



**PROPOSED REPLACEMENT
DWELLING AT 17 BROAD
DROVE, WISBECH,
CAMBRIDGESHIRE**

FLOOD RISK ASSESSMENT

MAY 2023

REPORT REF: 3211/RE/05-23/01

Evans Rivers and Coastal Ltd

T: 07896 328220

E: Enquiries@evansriversandcoastal.co.uk

W: www.evansriversandcoastal.co.uk

CONTRACT

Evans Rivers and Coastal Ltd has been commissioned by James Holland to carry out a flood risk assessment for a proposed replacement dwelling at 17 Broad Drove, Wisbech, Cambridgeshire.

QUALITY ASSURANCE, ENVIRONMENT AND HEALTH AND SAFETY

Evans Rivers and Coastal Ltd operates a Quality Assurance, Environmental, and Health and Safety Policy.

This project comprises various stages including data collection; depth analysis; and reporting. Quality will be maintained throughout the project by producing specific methodologies for each work stage. Quality will also be maintained by providing specifications to third parties such as surveyors; initiating internal quality procedures including the validation of third party deliverables; creation of an audit trail to record any changes made; and document control using a database and correspondence log file system.

To adhere to the Environmental Policy, data will be obtained and issued in electronic format and alternatively by post. Paper use will also be minimised by communicating via email or telephone where possible. Documents and drawings will be transferred in electronic format where possible and all waste paper will be recycled. Meetings away from the office of Evans Rivers and Coastal Ltd will be minimised to prevent unnecessary travel, however for those meetings deemed essential, public transport will be used in preference to car journeys.

The project will follow the commitment and objectives outlined in the Health and Safety Policy operated by Evans Rivers and Coastal Ltd. All employees will be equipped with suitable personal protective equipment prior to any site visits and a risk assessment will be completed and checked before any site visit. Other factors which have been taken into consideration are the wider safety of the public whilst operating on site, and the importance of safety when working close to a water source and highway. Any designs resulting from this project and directly created by Evans Rivers and Coastal Ltd will also take into account safety measures within a "designers risk assessment".

Report carried out by:

Rupert Evans, BSc (Hons), MSc, CEnv, C.WEM, MCIWEM, PIEMA

DISCLAIMER

This report has been written and produced for James Holland. No responsibility is accepted to other parties for all or any part of this report. Any other parties relying upon this report without the written authorisation of Evans Rivers and Coastal Ltd do so at their own risk.

COPYRIGHT

The contents of this document must not be copied or reproduced in whole or part without the written consent of Evans Rivers and Coastal Ltd or James Holland. The copyright in all designs, drawings, reports and other documents (including material in electronic form) provided to the Client by Evans Rivers and Coastal Ltd shall remain vested in Evans Rivers and Coastal Ltd. The Client shall have licence to copy and use drawings, reports and other documents for the purposes for which they were provided.

© Evans Rivers and Coastal Ltd

CONTENTS

| | |
|---|-----------|
| CONTRACT | i |
| QUALITY ASSURANCE, ENVIRONMENT AND HEALTH AND SAFETY | i |
| DISCLAIMER | i |
| COPYRIGHT | i |
| CONTENTS | ii |
| 1. INTRODUCTION | 1 |
| 1.1 Project scope | 1 |
| 2. DATA COLLECTION | 3 |
| 3. SITE CHARACTERISTICS | 4 |
| 3.1 Existing Site Characteristics and Location | 4 |
| 3.2 Site Proposals | 5 |
| 4. BASELINE INFORMATION | 7 |
| 4.1 Environment Agency Flood Zone Map | 7 |
| 4.2 Flood Defences and Environment Agency Flood Levels | 7 |
| 4.3 Internal Drainage Board | 8 |
| 4.4 Flood Warning and Emergency Planning | 8 |
| 5. TIDAL FLOOD RISK | 10 |
| 5.1 Actual Risk | 10 |
| 5.2 Residual Risk | 10 |
| 5.3 Internal Drainage Board | 11 |
| 6. FLOOD RISK MITIGATION AND EVACUATION | 12 |
| 6.1 Reducing Exposure to the Hazard | 12 |
| 6.2 Reducing Vulnerability to the Hazard | 12 |
| 6.3 Vulnerable Groups | 14 |
| 6.4 Safe Access/Egress | 14 |
| 6.5 Insurance | 16 |
| 7. OTHER SOURCES OF FLOODING | 17 |
| 7.1 Groundwater Flooding | 17 |
| 7.2 Surface Water Flooding and Sewer Flooding | 17 |
| 7.3 Reservoirs, Canals And Other Artificial Sources | 18 |
| 8. CONCLUSIONS | 19 |
| 9. BIBLIOGRAPHY | 20 |
| DRAWINGS | |
| HPD03 | |
| HPD04 | |

1. INTRODUCTION

1.1 Project Scope

1.1.1 Evans Rivers and Coastal Ltd has been commissioned by James Holland to carry out a flood risk assessment for a proposed replacement dwelling at 17 Broad Drove, Wisbech, Cambridgeshire.

1.1.2 It is understood that this Flood Risk Assessment will be submitted to the Planning Authority and Environment Agency (Agency, hereafter) as part of a planning application. Specifically, this assessment intends to:

- a) Consider the impacts of the 1 in 200 year and 1 in 1000 year flood events (inclusive of climate change), in accordance with NPPF;
- b) Review any literature and guidance specific to this area;
- c) Determine the extents of the aforementioned NPPF Flood Zones across the site, together with depths of floodwater and hazard;
- d) Assess the risks to people and property and propose mitigation measures accordingly;
- e) Review existing evacuation and warning procedures for the area;
- f) Carry out an appraisal of flood risk from any other sources such as groundwater as required by NPPF;
- g) Report findings and recommendations.

1.1.3 This assessment is carried out in accordance with the requirements of the National Planning Policy Framework (NPPF) dated 2021. Other documents which have been consulted include:

- DEFRA/EA document entitled *Framework and guidance for assessing and managing flood risk for new development Phase 2 (FD2320/TR2)*, 2005;
- Communities and Local Government 2007. *Improving the Flood Performance of New Buildings*. HMSO.
- DEFRA/EA document entitled *The flood risks to people methodology (FD2321/TR1)*, 2006;
- EA *Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose*, 2008;
- National Planning Practice Guidance – Flood Risk and Coastal Change.
- UK Government’s climate change allowances guidance.
- Environment Agency guidance entitled *Flood risk assessments: Climate change allowances – East Anglia; Essex, Norfolk, Suffolk, Cambridgeshire and Bedfordshire*.
- Fenland District Council Strategic Flood Risk Assessment Level 1 dated 2011 (2011 SFRA).

- Cambridgeshire County Council Preliminary Flood Risk Assessment dated 2011.
- River Nene Catchment Flood Management Plan (CFMP) dated 2009.
- Cambridgeshire’s Local Flood Risk Management Strategy 2015-2020.
- Fenland District Council Water Cycle Study Stage 2a dated 2011.
- East Cambridgeshire and Fenland Outline Water Cycle Study dated 2010.
- Wisbech Level 2 Strategic Flood Risk Assessment (2012 SFRA) dated June 2012.

2. DATA COLLECTION

2.1 To assist with this report, the data collected included:

- Ordnance Survey 1:10,000 street view map (Evans Rivers and Coastal Ltd OS licence number 100049458).
- British Geological Survey, *Online Geology of Britain Viewer*.
- British Geological Survey *Groundwater Susceptibility Map* obtained via Promap.
- 1:250,000 *Soil Map of Eastern England* (Sheet 4) published by Cranfield University and Soil Survey of England and Wales 1983.
- 1:625,000 *Hydrogeological Map of England and Wales*, published in 1977 by the Institute of Geological Sciences (now the British Geological Survey).
- Filtered LIDAR data at 1m resolution.
- Overtopping and breach data provided in the Wisbech Level 2 Strategic Flood Risk Assessment (2012 SFRA) dated June 2012.
- Environment Agency defence information via <https://environment.data.gov.uk/asset-management/index.html>

3. SITE CHARACTERISTICS

3.1 Existing Site Characteristics and Location

3.1.1 The site is located at 17 Broad Drive, Wisbech, Cambridgeshire. The approximate Ordnance Survey (OS) grid reference for the site is 545192 306725 and the location of the site is shown on Figure 1.

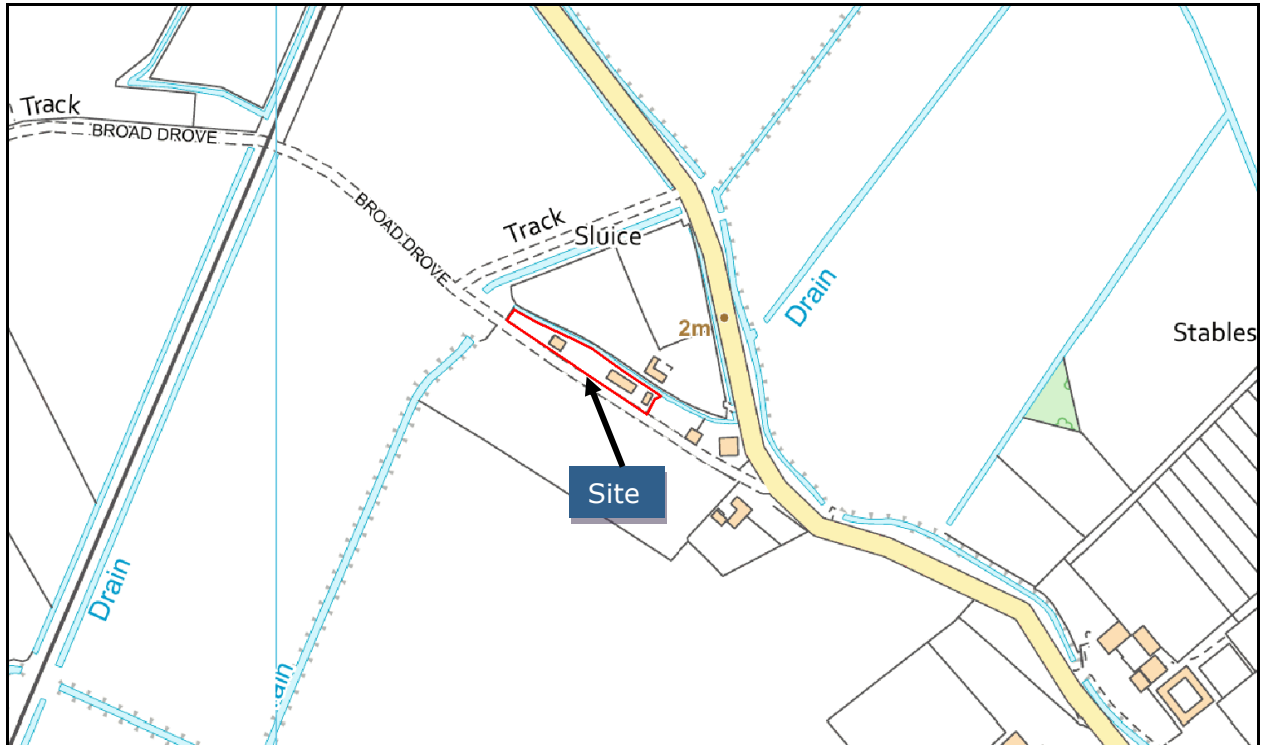


Figure 1: Site location plan (Source: Ordnance Survey)

3.1.2 The site comprises an existing dwelling and is accessed from Broad Drive adjacent to the south western frontage of the site.

3.1.3 Filtered LIDAR data at 1m resolution has been obtained to determine and illustrate the topography of the site and surrounding area (Figure 2).

3.1.4 The survey data indicates that ground levels across the area occupied by the dwelling are set at 1.66m AOD. Broad Drive is set at approximately 2.16m AOD.

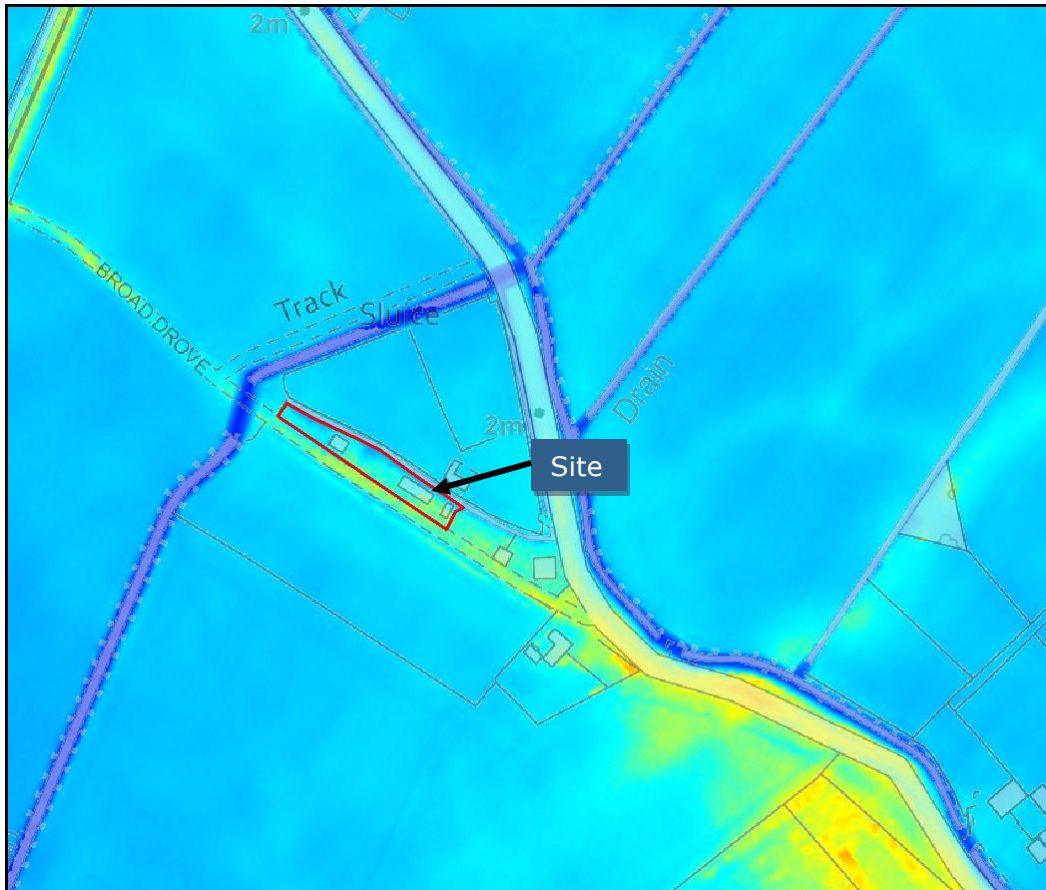


Figure 2: Filtered LIDAR survey data at 1m resolution where higher ground is denoted by red and orange colours and lower ground is denoted by blue and green colours

3.2 Site Proposals

- 3.2.1 It is the Client's intention to replace the existing dwelling across the site in the same location. The finished ground floor level will be set at 2.16m AOD to provide safe refuge and no internal flooding during modelled breach events.
- 3.2.2 The proposed layout can be seen on Figure 3 and Drawing Number HPD03 and HPD04.
- 3.2.3 Annex 3 of the NPPF confirms that residential development is classified as a 'more-vulnerable' use.

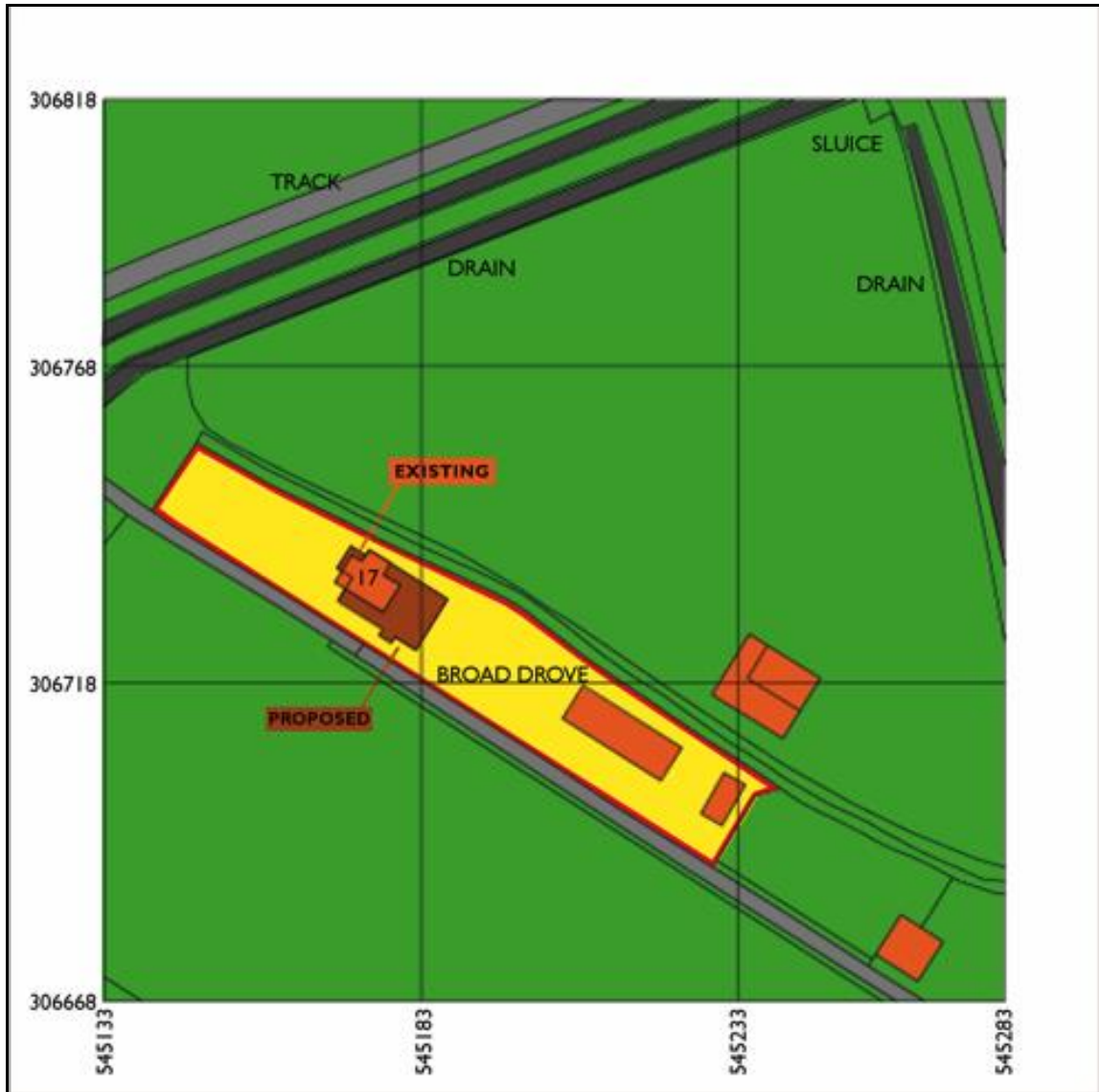


Figure 3: Proposed site layout in relation to existing dwelling

4. BASELINE INFORMATION

4.1 Environment Agency Flood Zone Map

- 4.1.1 The Environment Agency's Flood Zone Map (Figure 4) and Figure 1501-G-2.2 of the 2012 SFRA shows that the site is located within the NPPF defined Flood Zone 3 associated with the tidal River Nene.
- 4.1.2 The extent of the Flood Zone 3a 'High Probability' is defined as the 1 in 100 year return period fluvial event, or 1 in 200 year tidal event (or a combination of the two).
- 4.1.3 Flood Zone 3b functional floodplain is defined in Table 1 of the NPPG as the area where water flows or is stored during flood events. Figure 7 of the 2011 SFRA shows that the site is not located within the Flood Zone 3b.
- 4.1.4 The extent of the flood zones do not take into account the presence of any formal flood defences, or other features which also act as informal flood defences.

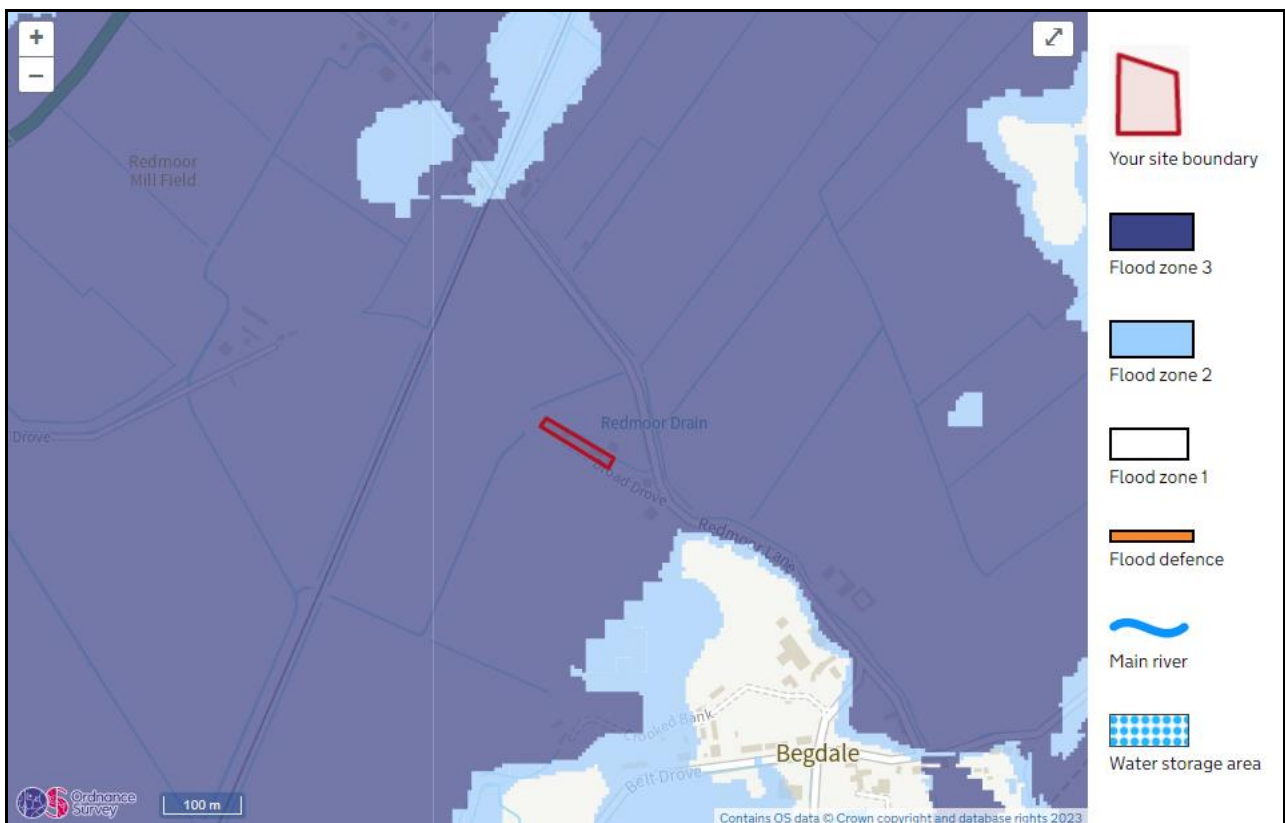


Figure 4: Environment Agency Flood Zone Map (Source: Environment Agency, 2023)

4.2 Flood Defences and Environment Agency Flood Levels

- 4.2.1 It is understood from the Environment Agency flood defence information via <https://environment.data.gov.uk/asset-management/index.html> that the River Nene to the north west of the site is defended by a flood wall set between 5.48m AOD and 5.95m AOD. The defences are in an adequate condition.
- 4.2.2 The 2012 SFRA includes overtopping and breach modelling of the defences and includes depth and hazard mapping which is discussed further in this report.

4.3 Internal Drainage Board

- 4.3.1 The site is located within the Hundred of Wisbech Internal Drainage Board area. Figure 4b of the 2011 SFRA and Figure 1501-D-1.2 of the 2012 SFRA shows that the closest IDB maintained drain is located 42m north of the site.
- 4.3.2 The information from the IDB's *Policy Statement on Flood Protection and Water Level Management* indicates that the IDB maintains the drainage network and more specifically water levels through the operation and maintenance of its pumping stations. The IDB's infrastructure, including its watercourses and pumping stations, is monitored by the IDB to ensure that their condition meet the standards of protection sought and improvement works are carried out where appropriate and necessary.

4.4 Flood Warning and Emergency Planning

- 4.4.1 The site is located within an Environment Agency Flood Warning area 055FWTNENE2A - Tidal River Nene from Dog-in-a-Doublet Sluice to Wisbech.
- 4.4.2 The Environment Agency has a target to issue flood alerts and warnings 9 hours ahead of the peak of the high tide. However, overtopping can occur in advance of the high tide further reducing the warning time. There is no target lead time for issuing severe flood warnings as these are mostly issued after flooding has already begun. Flood alerts are only issued during daylight hours.
- 4.4.3 Flood Alerts, Flood Warnings and Severe Flood Warnings are issued to residents and businesses within flood risk areas by the Agency's *Floodline Warnings Direct* (FWD) service. This system is managed by the Environment Agency and dials out a message to the recipient when a particular category of flood warning is being advised. The message is conveyed by a constant ringing of the telephone or can alternatively be communicated to mobile phones and computers. The system functions at all times, issuing flood warnings and alerts in conjunction with announcements on radio and other media. Owners and occupiers of dwellings or businesses thought to be at risk can sign up to the scheme. **The owners are encouraged to confirm details with the Agency and to sign up for these warnings.**
- 4.4.4 The various flood warning codes can be seen on Figure 5.

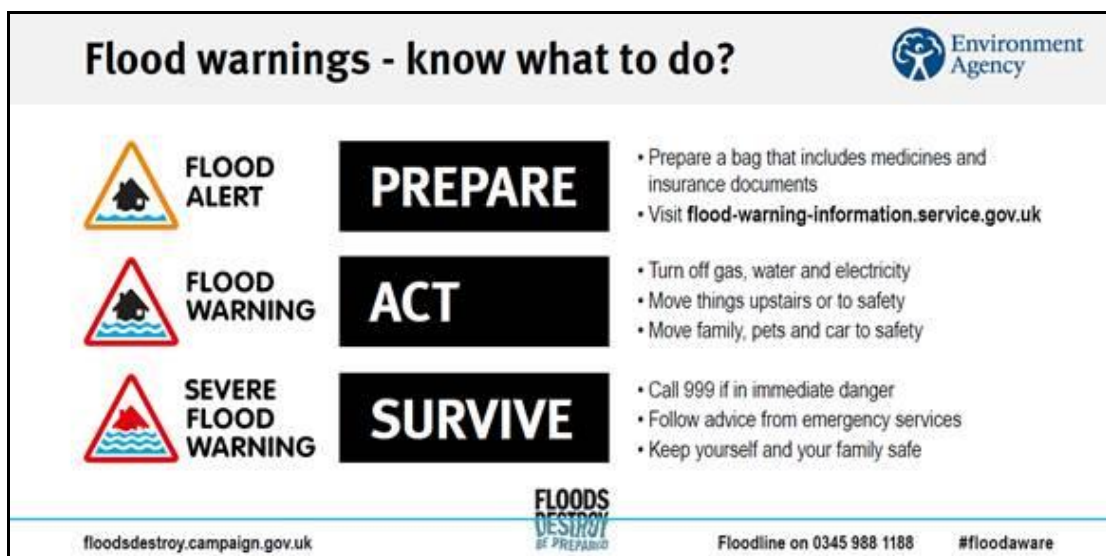


Figure 5: Flood warning codes (Source: Environment Agency)

- 4.4.5 It is understood that in the event of flooding, evacuation is managed by a multi-agency team in conjunction with the Police. The multi-agency team provides suitable premises for shelter, first aid, refreshments and possible transportation with consideration given to the elderly and vulnerable groups. It is essential that occupants produce robust Emergency Flood Plans to avoid putting themselves or emergency services at risk and that they do not rely solely on emergency services during the event.

5. TIDAL FLOOD RISK

5.1 Actual Risk

- 5.1.1 Overtopping mapping provided on Figures 1501-E-1.5.0 and 1501-E-1.7.0 of the 2012 SFRA shows that during the present day 1 in 200 year event and present day 1 in 1000 year event the site and Broad Drove do not become inundated.
- 5.1.2 During the climate change 1 in 200 year overtopping event Figure 1501-E-1.6.0 shows that the site and Broad Drove would not be inundated.
- 5.1.3 Figure 1501-E-1.8.2 of the 2012 SFRA also shows that during the climate change 1 in 1000 year event the site and Broad Drove would not be affected.

5.2 Residual Risk

- 5.2.1 Despite the low risk from overtopping, a “residual risk” of flooding from breaching of the defences could remain. The 2012 SFRA has investigated the impacts of breaching of the defences.
- 5.2.2 Figure 1501-E-1.1.0 and 1501-E-1.3.0 of the 2012 SFRA shows that the area intended for the replacement dwelling would be affected during the present day 1 in 200 year event and present day 1 in 1000 year event. The depth is shown to be between 0m and 0.25m.
- 5.2.3 During the climate change 1 in 200 year event and climate change 1 in 1000 year event, Figure 1501-E-1.2.2 and 1501-E-1.4.0 of the 2012 SFRA shows that the area intended for the replacement dwelling would be affected by flooding and that the flood depth would be between 0.25m and 0.50m. Broad Drive is shown not to be affected adjacent to the site.
- 5.2.4 By reviewing the flood mapping and LIDAR survey, the flood level has been estimated to be 2.16m AOD.

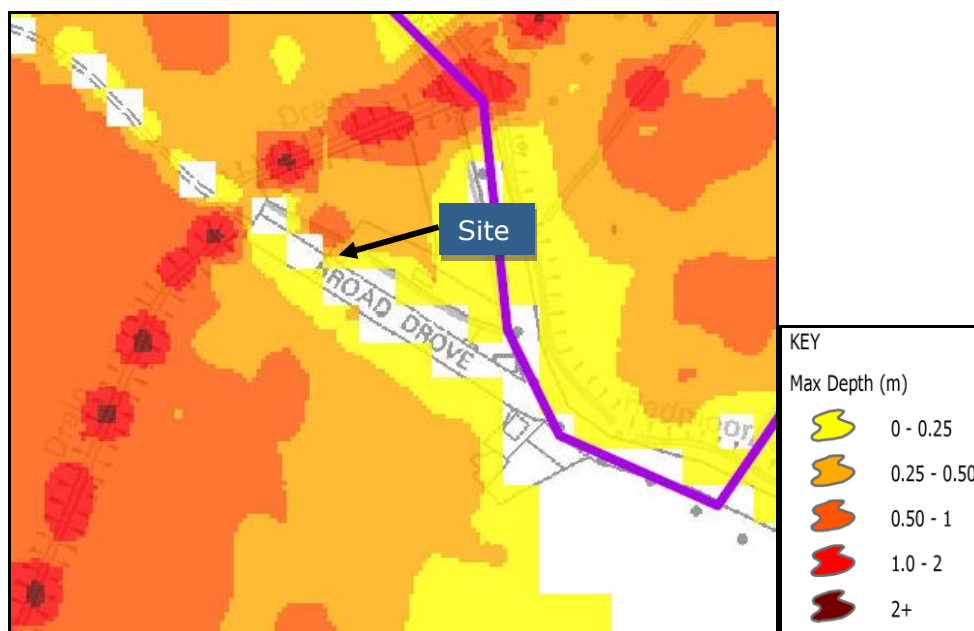


Figure 6: Breach depth map during 200yrCC event (taken from Figure 1501-E-1.2.2 of the 2012 SFRA)

5.3 Internal Drainage Board

- 5.3.1 It is understood from the IDB's *Policy Statement on Flood Protection and Water Level Management* that "Through the operation and maintenance of the pumping stations and the channel system the Board seek to maintain a general standard capable of providing flood protection to agricultural land and developed areas of 1 in 20 and 1 in 100 years respectively. This likely return period cannot be taken literally and should be considered as a chance of some overspilling from the system taking place each year as being 5% and 1% respectively".
- 5.3.2 Therefore, it is considered that there is a low risk of flooding to the site from the IDB drainage network.

6. FLOOD RISK MITIGATION AND EVACUATION

6.1 Reducing Exposure to the Hazard



- 6.1.1 In order to assess and reduce the exposure to the hazard and the vulnerability to the hazard after the site has been developed, the guidance outlined in the DCLG/DEFRA/EA document entitled *Flood Risk Assessment Guidance for New Development Phase 2; Flood Risks to People, Phase 2; Improving the Flood Performance of New Buildings* has been consulted.
- 6.1.2 In accordance with the Agency's recommendations and Paragraph 002 of the NPPF Planning Practice Guidance, the "design" event for which mitigation measures should be designed to in this case is the climate change 1 in 200 year flood level of 2.16m AOD. The "extreme" tidal climate change 1 in 1000 year flood level is also 2.16m AOD.
- 6.1.3 Paragraph 004 of the NPPF Planning Practice Guidance states that the first preference is to avoid flood risk by raising floor levels above the design flood level.
- 6.1.4 The proposed replacement dwelling will be set at 2.16m AOD and above all modelled flood levels and the hazard to people would be *Very low* thus complying with the NPPG.


6.2 Reducing Vulnerability to the Hazard

- 6.2.1 It is recommended that the occupants liaise with the Agency in order to register with the Agency's Flood Warnings Direct service and ensure that they are aware of the flood risk so that they have the option to escape/evacuate upon receipt of a *Flood Warning* or upon the instruction of the emergency services.
- 6.2.2 The occupants should develop a *Family Flood Plan*. Further guidance is offered in the Environment Agency's guidance document entitled *What to do before, during and after a flood*. The *Family Flood Plan* should consider, for example, information about vital medication needed and a *Flood Kit*.
- 6.2.3 A *Flood Kit* is a useful precautionary measure especially if evacuation from the site is prolonged. The kit should be stored in an accessible location to ensure that it is not affected by floodwater. The contents should also be checked every 6 months and items replaced if necessary.
- 6.2.4 It may be sensible to compile two *Flood Kit's* to suit each eventuality. For example, a smaller kit could be compiled which would allow the occupants to carry it during evacuation. A larger kit could also be compiled which included additional food and beverage items in case of ongoing refuge within the property. Both kits should contain the necessary items as suggested below.
1. Important documents
 2. Torch and batteries
 3. Mobile phone (fully charged)
 4. First-aid kit
 5. Wind-up radio
 6. Important telephone numbers
 7. Bottled water
 8. Non-perishable food provisions
 9. Rubber Gloves and wellington boots
 10. Medication or information relating to medication and its location
 11. Blankets, warm clothes

- 12. Essential toiletries
- 13. Camera to record any damage
- 14. Emergency cash

Table 1: Flood Event Action Plan

| Environment Agency Flood Warning Code | What to do! | Evacuate? |
|---|--|--|
| <p>Flood Alert (Flooding Possible. Be aware/prepared! Watch Out).</p>  | <ul style="list-style-type: none"> • Monitor flood risk through media and Floodline Warnings Direct. • Locate family members and inform them of risk. If away from the site make assessment on risk if considering returning to site (i.e. how long it will take to return etc). • Check flood kit, check occupants, check pets – BE PREPARED in case the situation gets worse. | <p>Not necessary.</p> <p>Occupants can evacuate themselves if they feel unsafe providing that they make a judgement in relation to any external flood hazard. Take flood kit, occupants and pets with you.</p> |
| <p>Flood Warning (Flooding of homes, businesses and main roads is expected. Act now!).</p>  | <ul style="list-style-type: none"> • Maintain communication through Floodline Warnings Direct and the media. • Begin to implement Flood Plan. • Consider advice given from emergency services/Environment Agency. • Check insurance, Check flood kit, Check Pets. • Check alternative accommodation arrangements. | <p>Occupants can evacuate themselves if they feel unsafe providing that they make a judgement in relation to any external flood hazard. Take flood kit, occupants and pets with you.</p> <p>People who do not evacuate should reside within the building.</p> <p>No formal evacuation or rest centre set-up will be undertaken at this warning level, however, if flooding is experienced across the area emergency services will rescue people.</p> |

| | | |
|---|---|---|
| <p>Severe Flood Warning (Severe flooding is expected. Imminent danger to life and property. Act now!).</p>  | <ul style="list-style-type: none"> • Leave site immediately if not already done so. • Take flood kit, occupants and pets with you. • Follow advice given by Emergency Services and Council. | <p>Leave site according to advice given by Emergency Services and Council. Take flood kit, occupants and pets with you.</p> <p>If evacuation cannot be undertaken, people should reside within the building with <i>flood kit</i> and maintain communication with the emergency services.</p> |
| <p>Warnings no longer in force (No further flooding is expected in the area. Be careful).</p> | <ul style="list-style-type: none"> • Return to site upon instruction from emergency services and assess any damage. • Contact insurance company depending on damage caused. • Beware of flood debris. • Do not touch sources of electricity. • Arrange for utilities to reconnect services. • Do not dispose of damaged property until your insurance company has agreed. | <p>Not applicable, however site may be uninhabitable.</p> <p>Return to site upon instruction from emergency services as floodwater may not have receded.</p> |

6.3 Vulnerable Groups

- 6.3.1 The occupants at the site may include vulnerable groups such as elderly people, those with sensory or physical disabilities, minority ethnic groups, or the infirm. Priority will need to be given to these people during the flood event.
- 6.3.2 Vulnerable groups should be identified by the occupants and priority should be given to these groups during the event.

6.4 Safe Access/Egress

Overtopping

- 6.4.1 The information in Chapter 5 indicates that the hazard across the site and Broad Drove would be *Very low* during all modelled events. Therefore, there would be safe refuge and safe access/egress at all times.

Breach

- 6.4.2 By consulting Figure 1501-E-3.2.0 and 1501-E-3.4.0 of the 2012 SFRA it can be seen that the hazard to people leaving the site during the climate change 200 year/climate change 1000 year breach event would be *Very low*.

6.4.3 A flood response plan will be compiled to ensure that the occupants are aware of the flood risk and procedures to take before, during and after a flood.

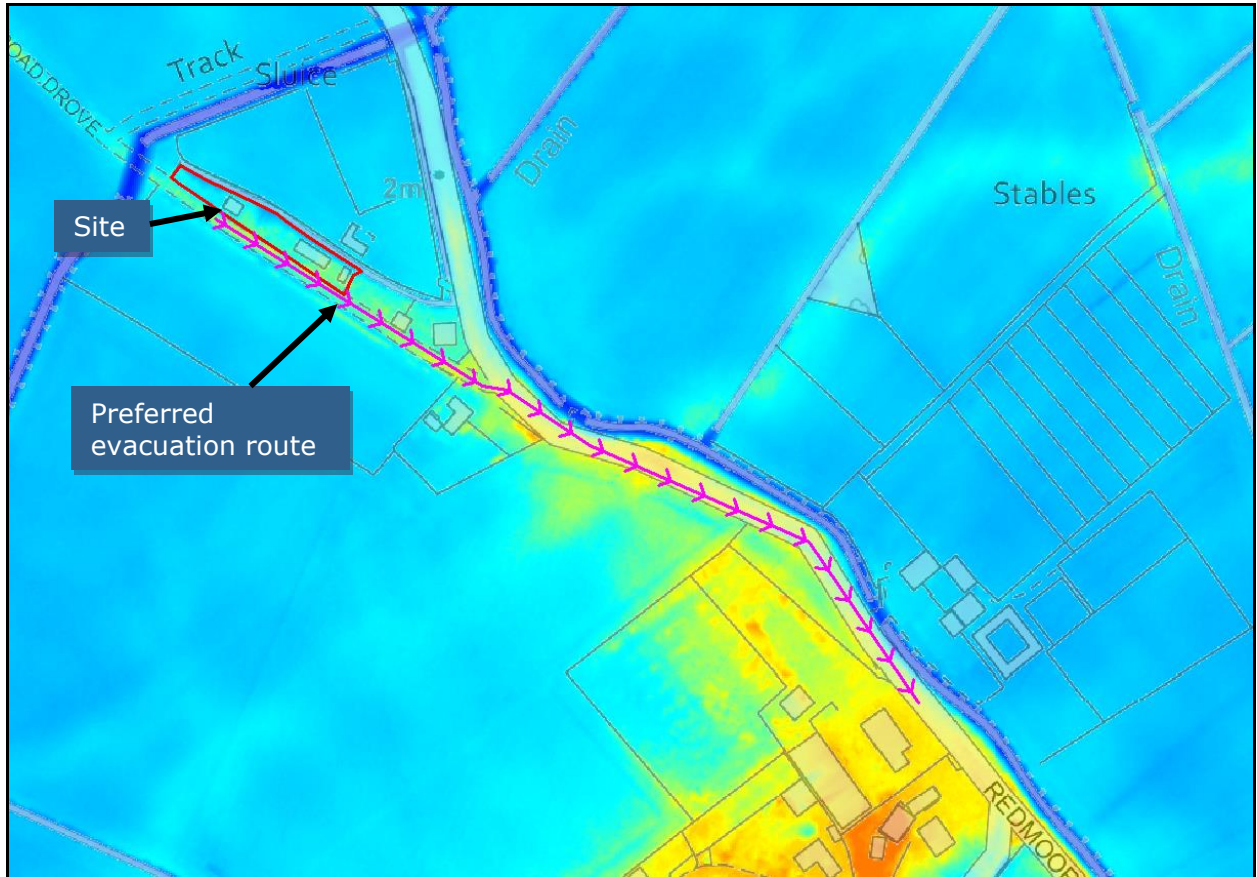


Figure 7: Evacuation route

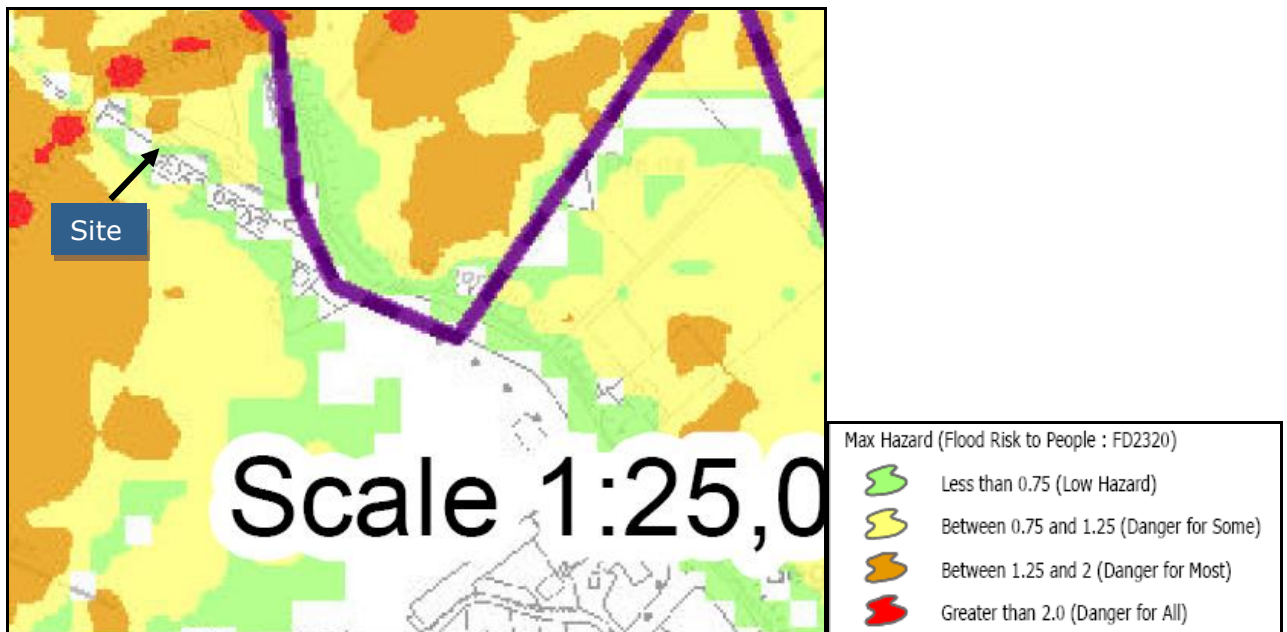


Figure 8: Breach hazard map during 1000yrCC event (taken from Figure 1501-E-3.4.0 of the 2012 SFRA)

6.5 Insurance

- 6.5.1 The Association of British Insurers (ABI) published a guidance document in 2012 entitled *Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England*.
- 6.5.2 The ABI guidance sets out the requirements of the insurance industry when considering flood risk and insurability of the property. The guidance suggests that properties should be protected for flood events up to the 1 in 100 year event in order to access insurance at a competitive price.
- 6.5.3 The guidance also states that insurers would of course prefer to cover properties which are not at risk of flooding, however, for those properties which are at risk of flooding insurers would prefer that the properties are raised above the flood level, over resistance measures which prevent floodwater from entering the building, or resilience measures which allows floodwater to enter the building.
- 6.5.4 The dwelling will be set above the climate change 1 in 100 year flood level, therefore, the ABI's requirement of protection during a climate change 1 in 100 year event will be exceeded and there will be a good chance of the property being insured at a competitive rate.

7. OTHER SOURCES OF FLOODING

7.1 Groundwater Flooding

- 7.1.1 In order to assess the potential for groundwater flooding during higher return period rainfall events, the Jacobs/DEFRA report entitled *Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study*, published in May 2004, was consulted, together with the guidance offered within the document entitled *Groundwater flooding records collation, monitoring and risk assessment (ref HA5)*, commissioned by DEFRA and carried out by Jacobs in 2006.

Soil and Geology at the Site

- 7.1.2 It can be seen from the various soil and hydrogeological data, listed in Section 2, that the soils beneath the site comprise clay and silt deposits.

Groundwater Flooding Potential at the Site

- 7.1.3 There have been no recorded groundwater flood events across the area between 2000 and 2003, as indicated by the Jacobs study. The 2012 SFRA states that there are no recorded groundwater flooding incidents within the study area.
- 7.1.4 The 2011 SFRA states that the clay deposits do not permit groundwater flow and that the CFMP for this area indicates that there are no groundwater flooding problems in the Fenland DC area.

7.2 Surface Water Flooding and Sewer Flooding

- 7.2.1 Surface water and sewer flooding across urban areas is often a result of high intensity storm events which exceed the capacity of the sewers thus causing them to surcharge and flood. Poorly maintained sewer networks and blockages can also exacerbate the potential for sewer flooding.
- 7.2.2 Figure 6 of the Fenland Level 1 SFRA indicates that there have been no historical sewer flooding incidents at the site or within the vicinity.
- 7.2.3 The Environment Agency's Surface Water Flooding Map (Figure 9) indicates that there is a very low surface water flooding risk (i.e. less than 1 in 1000 year chance).
- 7.2.4 It is generally accepted that the low risk flood event (i.e. between 1 in 1000 years and 1 in 100 years) on the Agency's map is used as a substitute for the climate change 1 in 100 year event to provide a worst-case scenario.



Figure 9: Environment Agency Surface Water Flooding Map (Source: Environment Agency, 2023)

7.3 Reservoirs, Canals And Other Artificial Sources

- 7.3.1 The failure of man-made infrastructure such as flood defences and other structures can result in unexpected flooding. Flooding from artificial sources such as reservoirs, canals and lakes can occur suddenly and without warning, leading to high depths and velocities of flood water which pose a safety risk to people and property.
- 7.3.2 The Environment Agency’s “Risk of flooding from reservoirs” map shows that the site is at risk from reservoir flooding when there is also flooding from rivers.
- 7.3.3 However, as the information associated with the maps suggest, it is considered that reservoir flooding is extremely unlikely to happen and such features are regularly inspected by qualified engineers under the Reservoir Act 1975.

8. CONCLUSIONS

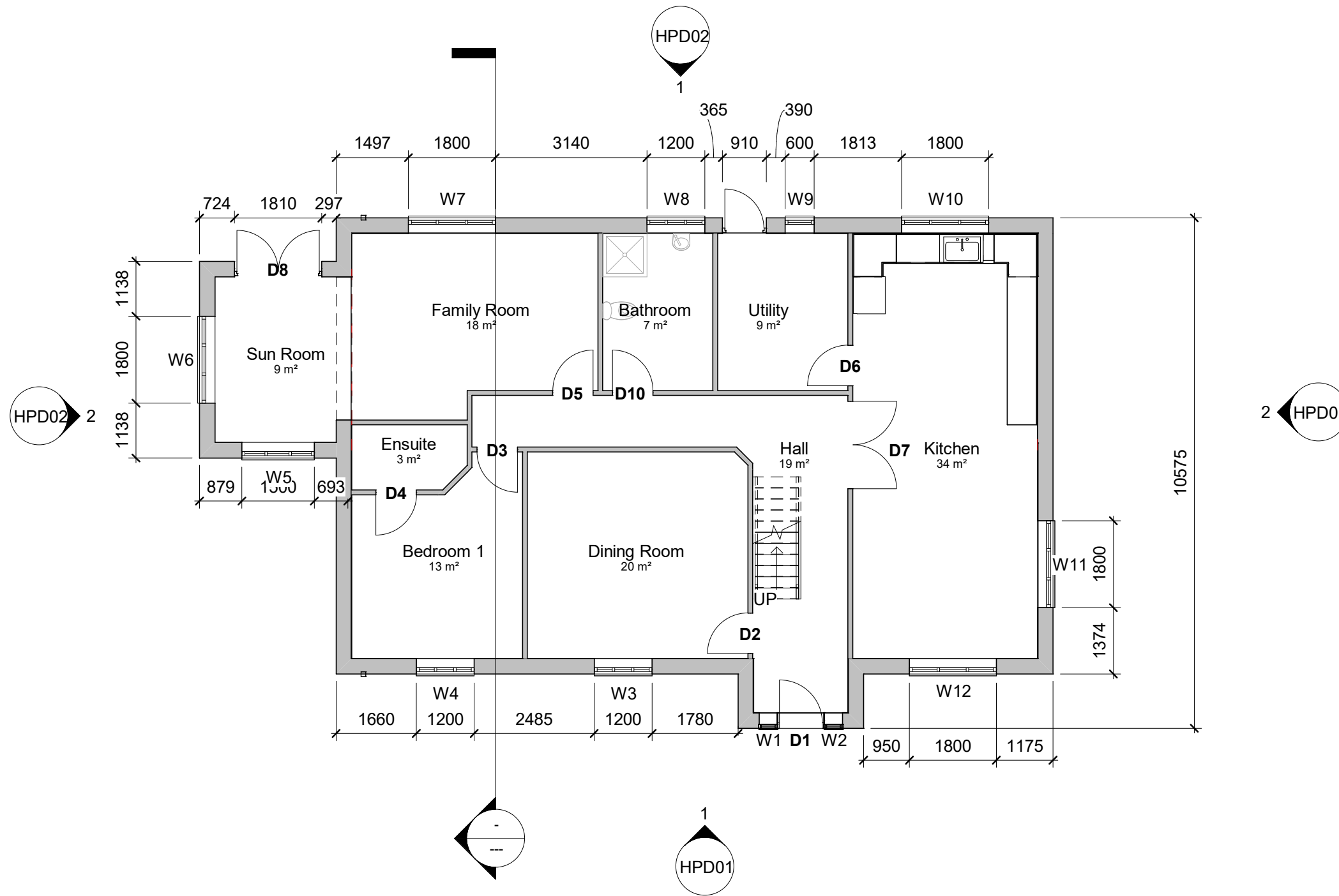
- The site is located within Flood Zone 3a.
- The overtopping mapping in the 2012 SFRA shows that the site would not be affected during the present day 1 in 200 year event and present day 1 in 1000 year event. The site would also not be inundated during the climate change 1 in 200 year event and climate change 1 in 1000 year event.
- The site is at risk during a breach event and the flood level at the site has been estimated to reach 2.16m AOD during the design climate change 1 in 200 year event and extreme climate change 1 in 1000 year event.
- The ground floor level of the replacement dwelling will be set at 2.16m AOD and above the flood level thus providing safe refuge and no internal flooding.
- A warning and evacuation strategy has been developed within this assessment. It is proposed that the occupants register with the Agency's *Flood Warnings Direct* and prepare a *Family Flood Plan*.
- Safe access/egress can be achieved during the peak of the overtopping and breach events.
- It is considered that there is a low risk of groundwater flooding at the site from underlying deposits. There is a very low surface water flooding risk.

9. BIBLIOGRAPHY

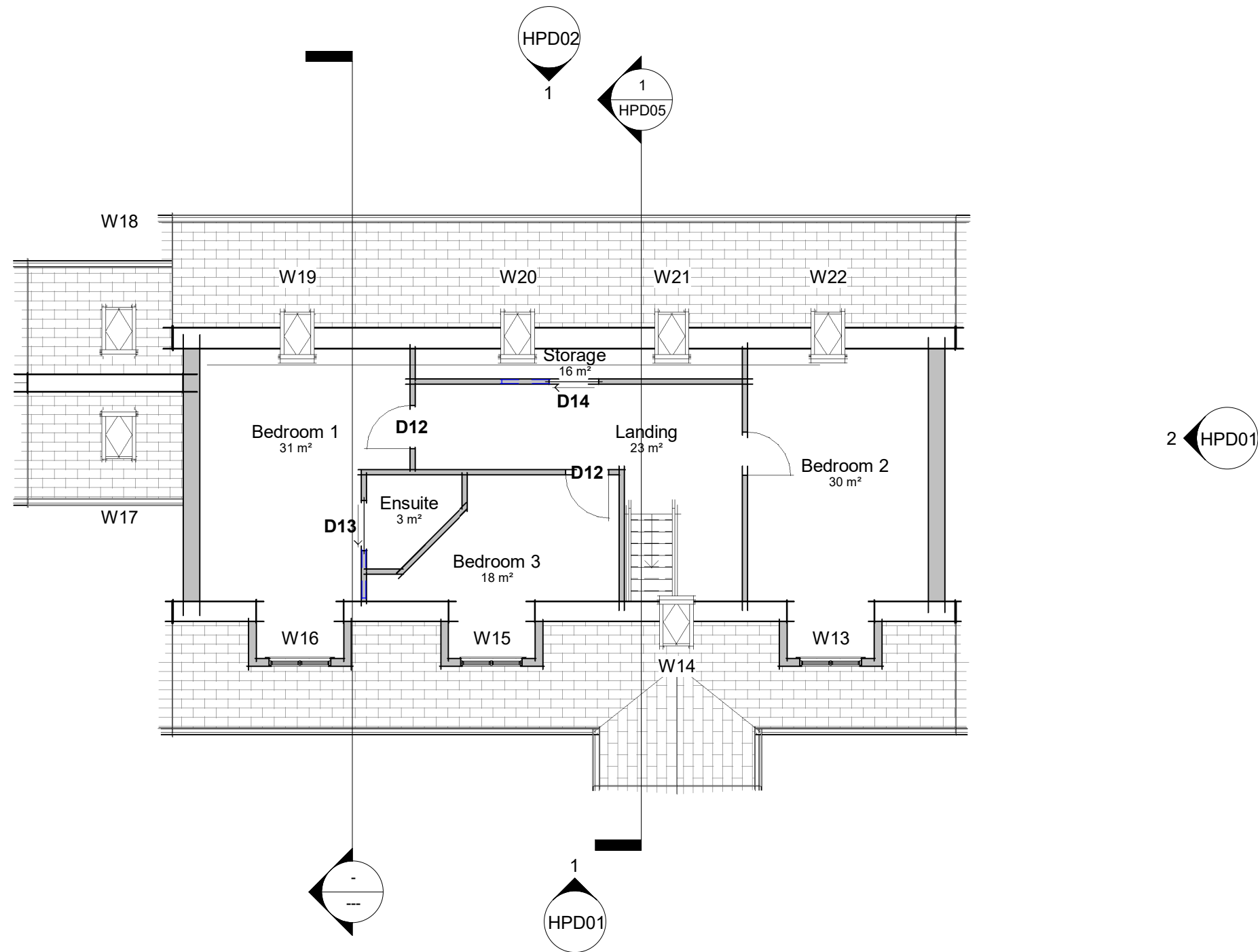
- i. Association of British Insurers 2012. *Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England*.
- ii. BRE 1991. Digest 365. *Soakaway Design*.
- iii. CIRIA 2005. *Standards for the repair of buildings following flooding, Report 623*. CIRIA.
- iv. CIRIA 2000. *Groundwater Control – design and practice, Report 515*. CIRIA.
- v. Cobby, D., et al. 2009. *Groundwater flood risk management: advances towards meeting the requirements of the EU Floods Directive*. Journal of Flood Risk Management.
- vi. Communities and Local Government 2012. *National Planning Policy Framework*.
- vii. Communities and Local Government 2007. *Improving the Flood Performance of New Buildings*. HMSO.
- viii. DEFRA/EA 2007. *Public Response to Flood Warning, Flood and Coastal Defence R&D Programme, R&D Technical Report SC020116*. Environment Agency.
- ix. DEFRA/EA 2006. *Flood Risks to People, Phase 2, R&D Technical Report FD2321/TR1, Flood and Coastal Defence R&D Programme*. Water Research Council.
- x. DEFRA/EA 2006a. *Flood Risks to People, Phase 2, R&D Technical Report FD2321/TR2, Flood and Coastal Defence R&D Programme*. Water Research Council.
- xi. DEFRA/EA 2005. *Framework and guidance for assessing and managing flood risk for new development, Phase 2, Flood and Coastal Defence R&D Programme, R&D Technical Report FD2320/TR2*. Water Research Council.
- xii. DEFRA/EA 2005a. *Flood Warning for Vulnerable Groups: A review of the literature, Flood and Coastal Defence R&D Programme*. Environment Agency.
- xiii. DEFRA/Jacobs 2006. *Groundwater flooding records collation, monitoring and risk assessment (ref HA5)*.
- xiv. DEFRA/Jacobs 2004. *Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS), Final Report, Volumes 1 and 2*.
- xv. Dickie et al. 2010. *Planning for SUDS – Making it happen. Report C687*. London: CIRIA
- xvi. Environment Agency 2008. *Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1*.
- xvii. Geological Society of London 2006. *Groundwater and Climate Change*. Geoscientist magazine, Volume 16, No 3.

- xviii. Institute of Geological Sciences 1976. *Hydrogeological Map of Northern East Anglia*, 1:125,000.
- xix. Institute of Geological Sciences 1977. *Hydrogeological Map of England and Wales*, 1:625,000. NERC.
- xx. NERC 2009. *Flood Estimation Handbook* [CD-ROM], Version 3. Institute of Hydrology.
- xxi. NERC 1975. *Flood Studies Report (FSR)*. Institute of Hydrology.
- xxii. Newman, A.P. 2004. *Protecting groundwater with oil-retaining pervious pavements: historical perspectives, limitations and recent developments*. Quarterly Journal of Engineering Geology and Hydrogeology.
- xxiii. ODPM 2003. *Preparing for Floods*. London: ODPM.
- xxiv. Pratt, C., Wilson, S., and Cooper, P. 2002. *Source control using constructed pervious surfaces; hydraulic, structural and water quality performance issues, Report C582*. London: CIRIA.
- xxv. Soil Survey of England and Wales 1983. *Soil Map of Eastern England (Sheet 4)*, 1:250,000. Cranfield University.
- xxvi. UK Groundwater Forum. *Groundwater Resources and Climate Change*. http://www.groundwateruk.org/Groundwater_resources_climate_change.aspx [accessed 08/04/2016]
- xxvii. Woods-Ballard., et al. 2007. *The SUDS Manual, Report C697*. London: CIRIA.

DRAWINGS



1 00 Ground Floor
1 : 100



1 01 First Floor
 1 : 100

