SECTION 2:

# FLOOD RISK ASSESSMENT AND STATEMENT

## PROPOSED ERECTION OF 11 LIGHT INDUSTRIAL UNITS

**STEPHENSON AVENUE, PINCHBECK, SPALDING, LINCOLNSHIRE PE11 3SW**

*Produced December 2025; revised April 2026 for Tawny Homes Limited*

# 1.0 DEVELOPMENT OVERVIEW AND POLICY CONTEXT

This Flood Risk Assessment (FRA) has been prepared to support a planning application for the redevelopment of a brownfield site at Stephenson Avenue, Pinchbeck.

The site extends to approximately 2,960 $m^2$ and lies within an established industrial estate. The proposed development comprises 11 light industrial units, together with associated access, parking, and landscaping.

The development comprises:

- 936 $m^2$ building footprint
- 1,824.79 $m^2$ hard landscaping (predominantly permeable)
- 200 $m^2$ soft landscaping

The FRA has been prepared in accordance with:

- National Planning Policy Framework (NPPF)
- Planning Practice Guidance (Flood Risk)
- Environment Agency climate change guidance (2024–2025)
- South Holland Strategic Flood Risk Assessment (2017)

The assessment demonstrates that the development can be made safe for its lifetime (75 years), will not increase flood risk elsewhere, and appropriately manages residual flood risk

## 1.1 Sequential and Exception Tests

### 1.1.1 Flood Zone Classification

The entire development site lies within Flood Zone 3a of the Environment Agency Flood Map, defined as:

- 1 in 100 year (1% Annual Exceedance Probability) or greater probability for river flooding
- 1 in 200 year (0.5% AEP) or greater probability for tidal/coastal flooding

### 1.1.2 Development Vulnerability Classification

The proposed industrial uses are classified as "less vulnerable" development under the flood risk vulnerability classification.

### 1.1.3 Compatibility Assessment

Less vulnerable development is considered appropriate within Flood Zone 3a without requiring the Exception Test, subject to:

a) Appropriate flood risk mitigation measures
b) No increase in flood risk elsewhere
c) Safe access and egress provisions

### 1.1.4 Sequential Approach

The site forms part of an established industrial estate with existing planning precedent for industrial development, available infrastructure and services; a sustainable location, therefore minimizing need to travel; and also economic development benefits for the local area

# 2. FLOOD RISK CONTEXT AND SITE CHARACTERISTICS

## 2.1 Site Location

### 2.1.1 Location Details

- Site Address: Stephenson Avenue, Pinchbeck, Spalding, Lincolnshire PE11 3SW
- Grid Reference: TF 25228 24386
- County: Lincolnshire
- Local Planning Authority: South Holland District Council

### 2.1.2 Site Context

The site is located within an established industrial estate, east of Stephenson Avenue and North of Spalding town centre. The site is approximately 200m north of the River Welland, and approximately 300m north of Vernatts Drain.

## 2.2 Site Description

The site is located approximately 200 metres north of the River Welland and lies within Flood Zone 3a, indicating a high probability of fluvial flooding.

Ground levels across the site are approximately 3.2 m AOD and are relatively flat.

Flood risk in the area is influenced by:

- The River Welland (primary source)
- Vernatts Drain (secondary source, ~300m south)
- Local drainage channels and IDB-controlled watercourses

The River Welland is defended by earth embankments with an approximate 1 in 100-year standard of protection, although climate change reduces this standard over time.

No recorded historical flooding has been identified at the site, although the wider Spalding area is known to be at flood risk.

### 2.2.2 Existing Drainage

The site currently comprises:

a) Brownfield industrial area with existing permeable surfaces
b) No formal drainage infrastructure within the site
c) Natural drainage patterns towards site boundaries

### 2.2.3 Site Boundaries

- North: Existing commercial development
- South: Open land with watercourses beyond
- East: Small drainage ditch
- West: Stephenson Avenue (highway)

## 2.3 Surrounding Context

### 2.4.1 Land Use Character

The immediate area comprises of a modern industrial and commercial buildings, with well-established employment uses, good transport infrastructure and limited residential development.

### 2.4.2 Watercourses

- River Welland: Main river approximately 200m south
- Vernatts Drain: Drainage channel approximately 300m south
- Local Watercourse: Small ditch within eastern site boundary
- Scraggs Dyke: Drainage board watercourse downstream

### 2.4.3 Flood Defences

The River Welland is defended by:

a) Earth embankments along both banks
b) Quoted 1 in 100-year standard of protection
c) Regular maintenance by Environment Agency
d) Sluice gates at Surfleet controlling discharge

## 2.4 Sequential Approach and Development Suitability

The proposed development is classified as **"less vulnerable"** under national planning guidance.

Less vulnerable development is appropriate in Flood Zone 3a, subject to:

- mitigation of flood risk
- safe access and egress
- no increase in flood risk elsewhere

The site is located within an established industrial estate with existing infrastructure and employment use, and therefore satisfies the **Sequential Test principles**.

The Exception Test is therefore **not required**.

# 3.0 SCOPING FLOOD RISK ASSESSMENT

## 3.1 Historical Flooding

### 3.1.1 SFRA Records

3.2.1.1 The South Holland Strategic Flood Risk Assessment (2017) review identified:

- No specific historical flooding incidents at the site
- General flood risk context for Spalding area

- Hazard and depth mapping for breach scenarios
- No site-specific flooding constraints noted

#### 3.1.2 Environment Agency Records

3.1.2.1 Consultation with Environment Agency records indicates:

- No recorded historical flooding at this specific location
- Wider area flooding associated with River Welland catchment
- Flood defence performance generally satisfactory
- No breach events in recent history

#### 3.1.3 Other Sources

3.1.3.1 Additional research through the following sources found no flooding records:

- British Hydrological Society Chronology of British Hydrological Events
- Internet-based searches for local flooding
- Anglian Water DG5 Register (sewer flooding)
- Local authority records

## 3.2 Flood Risk Sources Assessment

#### 3.2.1 Primary Sources

##### 3.2.1.1 River Welland

a) Main river with modelled flood data available
b) Defended to 1 in 100-year standard
c) Primary flood risk mechanism for the area
d) Overtopping and breach scenarios assessed
e) Climate change impacts considered

##### 3.2.1.2 Surface Water Runoff

a) Increased impermeability from development
b) Connection to existing drainage infrastructure required
c) Attenuation and sustainable drainage needed
d) Climate change allowances applied

#### 3.2.2 Secondary Sources

##### 3.2.2.1 Vernatts Drain

a) Located 300m south of site
b) Controlled by sluice gates at Surfleet
c) No specific flood level data available
d) Included within SFRA combined modelling

##### 3.2.2.2 Local Watercourses

a) Small ditch within eastern boundary
b) Flows north to Scraggs Dyke
c) Eventually discharges to River Welland via River Glen
d) Controlled by Internal Drainage Board

#### 3.2.3 Sources Discounted

##### 3.2.3.1 Overland Flow

a) No higher ground adjacent to promote overland flow
b) Site at similar level to surroundings
c) No concentrated flow paths identified
d) Further consideration not required

##### 3.2.3.2 Groundwater

a) Area not underlain by significant aquifer
b) SFRA identifies no groundwater flooding concerns
c) Groundwater Vulnerability Map indicates low risk
d) Further assessment not required

#### 3.3.3.3 Sewer Flooding

a) No incidents recorded on Anglian Water DG5 Register
b) Existing infrastructure adequate
c) No known capacity issues
d) Further assessment not required

# 4.0 FLOOD RISK ASSESSMENT

## 4.1 Fluvial Flood Risk (River Welland) Assessment

Environment Agency data indicates:

- **1 in 100-year flood level:** 4.52 m AOD
- **1 in 100-year + climate change:** 4.68 m AOD

This places the site approximately:

- **1.32 m below the 1% AEP level**
- **1.48 m below the climate change level**

Flood defences provide protection in standard events, but:

- overtopping may occur under climate change scenarios
- breach scenarios present a **residual risk**

SFRA modelling indicates:

- **Breach flood depths:** approx. 0.5–1.0 m
- **Maximum flood level at site:** approx. 4.0–4.2 m AOD

This represents a **low probability but high consequence** event.

## 4.2 Surface Water Flood Risk Assessment

The existing site is brownfield with permeable characteristics and limited runoff.

The proposed development introduces:

- 936 $m^2$ impermeable roof area
- permeable hardstanding with partial runoff
- minor soft landscaping

Using appropriate runoff coefficients:

- Roof: 936 $m^2$ @ 1.0
- Permeable paving: 1,824.79 $m^2$ @ ~0.35
- Soft landscaping: 200 $m^2$ @ ~0.1

**Effective impermeable area ≈ 1,450–1,600 $m^2$**

Estimated peak runoff (1 in 100 yr + 40% CC):
**~12–15 l/s (unattenuated)**

### 4.3 Other Sources of Flood Risk

- **Surface water mapping:** low–moderate risk, mainly at boundaries
- **Groundwater:** low risk
- **Sewer flooding:** no recorded incidents
- **Reservoirs:** no risk

These sources are not considered significant constraints.

# 5.0 MITIGATION MEASURES

### 5.1 Floor Level Recommendations

Finished floor levels are proposed at:

**Minimum: 4.0 m AOD**

This provides:

- ~0.8 m above existing ground
- protection against **breach scenario flood levels (~4.2 m AOD)**

Additional resilience measures are incorporated to **4.5 m AOD**.

### 5.2 Flood Resistance and Resilience

The development will incorporate:

- flood-resistant construction materials below 4.5 m AOD
- raised electrical and mechanical services
- sealed service penetrations
- non-return valves on drainage

This ensures buildings remain:

- structurally safe
- recoverable after flooding

### 5.3 Safe Access and Emergency Planning

Access is via Stephenson Avenue.

In extreme events (breach scenario):

- access may be temporarily affected
- however, **advance flood warning enables safe evacuation**

Mitigation includes:

- registration with Environment Agency Flood Warning Service
- site flood response plan
- evacuation procedures and staff training

## 5.4 Surface Water Management

Surface water will be managed through a **Sustainable Drainage System (SuDS)** in accordance with the drainage hierarchy.

### 5.4.1 Drainage Strategy

- Permeable paving across majority of hardstanding
- Underground geocellular attenuation storage
- Controlled discharge to Anglian Water sewer
- On-site exceedance routing

### 5.4.2 Key Design Parameters

- Design event: **1 in 100 year + 40% climate change**
- Discharge rate: **3.0 l/s (subject to Anglian Water agreement)**
- Required attenuation storage: **~105 $m^3$**

  This is based on:
  - inflow ≈ 145–150 $m^3$
  - outflow ≈ 43 $m^3$
  - net storage ≈ **104–105 $m^3$**

### 5.4.3 Outcome

The strategy ensures:

- runoff rates are **restricted to greenfield/brownfield equivalent**
- **no increase in flood risk off-site**
- compliance with SuDS standards

# 6.0 RESIDUAL RISK AND CLIMATE CHANGE

Residual risk arises from:

- defence overtopping
- defence breach scenarios
- extreme rainfall events

These risks are managed through:

- raised floor levels
- resilient building design
- attenuation and controlled drainage
- emergency planning

The development incorporates:

- **40% climate change allowance**
- **75-year design life resilience**

# 7.0 CONCLUSION

## 7.1 Summary Statement

This Flood Risk Assessment demonstrates that the proposed development of 11 industrial units at Stephenson Avenue, Pinchbeck can be made safe for its intended design life without increasing flood risk elsewhere.

The development site is located in Flood Zone 3a, and the proposed industrial use is classified as "less vulnerable" development, which is appropriate for this flood zone classification.

The recommended mitigation measures include:

- Setting ground floor levels at minimum 4.0mOD with resilience to 4.5mOD
- Incorporating flood-resistant building design
- Implementing comprehensive sustainable drainage system
- Establishing emergency planning and flood warning arrangements
- Restricting surface water discharge to 3.0 l/s maximum

The surface water drainage strategy provides:

- Betterment from existing brownfield runoff rates
- Climate change resilience through 40% allowance
- 105m$^3$ attenuation storage capacity
- Permeable paving reducing overall runoff
- Controlled discharge to existing infrastructure

The development complies with:

- National Planning Policy Framework flood risk requirements
- Local planning policy for employment development
- Environment Agency standing advice for development in flood zones
- Current climate change guidance (December 2025)
- Sustainable drainage standards and best practice

Subject to implementation of the recommended mitigation measures and compliance, the proposed development represents appropriate development that can be made safe for its design life while contributing positively to local employment provision and economic growth.

The development will not increase flood risk elsewhere through the implementation of the comprehensive sustainable drainage system that restricts discharge rates below existing brownfield runoff levels.

Further information is contained within the following appendices:

APPENDICES

- **Appendix C:** Environment Agency Flood Data
- **Appendix D:** Environment Agency Flood Risk Map
- **Appendix E:** Storage Calculations

Drainage and Flood Risk Plans are included as a separate document within these submissions.

# APPENDIX C:
## ENVIRONMENT AGENCY FLOOD DATA

# C1. DATA SOURCES AND REFERENCES

## C1.1 Environment Agency Data

### C1.1.1 Mapping Products

- Flood Map for Planning (Rivers and Sea) - December 2025 version
- Risk of Flooding from Surface Water - Current online version
- Long Term Flood Risk Information - Online service
- Historic Flood Map - Online archive

### C1.1.2 Technical Data

- River Welland Hydraulic Model - ISIS-TUFLOW 2016
- Flood Level Data - Provided by EA Anglian Region
- Defence Asset Database - NFCDD
- Climate Change Allowances - Updated 2024

## C1.2 South Holland SFRA

### C1.2.1 Document Reference

- Title: South Holland Strategic Flood Risk Assessment
- Author: Royal Haskoning DHV
- Client: South Holland District Council
- Date: February 2017
- Status: Adopted planning evidence base

### C1.2.2 SFRA Outputs Used

- Breach scenario flood depth mapping
- Breach scenario flood hazard mapping
- Historical flooding analysis
- Policy recommendations

## C1.3 Additional Sources

### C1.3.1 Technical Guidance

- NPPF - National Planning Policy Framework (2023)
- Planning Practice Guidance - Flood Risk
- CIRIA C753 - SuDS Manual
- CIRIA C624 - Development and Flood Risk

### C1.3.2 Local Data

- Anglian Water sewer records
- Welland & Deeping IDB watercourse data
- Site survey information
- Previous flood risk assessments

# C2. DATA CONFIDENCE AND LIMITATIONS

## C2.1 Data Quality

### C2.1.1 Confidence Levels

| Data Source | Confidence | Notes |
|---|---|---|
| EA Flood Zones | High | Based on detailed hydraulic modelling |
| River Welland Levels | High | Validated model, recent data |
| SFRA Breach Scenarios | Medium-High | 2D modelling, conservative assumptions |
| Surface Water Mapping | Medium | National dataset, limited local validation |
| Climate Change | Medium | Based on UKCP18 projections, inherent uncertainty |
| Historical Data | Medium | Limited records for specific site |

## C2.2 Limitations

### C2.2.1 General Limitations

- Flood maps show risk, not actual flooding
- Climate change projections contain uncertainty
- Defence condition can change over time
- Blockages and other factors not modeled
- Site-specific factors may differ from modelled

### C2.2.2 Specific Limitations

- Site ground levels assumed from adjacent survey
- Defence crest levels approximate
- Breach location uncertainty in SFRA scenarios
- Surface water mapping does not include site drainage
- Historical records may be incomplete

# APPENDIX D:
## ENVIRONMENT AGENCY FLOOD RISK MAP

# Flood map for planning

| Your reference | Location (easting/ northing) | Created |
|---|---|---|
| **TAWNY_SAv_GovFlood_Dec25** | **525232/324392** | **21 December 2025 10:28** |

**Your selected location is in flood zone 3, an area with a high probability of flooding.**

**This means**:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see https://www.gov.uk/guidance/flood-risk-assessment-standing-advice)

**Notes**

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2025 AC0000807064. https://flood-map-for-planning.service.gov.uk/os-terms




Environment Agency

## Flood map for planning

Your reference
**TAWNY_SAv_GovFlood_Dec2**

Location (easting/northing)
**525232/324392**

Scale
**1:2,500**

Created
**21 Dec 2025 10:29**

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60 m



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# APPENDIX E:
## STORAGE CALCULATIONS

# E1. INTRODUCTION

This appendix presents the revised surface water drainage calculations for the proposed development at Stephenson Avenue, Pinchbeck, Spalding.
The calculations have been updated to reflect the confirmed development parameters and site areas, ensuring consistency with the drainage strategy and Flood Risk Assessment.
The development comprises:

- **Total site area:** 2,960 $m^2$
- **Building footprint:** 936 $m^2$
- **Hard landscaping:** 1,824.79 $m^2$
    - 1,690.62 $m^2$ permeable tarmac/asphalt
    - 134.17 $m^2$ gravel surfacing
- **Soft landscaping:** 200 $m^2$

The drainage design has been undertaken in accordance with:

- CIRIA SuDS Manual (C753)
- FEH rainfall methodology
- National Standards for Sustainable Drainage Systems (DEFRA, 2025)

# E2. DESIGN CRITERIA

The surface water drainage system has been designed using the following parameters:

- **Design event:** 1 in 100 year rainfall event
- **Climate change allowance:** +40% (Higher Central)
- **Design life:** 75 years
- **Critical storm duration:** assessed across multiple durations
- **Permitted discharge rate:** 3.0 litres/second (subject to Anglian Water approval)

The objective of the drainage design is to ensure that post-development runoff is controlled to a rate equivalent to, or better than, the existing brownfield condition and that no increase in flood risk occurs elsewhere.

# E3. SITE RUNOFF PARAMETERS

## E3.1 Existing Site Conditions

The existing site is brownfield in nature, comprising largely permeable surfaces. For the purposes of calculation, a runoff coefficient of **0.30** has been applied.

| Parameter | Value |
|---|---|
| Site area | 2,960 $m^2$ |
| Runoff coefficient | 0.30 |
| Effective contributing area | **888.00 $m^2$** |

## E3.2 Proposed Development

The proposed development introduces a combination of impermeable and permeable surfaces. Runoff coefficients have been applied as follows:

- Roof areas: **1.00**
- Permeable hardstanding: **0.35**

- Soft landscaping: **0.10**

| Surface Type | Area ($m^2$) | Runoff Coefficient | Contributing Area ($m^2$) |
|---|---|---|---|
| Buildings (roofs) | 936.00 | 1.00 | 936.00 |
| Hard landscaping (permeable) | 1,824.79 | 0.35 | 638.68 |
| Soft landscaping | 200.00 | 0.10 | 20.00 |
| **Total** | **2,960.79*** | | **1,594.68** |

*Minor rounding difference due to detailed area schedule.

### E3.3 Comparison of Existing and Proposed Runoff

| Parameter | Existing | Proposed |
|---|---|---|
| Effective contributing area | 888.00 $m^2$ | 1,594.68 $m^2$ |

The proposed development results in an increase in effective contributing area of approximately 706.68 $m^2$, representing a 79.6% increase relative to the existing condition.
This increase necessitates attenuation storage to manage peak runoff rates.

# E4. RAINFALL DATA

Rainfall depths have been derived from FEH data for the site location and adjusted to include a 40% climate change allowance.

| Duration (minutes) | Rainfall Depth (mm) |
|---|---|
| 15 | 25.9 |
| 30 | 37.5 |
| 60 | 49.3 |
| 120 | 63.1 |
| 180 | 72.5 |
| 240 | 79.7 |
| 360 | 90.7 |
| 480 | 99.5 |
| 600 | 107.0 |

# E5. RUNOFF VOLUME CALCULATIONS

Runoff volumes have been calculated using the equation:

**Volume ($m^3$) = Rainfall depth (m) × Effective contributing area ($m^2$)**

Based on an effective contributing area of **1,594.68 $m^2$**, the following runoff volumes are obtained:

| Duration (minutes) | Rainfall Depth (mm) | Inflow Volume ($m^3$) |
|---|---|---|
| 15 | 25.9 | 41.30 |
| 30 | 37.5 | 59.80 |
| 60 | 49.3 | 78.62 |
| 120 | 63.1 | 100.62 |
| 180 | 72.5 | 115.61 |
| 240 | 79.7 | 127.10 |
| 360 | 90.7 | 144.64 |
| 480 | 99.5 | 158.67 |
| 600 | 107.0 | 170.63 |

# E6. ATTENUATION STORAGE ASSESSMENT

The drainage system incorporates a flow control device limiting discharge to **3.0 litres/second**. Outflow volumes are calculated as:

**Outflow ($m^3$) = 3.0 × duration (seconds) / 1000**

| Duration (minutes) | Inflow ($m^3$) | Outflow ($m^3$) | Storage Required ($m^3$) |
|---|---|---|---|
| 60 | 78.62 | 10.80 | 67.82 |
| 120 | 100.62 | 21.60 | 79.02 |
| 180 | 115.61 | 32.40 | 83.21 |
| 240 | 127.10 | 43.20 | **83.90** |
| 360 | 144.64 | 64.80 | 79.84 |
| 480 | 158.67 | 86.40 | 72.27 |
| 600 | 170.63 | 108.00 | 62.63 |

## E6.1 Critical Storm Duration

The critical storm duration is identified as **240 minutes**, at which point the maximum storage requirement occurs.

## E6.2 Required Storage Volume

The calculated storage requirement is:

- **Minimum effective storage:** 83.90 $m^3$ (≈ 84 $m^3$)

Allowing for design tolerance and long-term performance:

- **Recommended design storage (10% allowance):** 93 $m^3$

### E6.3 Proposed Storage Provision

The proposed drainage design includes:

- **Underground geocellular attenuation storage:** 105 $m^3$ (effective volume)

This exceeds the calculated requirement and provides:

- Additional resilience to climate variability
- Operational tolerance for system performance
- Allowance for potential long-term reduction in permeable paving efficiency

# E7. STORAGE SYSTEM VOLUME CHECK

Assuming a typical geocellular storage void ratio of **95%**, the required gross storage volume is:

**Gross volume for 105 $m^3$ effective storage:**
≈ 110 $m^3$

This aligns with the proposed attenuation system design.

# E8. DISCHARGE RATE AND BETTERMENT

The proposed discharge rate of **3.0 l/s** is considered appropriate for the site and broadly reflects existing brownfield runoff conditions.

This ensures:

- No increase in peak runoff rates
- Protection of downstream infrastructure
- Compliance with sustainable drainage principles

Final discharge rates will be subject to agreement with Anglian Water.

# E9. SUMMARY

The revised calculations demonstrate that:

- The corrected development generates an effective impermeable area of **1,594.68 $m^2$**
- The critical storm duration is **240 minutes**
- The required attenuation storage is approximately **84 $m^3$**

- The proposed system provides **105 m³ storage**, exceeding requirements

The drainage strategy is therefore:

- Robust and policy compliant
- Designed for climate change resilience
- Capable of preventing increased flood risk off-site