the upper floor if required; site access is located in Flood Zone 3.

We therefore conclude that the site is suitable for the development as proposed, provided adequate mitigation of flood risk is included in the as built dwelling.

12 Recommendations (Proposed Development - Ground Floor Level and Residual Risk Mitigation)

The site is located at approximately +2.8mAOD. The average road level along Luck Lane is +2.7mAODN. The existing outbuildings have finished floor levels of ~+2.9mAODN. The extreme combined flood level for a 1 in 200 year event is likely to be more than this level on the site. Climate changes and other uncertainties indicate some additional flood risk; we therefore recommend that the minimum floor level should be at around +3.4mAODN. The Environment Agency/ERYC normally requests 600mm above average ground or adjacent road levels (whichever is the greater).

We would also recommend that flood resilience measures are built into the development, in accordance with EA guidance (located 300mm above FFL), with all electrical sockets and electrical connections located a minimum of 450mm above the finished floor level (see Appendix F) – (equivalent to 1050mm above the average site level).

i.e. a minimum ground floor level of +3.4 mAOD

It would also be worth considering other flood mitigation measures in the building construction. The 0.5% flood outline gives a maximum flood depth of +3.78mAODN.

A suitable surface water drainage scheme is required.

Safe refuge is provided on the upper floor being higher than +5.5mAODN (proposed upper floor level <+5.7mAODN). Emergency evacuation to higher land east along Staithes Road towards Preston (Flood Zone 1). A Flood Warning and Evacuation Plan is recommended.

With climate changes over 100 years increased peak rainfall will increase.

With climate changes over 100 years Humber overtopping presents a "No Danger "; a breach presents a "No danger".

APPENDICES

Appendix A – Location Plan

Appendix B – Site Photographs

Appendix C – Other Plans

- Plan No 1 online SFRA2021 Strategy Update
- Plan No 2 online SFRA2022 Proposed Update
- Plan No 3 online SFRA2016 Development & Allocations
- Plan No 4 online SFRA2019 Flood Risk (ERYC Flood Data)
- Plan No 5 online SFRA2019 Watercourses (ERYC Flood Data)
- Plan No 6 online SFRA2019 Historic Flooding (ERYC Flood Data)
- Plan No 7 online SFRA2019 Groundwater (ERYC Flood Data)
- Plan No 8 online SFRA2019 Flood Defences (ERYC Flood Data)
- Plan No 9 online SFRA2019 HNB Tidal Climate Change (ERYC Flood Data)
- Plan No 10 online SFRA2019 Future Risk (ERYC Flood Data)
- Plan No 11 online SFRA2019 EA Flood Defences (ERYC Flood Data)
- Plan No 12 online SFRA2019 Flood Alert (ERYC Flood Data)
- Plan No 13 online SFRA2019 Surface Water Risks (ERYC Flood Data)
- Plan No 14 online SFRA2019 Future Surface Water Risks (ERYC Flood Data)
- Plan No 15 SFRA Appendix K (FRA Requirements – ERYC)
- Plan No 16 Site Level Plan (with proposals)

Appendix D - Copyright

Appendix E – EA product 4 data

Appendix F – Schedule of Flood Proofing

This document has been prepared by:-

Richard Bate BSc of A & F Consulting Engineers LLP



Signed.....Dated:- 12th December 2022