Flood Risk Assessment for
Proposed Change of Use Development at
Falkland Way, Barton-upon-Humber
North Lincolnshire

On behalf of Fiona Pounder, Hoperty Limited, Unit 4, Falkland Way, Barton Upon Humber, North Lincolnshire DN18 5RL

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CONTENTS

1 Introduction

1.1 Preamble
1.2 Flood Risk Assessments
1.3 North Lincolnshire Council Policy
1.4 Glossary

2 Preliminary Studies

2.1 Initial Desk Top Study
2.2 Historical Research
2.3 Findings of Research
2.4 Identification of Flood Risk

3 Sequential and Exception Tests

3.1 Sequential Approach
3.2 Exception Test

4 Feedback from Consultees

4.1 Environment Agency
4.2 Internal Drainage Board
4.3 Strategic Flood Risk Assessment (Lead Local Flood Authority)
4.4 Flood Risk Investigations (Lead Local Flood Authority)

5 Site Surveys

6 Flood Alleviation Measures Currently in Place

6.1 Failure Mechanisms
6.2 Tidal Overtopping
6.3 Tidal Embankment Failure
6.4 Surface Water Run-off
6.5 Overland Flooding
6.6 Groundwater Flooding
6.7 Effects of Development on Existing Flood Defence Protection
6.8 Sustainability of Existing Flood Defence Protection

7 Future Flood Defence Protection Considerations

7.1 Additional Flood Protection Requirement
7.2 Climate Change
7.3 Development Run Off & Site Raising
7.4 Neighbouring Locations, Social Consequences & Sustainability
7.5 Safe Means of Escape in the Event of a Flood Event

8 Conclusions

9 Recommendations (Proposed Development - Ground Floor Level)

10 Appendices - See next sheet

APPENDICES

Appendix A – North Lincolnshire Council's Map References

A1 North Lincolnshire Council's SFRA Historic Flood Events

A2 North Lincolnshire Council's SFRA Map

A3 North Lincolnshire Council's SFRA Watercourses Map

A4 North Lincolnshire Council's SFRA IDB and Flood Management

A5 North Lincolnshire Council's SFRA Map

A6 North Lincolnshire Council's EA hazard mapping Map

Appendix B – Extract from SFRA

Appendix C – Plans

Plan No 1 Location Plan and Block Plan
Plan No 2 Surface Water Flood Risk

Appendix D – Photographs

Appendix E - Copyright

1 Introduction

1.1 Preamble

Fiona Pounder, Director of Hoperty Limited, Unit 4, Falkland Way, Barton Upon Humber, North Lincolnshire, DN18 5RL, on behalf of, Hoperty Limited, instructed us to prepare a flood risk assessment for the proposed change of use of developed of land (from D2 Leisure (Gymnastics) to B2 (General Industrial), B8 (Storage and Distribution) and E(g)), at Unit 1, Falkland Way, Barton-upon-Humber, North Lincolnshire DN18 5RL.

The proposed site which is ~800m south of the River Humber estuary, has an open channel watercourse running along parts of the northern and eastern site boundary. Nearby are several other open channel watercourses, with Barton Haven (water level controlled in this location, but tidal downstream and adjacent to the Humber estuary) being located west along the south side of the railway line. The nearest approach of Barton Haven to the site is ~150m west. This Main River is fed by a tributary drain running north (Pasture Road) and south (Pasture Road North). There are also numerous water bodies located along the Humber foreshore (from excavated clay pits and environmental areas) the nearest to the site is some 50m north. The most significant watercourse is the River Humber (tidal); there is no recorded history of flooding on the site.

The site is located on the lower slopes of the Lincolnshire Wolds, and it occupies the upper part of the estuarine flood plain. Natural drainage takes place through open channels into the River Humber; this is currently assisted with pumped drainage. A variety of banks for flood protection have been constructed; these banks have been progressively modernised and extended to date. There is no flood protection infrastructure present on site.

The land use is currently a vacant leisure facility (Gymnastics), with amenity, commercial and industrial development adjacent. Further from the site are agriculturally related developments, residential and recreational sites.

1.2 Flood Risk Assessments

Flood risk assessments may be required under certain low lying sites in accordance with NPPF s10, which was issued in March 2012.

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. Extracts 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

165. 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.

166. 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.

167. All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and 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 integrated 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.

168. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. 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.

169. If it is not possible for development to be located in areas 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.

170. 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.

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

172. 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 ifrelevant 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.

173. 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 assessment59. 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

174. Applications for some minor development and changes of use60 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 59.

175. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:
a) take account of advice from the lead local flood authority;
b) have appropriate proposed minimum operational standards;
c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
d) where possible, provide multifunctional benefits.

59 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.

60 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.

1.3 North Lincolnshire Council Policy

The Government has published a National Planning Policy Framework (NPPF), which relates to Development and includes Flood Risk, as well as the North Lincolnshire Council's (NLC) Strategic Flood Risk Assessment (SFRA) in November 2021. The SFRA has been studied with associated material, and support the comments made in this report. The SFRA confirms that part of the site is located in Flood Zone 2/3 (a) Tidal; see Appendices for details.

The SFRA indicates the need for sustainable development within the remit of PPS 25, and advocates the use of the sequential test, with a two stage assessment; climate change considerations; and further guidance and information.

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 introduce 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 to 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)

Table 2 – Flood Zone Definitions & Aims of PPS25 (NLC SFRA table 3.1)

Flood Zone	Definition
Zone 1 Low Probability	This Zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (< 0.1%).
Zone 2 Medium Probability	This Zone comprises land assessed as having between a 1 in 100 and 1 in 1000 (1% – 0.1%) annual probability of river flooding or between a 1 in 200 and 1 in 1000 (0.5% – 0.1%) Annual probability of sea flooding in any year.
Zone 3a High Probability	This Zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (> 1%) or a 1 in 200 or greater annual probability of flooding from the sea (> 0.5%) in any year.
Zone 3b The Functional Floodplain	This Zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or, is designed to flood in an extreme (0.1%) flood should provide a starting point for consideration and discussions to identify the functional floodplain.

Table 3.1 - Flood zone definitions (reflects the table in NPPG Note 25).

1.4 Glossary

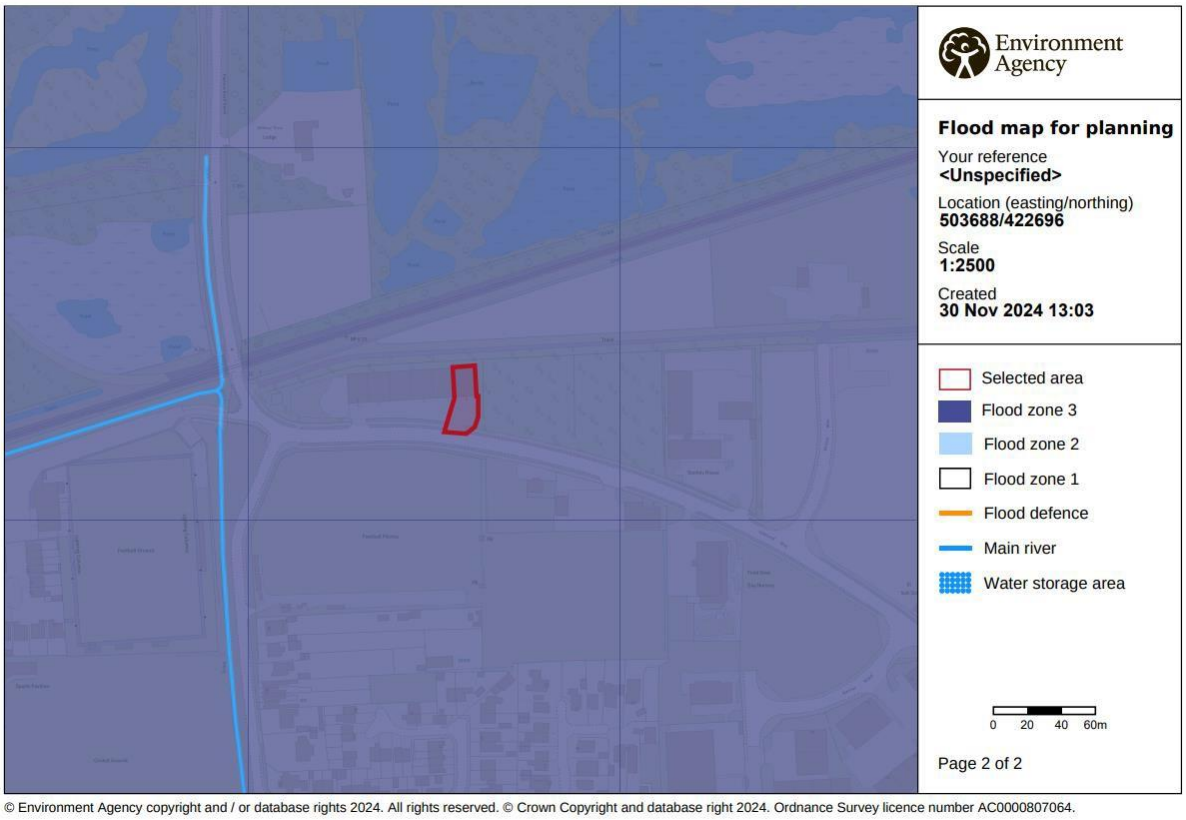
To aid understanding, an explanation of engineering and other terminology is provided:-

- AODN — Above Ordnance Datum Newlyn
- AODL — Above Ordnance Datum Liverpool
- Benchmark — Accurately fixed level used for levelling
- Carr — an area of fen woodland or bog in which scrub has become established
- Channel — A cut into the land which allows water to pass through
- EA — Environment Agency
- FRA — Flood Risk Assessment (site specific)
- IDB — Internal Drainage Board
- Main River — Watercourse managed by the EA
- NLC — North Lincolnshire Council
- NPPF — National Planning Policy Framework
- 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

2 Preliminary Studies

2.1 Initial Desk Top Study

Initially a desktop study was carried out in accordance with the Planning Policy Statement 25, Development and Flood Risk, following a planning application for industrial and office development. The gov.uk website considers that the site is located in Flood Zone 3 (High)[1].



Courtesy of flood-map-for-planning.service.gov.uk website (30 November 2024)

[1] From the gov.uk's website (November 2024).

2.2 Historical Research

The historical research consisted of an internet surf and references to archives. Historic research includes previous relevant Flood Risk Assessments.

The Internet surf of the gov.uk website revealed that the area is located in Flood Zone 3, and has a high probability of flooding. However, flood defences are present and operated effectively during the 2013 tidal surge. 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.

Further Internet perusal and searches of the gov.uk's website[2] publicised that:-

- Ground water aquifers were not confirmed
- Flood Risk from rivers or sea is medium (between 1% and 3.3%)
- There is no risk of flooding from a reservoir
- There is a very low risk of flooding from surface water (less than 0.1%)

No direct reference was found concerning any flooding on the site, although parts of Barton have flooded previously[3], with other areas generally been referred to suffer from periodic flooding, and were naturally marshland. The area appears to be covered by Flood Warning (floodassist.co.uk). The adjacent Humber defences were shown as overtopped or breached (extent unknown), although no land or adjacent land was flooded[4].

Other websites indicated Ordnance Survey Mapping 1886, with low resolution aerial photography. The internet revealed extensive historic records concerning Barton-upon-Humber. The *http://www.inbarton.co.uk/* website described the History of Barton as:-

The town of Barton upon Humber is of Anglo-Saxon origin and it is during this period that a major settlement on Castledyke South was in occupation (Around where Kings Garth Mill {the Old Mill pub} is now). There has been a large excavation of an Anglo-Saxon cemetery around this site. There is also evidence that the Romans settled on a site to the east of the Beck stream by 400AD after moving from the location of Poor Farm to the east of the modern town. There may have been a significant local Roman community.

It is clear that the higher land offered shelter from flooding, but close enough to various local resources including the River Humber. It is not known when the embankments were first constructed, however embankments were shown on the earliest OS mapping 1886. No area or part of the site was identified from historic mapping as marsh, spring or similar water feature. The existing railway line will act as an intermediate flood embankment.

[2] 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.
[3] The BBC reported flooding to Baysgarth Park date unknown (before 24 September 2014). 15th September 1935 flooding to terrace properties around the Haven [Barton]. June 2007 the Beck flooded.
[4] The Tidal Surge on the 5th of December and its Effects on the Humber - Environment Agency November 2014

The North Lincolnshire Council prepared a Preliminary Flood Risk Assessment (addendum with report) in 2017. This report confirmed that there had been no significant flood events since 2011, but that generally understanding had increased and flood risks were reduced.

Photographs of flooding and other sources indicate flooding in parts of Humber Estuary flood plains in 1935, 1947, 1953, 2000, 2007, 2008, 2009, 2011, 2012, 2013 and 2016; none of these instances of flooding affected the site or adjacent access.

2.3 Findings of Research

The site is located to the northern part of the Lincolnshire Wolds. Rocks of the solid geology are the Welton Chalk Formation that were laid down in the Cretaceous period, between 90 -101 million years ago. Superficial deposits are described as Tidal Flat Deposits – Clay and Silt, deposited up to 2 million years ago. The site and surrounding area are part of the Lincolnshire Wolds, which permit water percolation through the limestone bedrock.

The location was typically selected for development due to the proximity to the River Humber, which later had a train station, with the higher land offering safe refuge from flooding.

Current adjacent land use is mixed development, comprising of adjacent commercial units (west), railway line (north), disused/agriculture/shrub land (east), and recreational (south). Further from the site, there is other related developments, including water related (ponds, tourism and ecology) and residential.

The site is away from tidal and low land flooding due to its relative higher elevation and established flood defences. Nevertheless, tidal flooding could occur either from overtopping or from breach of the embankments or walls.

Other flood risks include localised surface water and groundwater. Surface water flood risks are thought to be generally very low, existing surface water drainage arrangements are considered satisfactory. Groundwater risks have not been confirmed, but no historic springs or history of ground water problems has been noted on the site or on adjacent areas.

The Ordnance Survey map of 1886 (scale 1:10,560) indicates the site as agricultural. The site appears free from marshy ground, with no watercourses or water features shown. The railway line is shown. The site is unchanged until the early 1970’s, with no historic flooding or related indications.

Please refer to the Appendices located at the end of this report when studying these references. Appendix A confirms the North Lincolnshire Council SFRA mapping.

Reference A1. Historic Flood Events (taken from SFRA 2021). This plan indicates EA historic flood areas, the site is unaffected.

Reference A2. SFRA Map (taken from SFRA 2021). This plan indicates the flood zones; the site is located away from flood storage areas.

Reference A3. Main River watercourses (taken from SFRA 2021). This plan indicates EA main rivers (not present on the site – near the railway crossing).

Reference A4. IDB and Flood Management features. The site is located in an area administered by the North East Lindsey IDB, and has no flood management features.

Reference A5. SFRA Map (taken from SFRA 2021). This plan indicates the flood zones; the site is located in Flood Zone 2/3 (a) Tidal.

Reference A6. EA hazard mapping Map (taken from SFRA 2021). This plan indicates the breach depth 0.5% AEP (2115) of hazard 1.6+.

In 1935, 1947, 1953, 2000, 2007, 2008, 2009, 2011, 2012, 2013 and 2016 the region saw extensive flooding, and floodwaters threatened to flood parts of Barton, although no actual flooding occurred in the town.

The previously the SFRA 2011 provided a critical flood level of +6.64mOD for Barton-upon-Humber. The current flood risk advice matrix gives: Danger to MOST (Hazard Rating 1.25 - 2). The site is rated as “hazard: 1.6+” (Appendix A).

From these references, we deduce that it is possible the site may flood from the River Humber either by overtopping or breach of the defences. Other flood risks are very low. Therefore, during very high rainfall events and/or a saturated catchment localised on site flooding could also occur, albeit unlikely. All known historic flood events indicate that the site is away from flooding. We deduce that, the risk of flooding is greater than 1 in 200 years (>0.5%) from tidal flooding. Surface water flood risks with adequate drainage are also thought be less than 1 in 1000 years (<0.1%).

2.4 Identification of Flood Risk

The site is located in "Flood Zone 3 – high probability of flooding", and as such there is an identified combined flood risk, corresponding to 0.5% or more than probability of tidal flooding.

The EA has previously provided additional information, which indicates that the site would be at risk of flooding if there were no defences present (flood defences do exist).

The combined flood risk from rivers and sea is cited at *gov.uk* as medium risk between 1% and 3.3%. Surface water flood risks are typically very low <0.1% probability. There is no risk of flooding from a reservoir. The cited flood risk is corroborated by other sources of data.

The tidal surge 2013 is estimated at Hull to have a return period of 1,285 years, with a skew surge of 1.93m[5]; Immingham has a return period of 798 years, with a skew surge of 1.66m. Insufficient data is available for other areas to derive the return period. Other sources estimate the 2013 tidal surge to have an annual probability of occurrence of less than 0.5% in the Humber Estuary vicinity.

There are therefore conflicting values of estimated flood risk. Using the benchmark of the 2013 tidal surge the flood risk appears to be significantly less than 0.5% probability, whilst using modelled data from the EA and government indicates significantly higher flood risks potentially as high as 1%. The true estimation is likely to be somewhere between.

[5] A comparison of the 31 January – 1 February 1953 and5 – December 2013 coastal flood events around the UK

3 Sequential and Exception Test

The sequential approach and exception test are referred to in both the SFRA and NPPF. The development classification falls within the "Less Vulnerable" category (Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.). The proposal falls into the category of change of use.

The NLC advises to use the "Undertaking the Sequential and Exception Tests" as illustrated in section 7.13 of the SFRA. As follows:

1. Step 1 – Is the Proposal within a flood risk area? YES.
2. Step 2 – Is the Proposal a change of use…? YES. (Sequential Test not required, but Exceptions Test may and site-specific Flood Risk Assessment covering drainage and SUDS issues may be required)
3. Step 3 – N/A Apply the Sequential Test (change of use is exempt).
4. Steps 4 & 5 – N/A Apply and meet the Exception Test (change of use is exempt).

Table 3 - (NLC SFRA table 7.2)

7.38 Table 7.2 below shows development which is allowed not allowed within each flood risk zone and whether an Exception Test is required or not.

Flood Risk Zone	Development Allowed	Development Not Allowed
1 Low Probability	All uses, subject to FRA – Essential infrastructure; Highly Vulnerable (e.g. hospitals, mobile home sites); More Vulnerable (e.g. dwellings, landfill sites); Less Vulnerable (e.g. general industrial, transport infrastructure); Water Compatible (e.g. water based recreation, amenity open space, docks, marinas and wharves). Exception Test not required.	No constraints due to river, tidal or coastal flooding
2/3(a) Medium or High Probability	Less Vulnerable, Water Compatible, subject to FRA. Exception Test needed for More Vulnerable and Essential Infrastructure.	Highly Vulnerable; More Vulnerable and Essential Infrastructure if Exception Test cannot be met or there are alternative sites in SFRA Flood Zone 1
3(b) Functional Floodplain	Water Compatible, subject to FRA. Exception Test needed for Essential Infrastructure.	Highly Vulnerable, More Vulnerable, Less Vulnerable; Essential Infrastructure if Exception Test cannot be met or there are alternative sites in SFRA Flood Zones 1 or 2/3(a)

Table 7.2 - Exception Test guide

Since the site is located within Flood Zone 3 and is less vulnerable the exception test is not required for the proposed development, since the development is appropriate.

4 Feedback from Consultees

4.1 Environment Agency

The Environment Agency's (and gov.uk) website has been extensively consulted in respect of flood risk; the findings are presented and discussed in this report. No evidence exists concerning actual flooding of the site.

4.2 Internal Drainage Board

The local drainage board is the North East Lindsey Internal Drainage Board; previous discussions with the local Drainage Board engineer (Mr. Darren Scott) confirmed that he had no knowledge of any flood events connected with the site.

According to local knowledge, i.e that within living memory, flooding has never occurred on this site.

4.3 Strategic Flood Risk Assessment (Lead Local Flood Authority)

The Lead Local Flood Authority is the Planning Authority (the North Lincolnshire Council), and as such has been fully consulted with via the internet. This report follows North Lincolnshire Council policy and guidance.

4.4 Flood Risk Investigations (Lead Local Flood Authority)

There have been no flood events affecting Barton directly and therefore no specific Flood Investigation Report has been completed. None of the flood events reported on the North Lincolnshire website affected the site or adjacent areas.

5 Site Surveys

A site survey by ourselves was undertaken on Wednesday 12th September 2018, the site visit also included an inspection of the surrounding area. Recent previous site information on the flood defences and the Barton Haven was also considered. A selection of photographs was taken during the survey.

Typically, ground levels are around +4.0m AODN or lower. Levels in the adjacent watercourses (west Main River) are lower, around +2.0m AODN or lower. No evidence of flooding was noted on site.

In addition, spot heights on the adjacent railway crossing (Falkland Way) have been discovered, which are between 4.15 and 4.17 mAODN.

A remote review was undertaken during the preparation of this report (2024).

6 Flood Alleviation Measures Currently in Place

6.1 Failure Mechanisms

There are four possible sources for inundation by flooding:-

- Tidal overtopping or breach
- From surface water run-off
- Overland Flow
- From groundwater

The SFRA indicate the site is located in 1T5 (tidal) and indicates possible flooding sources (extract below):

Compartment Reference	Compartment Name	Primary Sources of Flood Risk
1T5	Barton upon Humber	Humber Estuary New Holland Main Drain Barrow Beck Butts Beck Midby Drain, Barrow Barrow complaints

Table 4.1 - Flood compartments; Eastern Coastal Area

The reference prefix denotes the primary source of flood risk in the compartment;
T = Tidal;
F = Fluvial

6.2 Tidal 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 extensive low-level farmland along the River Humber located between the embankments and the site would limit the impact of this scenario, as a large and expansive potential storage area would need to be filled before the site would be affected.

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

6.3 Tidal Embankment Failure

It is unlikely that these flood embankments would fail, due to the high quality of construction protecting this mixed 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 good condition.

If a breach did occur the effects would be limited due to the proximity of adjacent lower land, which would act as a storage area until the breach was repaired.

If required, a hydraulic calculation can be made for the effects on the site from a 25-metre breach in the adjacent flood embankments (breach scenario).

6.4 Surface Water Run-Off

Historically there is no single reference to surface water run-off flooding specific to the site. Surface water flood risks are less than 0.1% per annum for the site. Surface water will naturally collect into the watercourses; the watercourse could fill with rainwater and cause adjacent flooding.

6.5 Overland Flooding

Historically there is no single reference to overland flooding specific to the site. The risk from reservoir failure is not plausible. Surface water flood risks are described above. Groundwater risks are described below. It is possible that the watercourse could overfill and cause overland flooding to the site. gov.uk reports: Flooding from reservoirs is unlikely in this area.

6.6 Groundwater Flooding

Historically there is no single reference to groundwater flooding specific to the site. Groundwater flood risks are suspected from the underlying rock aquifer. It is possible that the limestone aquifer could, under certain conditions, permit the formation of a spring. This has not been reported or observed in this area. gov.uk reports: Flooding from groundwater is unlikely in this area.

6.7 Effects of Development on Existing Flood Defence Protection

The development does not encroach onto any flood defence provision or other drainage channels, so the development will have no effect on the existing flood defence structures. This assumes that access to the adjacent watercourses is available at all times.

6.8 Sustainability of Existing Flood Defence Protection

The Environment Agency currently maintain the existing flood protection, with various improvements and maintenance works being carried out from time to time. The site is not located in or near any prospective flood defence works, and is unlikely to have any detrimental sustainability effects.

7 Future Flood Defence Protection Considerations

7.1 Additional Flood Protection Requirement

There is no additional flood protection requirement resulting from the proposed development. Continued maintenance of the existing flood defences at current standards is assumed.

7.2 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.

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.

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 change is included in this report.

7.3 Development Run Off and Site Raising

The change of use of land on the site will result in no change in the characteristics of runoff.

7.4 Neighbouring Locations, Social Consequences & Sustainability

As long as run off 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 change of use will result in the improvement of the development for the area.

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

A safe means of escape during flooding can be provided by people relocating during a flood emergency to higher land along the A1077 Barrow Road.

8 Conclusions

Historically the site lies within the historical flood plain of the Humber Estuary and probably flooded occasionally in the past, prior to embanking of the River Humber, although there is no record of flooding on the site.

The site lies on previously developed land and is away from any tidal inundation, due to the protection offered by the flood embankments and walls of the River Humber and Barton Haven, behind which the site is located. There are no identified fluvial flood risks.

The SFRA flood risk advice matrix indicates: *Consult EA - The LPA should consult the Environment Agency. The Environment Agency is likely to object to proposals including new ground floor habitable accommodation. The application should be supported by a Flood Risk Assessment which fully assesses the risks and demonstrates that the mitigation measures proposed will make the development and its occupants safe for its lifetime. Mitigation measures should be in line with (or by exception close to) those required for new build development and the FRA should identify the extent to which this can be achieved. Self-contained ground floor residential accommodation must have finished floor levels above the 2115 0.1% AER breach flood depth. Please refer to the following document for information on flood resilience and resistance techniques to be included: 'Improving Flood Performance of New Buildings - Flood Resilient Construction' (DCLG 2007).*

There is a potential for tidal inundation via the Humber Estuary if the flood embankments and walls failed catastrophically. No overtopping, breaches or similar failures were noted at or near Barton during the 2013 tidal surge. Other areas with lower embankments are more likely to flood first (as happened in 2013).

The development will have no effect, other than adding to the amount of development in the area, regarding flood risk. There are no known serious flood events affecting this part of Barton, even allowing for the most serious events in the last 100 years, i.e. in 1935, 1947, 1953, 2000, 2007, 2008, 2009, 2011, 2012, 2013 or 2016. None of which affected the site, despite breaches and overtopping of the flood embankments of River Humber in 2013.

Surface water flood risks are very low. Other identified flood risks are low or negligible.

The Change of Use to Less Vulnerable is compatible with the identified Flood Risk. We therefore conclude that the site is suitable for the development as proposed.

9 Recommendations (Proposed Development - Ground Floor Level)

The existing site development level is suitable as proposed.

The previous critical flood level of the SFRA is given as +6.64mOD for a 1 in 200 year event. Adjacent areas have similar levels. Notwithstanding that climate changes and other uncertainties indicate some flood risk.

We would also recommend that flood resilience measures are built into the development if possible, in accordance with EA guidance, to include, all electrical sockets and electrical connections located a minimum of 300mm above the finished ground floor level (equivalent to 900mm above the average site level).

It would also be worth considering other flood mitigation measures in the building.

Safe Refuge may be found off the site along the A1077.

10 APPENDICES

Appendix A – North Lincolnshire Council's Map References

A1 North Lincolnshire Council's SFRA Historic Flood Events

A2 North Lincolnshire Council's SFRA Map

A3 North Lincolnshire Council's SFRA Watercourses Map

A4 North Lincolnshire Council's SFRA IDB and Flood Management

A5 North Lincolnshire Council's SFRA Map

A6 North Lincolnshire Council's EA hazard mapping Map

Appendix B – Extract from SFRA

Appendix C – Plans

Plan No 1 Location Plan and Block Plan
Plan No 2 Surface Water Flood Risk

Appendix D – Photographs

Appendix E - Copyright

This document has been prepared by:-

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Signed… .....***Dated:- 30th November 2024***