STM environmental

ENVIRONMENTAL CONSULTING , SOFTWARE & TRAINING

FLOOD RISK ASSESSMENT

Site Address

B.M Scaffolding

Brockhampton Road

Havant

Hampshire

PO9 1JU

Client

The Planning Service

Date

17/01/2019

1 Document Control

FLOOD RISK ASSESSMENT

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Report Author:	Maria Francesca Caggiano (MSc, BSc) **Environmental Engineer**
Authorised by:	Simon Makoni (MSc, BSc) **Environmental Engineer/Director**

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2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
HCC	Hampshire County Council
HBC	Havant Borough Council
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
SuDS	Sustainable Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system

3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and is solely for use by The Planning Service (Client).

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report. Furthermore, STM accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Any party using or placing reliance upon any information contained in this report, do so at their own risk.

4 Executive Summary

Location	B.M Scaffolding, Brockhampton Road, Havant, Hampshire PO9 1JU Grid reference: 470849, 105969
Proposed Development	Proposed extension to existing industrial unit and creation of first floor level; change of use of site from B2 (general industrial) to B8 (storage and distribution).
Flood Zone	Flood Zone 3
Sequential and Exception Tests	Development is minor and less vulnerable so Sequential and Exception Tests should not be required. LLFA to decide.
Main Sources of Flooding	Lavant and Hermitage Streams.
Flood Defences	The river runs in culvert at the site.
Records of Historic Flooding	March 1991.
Fluvial (River) and Tidal (Sea) Flood Risk	Medium – Site benefits from flood defences; One recorded incident in 1991.
Pluvial (Surface Water) Flood Risk	Medium – No significant surface water flooding incidents identified.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low – No significant artificial sources identified.
Groundwater Flood Risk	Low – Although site is potentially susceptible to groundwater flooding below ground level, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development may decrease the floodplain capacity to store water. As such the implementation of voids is recommended to provide compensation.
Proposed Flood Risk Mitigation Measures	• Finished floor levels will be set no lower than 5.2mAOD; • Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding; • Occupants will sign up for EA Emergency Flood Warning Direct Service; • Safe egress to flood zone 1 is a 2-minute walk away and safe refuge is available on upper floors.
Surface Water Management (SuDS)	SuDS would reduce current surface water run off rates however given the small size of the site, there is limited potential for implementation. Consideration should be given to soakaways, living roof, rainwater harvesting and permeable paving where possible.
Conclusions	Taking into account the proposed mitigation measures and the provision of flood displacement storage, the flood risk to the property and its occupants is considered to be manageable.

5 Introduction

STM Environmental Consultants Limited (STM) has been appointed by The Planning Service (Client) to provide a Flood Risk Assessment (FRA) at a site located at B.M. Scaffolding, Brockhampton Road, Havant, Hampshire, PO9 1JU.

6 Development Proposal

The FRA is required to support a planning application for a proposed extension to existing industrial unit and creation of first floor level; change of use of site from B2 (general industrial) to B8 (storage and distribution).

Further details including drawings of the development plans are available in Appendix 2.

7 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

9 Legislative and Policy Context

9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 10 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk. Among other things it states that LPAs should try to ensure that “inappropriate development in areas at risk of flooding is avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere”. It further states that when determining planning applications, LPAs should “only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- 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; and
- development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments.

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they “reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast.”

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits; and
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

9.2.2 Local Planning Policy

Policy CS13 of the Havant Borough Council Core Strategy addresses flood and erosion risk.

The council will permit development proposals that avoid areas of medium and high flood risk and flood risk from other sources as identified in the Strategic Flood Risk Assessment, and which do not increase the risk of flooding elsewhere.

Development on land identified in the Strategic Flood Risk Assessment to be at risk from flooding will not be allowed unless it meets the sequential and exception test (where required) in relation to PPS25.

Development proposals in areas at risk of flooding will only be permitted where:

- The site is located in a low hazard area as defined in the Strategic Flood Risk Assessment.
- A site-specific Flood Risk Assessment demonstrates that the development will be safe, including the access, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- The scheme incorporates appropriate flood resilience and resistance measures.
- Appropriate flood warning and evacuation plans are in place.
- New site drainage systems are designed taking account of events which exceed the normal design standard.

All development will be required to ensure that there is no net increase in surface water runoff. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it is proven that SuDS are not appropriate. Where SuDs are provided arrangements must be put in place for their whole life management and maintenance.

9.3 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood risk assessments are required for developments within one of the flood zones. This includes developments:

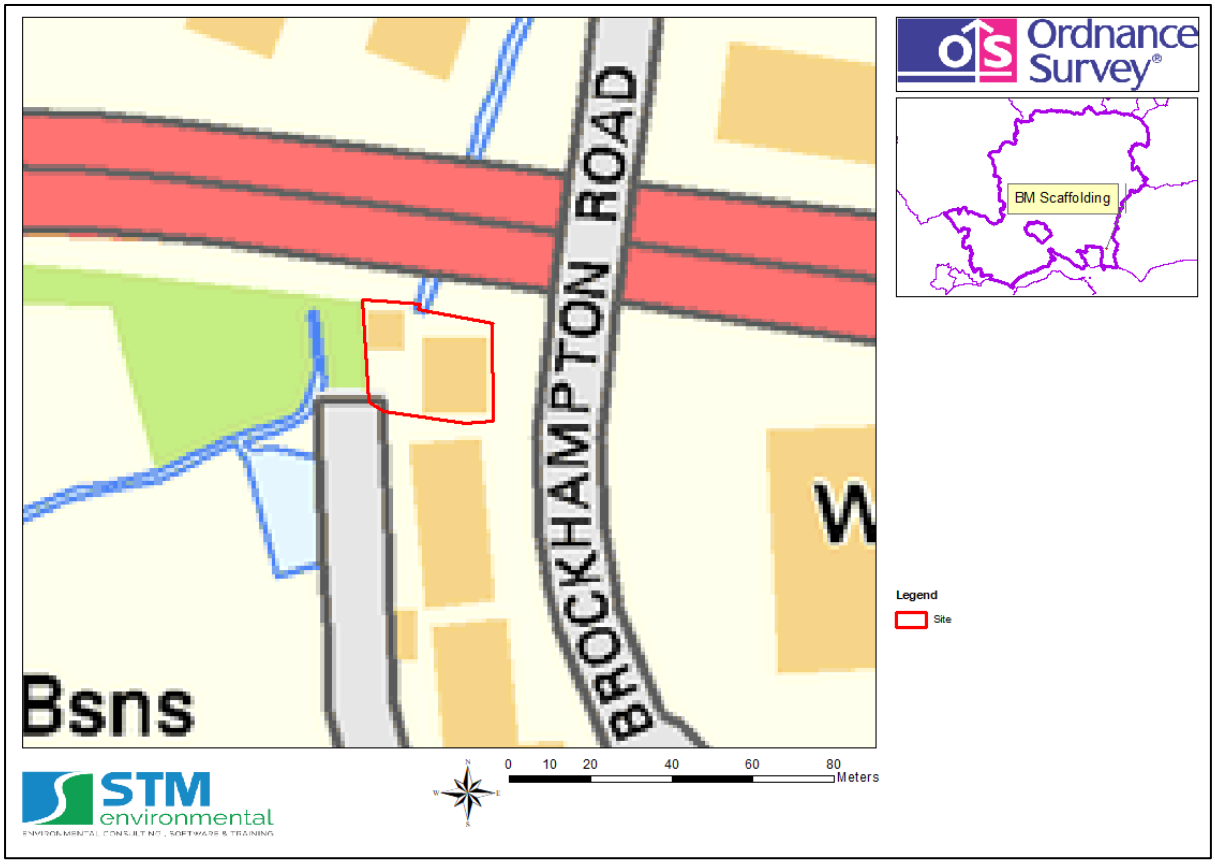
- in flood zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in flood zone 1
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)
- in an area within flood zone 1 which has critical drainage problems as notified by the Environment Agency

10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at B.M Scaffolding, Brockhampton Road, Havant, Hampshire, PO9 1JU. It is centred at national grid reference 470849, 105969. The site has an area of approximately 825m^2.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.


BROCKHAMPTON ROAD
Bsns
Ordnance Survey
BM Scaffolding
Legend
Site
0 10 20 40 60 80
Meters
STM environmental

Ordnance Survey
BM Scaffolding
Legend
Site
World Imagery
0 5 10 20 30 40
Meters
STM environmental

10.2 Site Access

The site is accessed via Brochampton Road.

10.3 Local Planning Authority

The site falls within the jurisdiction of Havant Borough Council in terms of the planning process.

10.4 Lead Local Flood Authority

Hampshire County Council is the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3 as defined by the EA and LLFA.

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently used as industrial.

10.6.2 Surrounding Land Uses

A description of current land uses surrounding the boundaries of the site is given below in Table 1 below.

Table 1: Summary of surrounding land uses

Boundary	Land Use Description	
	Immediately Adjacent (within 0 – 25m)	General Local Area (i.e. within 25 - 250m)
Northern	Highway	Industrial / Residential
Eastern	Industrial	Industrial
Southern	Industrial	Industrial
Western	Industrial	Commercial

10.7 Hydrology

The nearest main watercourse is the Hermitage Stream which runs in culvert within the site and the Lavant Stream which is located 600m to the east of the site.

10.8 Geology

Data from the British Geological Survey indicates that, the underlying superficial geology is characterised as Alluvium. The underlying bedrock geology is characterized as Chalk Formation.

10.9 Hydrogeology

The site lies upon a secondary A superficial aquifer and a principal bedrock aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

10.10 Topography

A LIDAR map showing the topology of the site and surrounding area is available in Appendix 3. The ground level at the site ranges from 4.3mAOD to 5mAOD. At the location of the extension, the ground is at approximately 4.4mAOD.

A topographic survey has not been conducted.

11 The Sequential and Exception Tests

11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Minor development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.
- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

The development is considered to be minor and as such the Sequential Test should not be required by the LLFA.

11.2 The Exception Test

If alternative sites of lower flood risk are not available then the proposed development may require an Exception Test to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;

- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 1 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: NPPF flood zone vulnerability compatibility (source: NPPF).

Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Based on its scale and nature, the development is considered to be less vulnerable. As such the Exception Test should not be required by the LLFA.

12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

12.1 Fluvial (River) and Tidal (Sea) Flood Risk

12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream.
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 100 and 1 in 1000 annual probability of flooding;
- Flood zone 3 - Greater than 1 in 100 annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 annual probability of fluvial flooding and/or greater than 1 in 200 annual probability of tidal flooding;
- Flood zone 3b: functional flood plain (definition specific to the LLFA). Less than a 1 in 20 annual probability of fluvial and/or tidal flooding.

12.1.3 Main Potential Sources of Local Fluvial Flooding

The nearest potential sources of fluvial flooding to the site are considered to be the Lavant and Hermitage streams.

12.1.4 Records of Historic Fluvial Flooding Incidents

The EA informed that they are aware if flooding to this area in March 1991. They do not hold specific details.

The Historic Flood Map was not provided by the EA as part of the Product 4 data in Appendix 10.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within flood zone 3 as defined by the Environment Agency and the LLFA indicating that it has greater than 1 in 100 annual probability of fluvial flooding.

12.1.6 Mechanisms for Tidal Flooding

Tidal flooding may be described simply as the inundation of low lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

12.1.7 Definition of EA Tidal Flood Risk Zones

As with fluvial flood risk, tidal flood risk is assessed using flooding maps produced by the Environment Agency. The difference is in the probability return periods used to define tidal flood zones. The EA tidal flood zones are defined as:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 200 and 1 in 1000 annual probability of tidal flooding;
- Flood zone 3 - Greater 1 in 200 annual probability of tidal flooding.

12.1.8 Potential Sources of Tidal Flooding

The area in which the site is located is considered unlikely to be affected by tidal flooding.

12.1.9 Flood Defences

The EA's Areas benefitting from flood defences and current flood defences map which is available in Appendix 7 shows that the site does not benefits from flood defences. The Hermitage stream runs in culvert through the site however its condition is considered to be poor.

12.1.10 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 4 dataset which is presented in Appendix 10 provides modelled flood levels and flows for model node points close to the site. These are summarised in Table 2 below.

Table 3: EA modelled flood levels and expected flood depths for different return periods and scenarios.

Lavant & Hermitage 1D Levels	Flood Levels (mAOD)			
	Dam		No Dam	
	1 in 100	1 in 1000	1 in 100	1 in 1000
Node at the site	4.667	4.698	1.755	2.282

12.1.11 Long Term Fluvial Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 8 indicate that the long-term risk from fluvial flooding to most of the site is medium with the area underlain by the culvert being at high risk.

12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;
- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;

- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur.
- Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of fluvial flooding to the site is considered to be surface water ponding and flooding associated with heavy rainfall.

12.2.3 Records of Historic Pluvial Flooding Incidents

Annex E the LLFAs Level 1 SFRA which includes evidence of records of pluvial flooding in the borough was not available.

12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

The EA's reservoir flood risk map indicates that the site does not lie within an area that is at risk of reservoir flooding.

12.2.5 Sewer Flooding

A map showing recorded incidents of sewer flooding is not available.

12.2.6 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 100 year and 1 in 1000 rainfall return periods provided by the EA are available in Appendix 6.

The maps show that the site would witness depths of approximately 300mm around the building during the 1 in 100-year event with higher depths along the northern boundary of the site.

During the 1 in 1000-year flood, the majority of the site would witness flood depths up to 600mm.

12.2.7 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 8 indicate that the long term risk of flooding from surface water is considered to be low to medium.

12.3 Risk of Flooding from Multiple Sources (ROFMS)

The Environment Agency provides a map which gives an indication the overall flood risk from fluvial, tidal and surface water sources considering the presence of river defences. This map indicates that there is between 1% and 3.3% chance of flooding at the majority of the site in any year with the area underlain the culvert having more than 3.3%. A copy of the map is presented in Appendix 8.

12.4 Groundwater Flood Risk

Groundwater flooding occurs when water rises from the underlying aquifer at the location of a spring – where the underlying impermeable geology meets the ground surface. This tends to occur after much longer periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

12.4.1 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS, which is available in Appendix 9 indicates that the potential for groundwater flooding to occur below

ground level does exist. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at less than 3mbgl.

12.5 Critical Drainage Area

A Critical Drainage Area may be defined as “a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure”. A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as “an area within Flood Zone 1 which has critical drainage problems and which has been notified… [to]…the local planning authority by the Environment Agency”.

There is no sufficient information available to determine whether the site lies within a critical drainage area.

13 Potential Impacts of the Development on Local Flood Risk

13.1 Impacts on Flood Storage

13.1.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are considered to be insignificant. The extension will be built on already hardstanding areas.

However, it may reduce the capacity of the floodplain to store water. Therefore, the development will have to offset the floodplain loss.

13.2 Impacts on Flood Flow Routes

As the development does not involve the significant redesign of buildings at the site, it will not alter flood flow paths.

14 Flood Risk Mitigation Measures

14.1 SuDS

The Department for Communities and Local Government 's (DCLG) Planning practice guidance and Planning system (PPGPS) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 3 below to reduce surface water discharges from the site.

Table 4: SuDs Options

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge directly to a water course;
- Discharge rainwater directly to a surface water sewer/drain;
- Discharge to a combined sewer.

Figure 1: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Additionally, the relevant schedules from Policy CC4 – Minimizing Surface Water Run-off with Sustainable Drainage Systems are:

- Developments must maximize attenuation levels, achieving greenfield rates where possible;
- All new car parks and hard standing areas should be rainwater permeable with no run-off directed in to the sewer network;
- All flat roofs should be green or brown roofs to contribute to reducing surface water run-off.

Given the nature of the development and the size of the site, it is considered that there are limited opportunities for implementing SuDS. Measures such as green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks should be considered. If required, the SuDS strategy will be detailed in a separate report as is outside the scope of works of this FRA.

14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

14.2.1 Finished Floor Levels

The average ground level at the location of the extension is 4.4mAOD.

For minor extensions EA Standing Advice states that finished floor levels are either no lower than existing floor levels or 300 millimetres (mm) above the estimated flood level. Where floor levels cannot be set to 300mm above existing flood levels, applicants should check with the LPA if they need to take flood resistance and resilience measures.

In line with the climate change guidance issued on the 19th February 2017, the EA would expect a basic approach to climate change allowance to be adopted for this this development. Based on the use of the central allowance for less vulnerable developments, design floor levels will be set to 500mm above the 1% AEP flood extent.

As outlined in section 12.2.4 the EA's maximum predicted flood level at the site for 1% AEP event is 4.7mAOD (see Appendix 10). Based on this finished ground floor levels across internal areas of the development will be set at minimum of 5.2mAOD.

14.2.2 Flood displacement storage

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.

Similarly, where ground levels are elevated to raise the development out of the floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced. The requirement for no loss of floodplain storage means that it is not possible to modify ground levels on sites which lie completely within the floodplain

(when viewed in isolation), as there is no land available for lowering to bring it into the floodplain.

As the whole site lies within flood zone 3, the use of under-floor voids with adequate openings beneath the raised finished floor levels can be considered. They are generally considered to provide indirect compensation or mitigation, but not true compensation for loss of floodplain storage.

Ideally, void openings should be a minimum of 1m long and open from existing ground levels to at least the 1% annual probability (1 in 100 year) plus climate change flood level. By setting finished floor levels at 300mm above the design flood level, there is usually enough space provision for voids below. There should be a minimum of 1m of open void length per 5m length of wall. Void openings should be provided along all external walls of the proposed extension. If security is an issue, 10mm diameter vertical bars set at 100mm centres can be incorporated into the void openings.

14.2.3 Flood Resilience Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water exclusion strategy - where emphasis is placed on minimising water entry whilst maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (not more than 0.3m).
- Water entry strategy - buildings are at significant risk of structural damage if there is a water level difference between outside and inside of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved (greater than 0.6m).

Given that flood depths less than 0.3m are predicted in extreme scenarios, the water exclusion strategy is considered most applicable for this site.

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized through the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of resilient flooring materials as ceramic tiles or stone floor finishes;
- Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
- Damp proof membrane of impermeable polythene at least 1200 gauge;
- Avoid the use of MDF carpentry.

Wall construction:

- Use rigid closed – cell material for insulation above the DPC;

Doors:

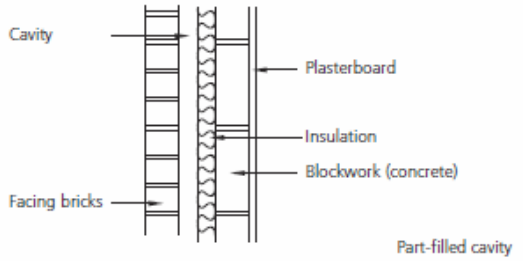
- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for fouls and surface water drainage.

Improving the flood performance of new buildings

Figure 6.10 Cavity External Walls – Part-filled cavity with sacrificial plasterboard



Part-filled cavity

- External face consisting of engineering bricks up to required level for flood protection (up to d.p.c.). Other external facing materials can be used above this level, but ensure transition is watertight.
- Rigid insulation
- Internal cement based render, preferably with lime content. Composition depends on masonry; the following mix is effective:

  1 cement : 6 sand: 1 lime on concrete blocks.
- Stainless steel wall ties should be used to minimise corrosion and consequent staining.
- Sacrificial plasterboard can be used, but it needs to be removed between ground floor to flood level. The board should be laid horizontally to make removal easier.

As well as the above the following flood resilience features should be applied as part of the development:

- Electrical sockets should be installed above flood level for the ground floor;
- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

14.3 Emergency Plan

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa.

The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA. Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor calculated using Tables below.
The scoring methodology and calculation matrix for this is summarised in Appendix 12.

The EA Product 4 data doesn't provide flood flows at the location of the development. It is therefore not possible to calculate a flood hazard score.

The use of a flood emergency plan is therefore sufficient for the proposed development. The key elements of the emergency plan are described below.

14.3.1 EA Flood Warnings Direct Service Subscription

The occupants will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone, mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at https://fwd.environment-agency.gov.uk/app/olr/home along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

14.3.2 Access and Safe Egress

Access to and egress from the site is via Brockhampton Road.

Safe egress to Flood Zone 1 is available by walking south for 2 minutes on Brockhampton Road and turning east on Harts Farm Way. Directions of this route are presented in Appendix 11 .

14.3.3 Safe Refuge

The proposed development will have internal connections to upper floors in the property which will act to provide sufficient safe refuge in the event of an extreme flood event.

15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- The site is classified as a less vulnerable minor development and is therefore unlikely to require sequential and exception tests to be undertaken.
- The main sources of potential flooding to the site are the Lavant and Hermitage Streams;
- The EA define the site as being within flood zone 3 ;
- EA mapping indicates that the site is in an area that don't benefit from flood defences;
- One record of fluvial flooding incident was identified at or in the vicinity of the site;
- The EA considers the sites overall flood risk to be medium

- The development will not result in a significant change in the impermeable area of the site; however, the extension might alter the capacity of the floodplain to store water. The use of voids is recommended.
- There is limited opportunity for implementing SuDS mitigation measures. Consideration should be given to use of soakaways, living roofs and permeable paving where possible.
- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible.
- Occupants will subscribe to the EA Flood Warnings Direct Service
- Safe egress routes to flood zone 1 are easily accessible.
- In the event that evacuation is not possible, safe refuge is available in the upper floors of the building.

Based on the information reviewed and taking into account the proposed mitigation measures and the implementation of flood displacement storage, it is considered that the overall flood risk to the proposed development is manageable.

16 References

1. Communities and Local Government - National Planning Policy Framework NPPF, March 2012.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment – Havant Borough Council, October 2013.
4. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
5. Google Maps accessed January 2019.

17 Appendices

17.1 Appendix 1 – Site Photographs

17.2 Appendix 2 – Development Plans

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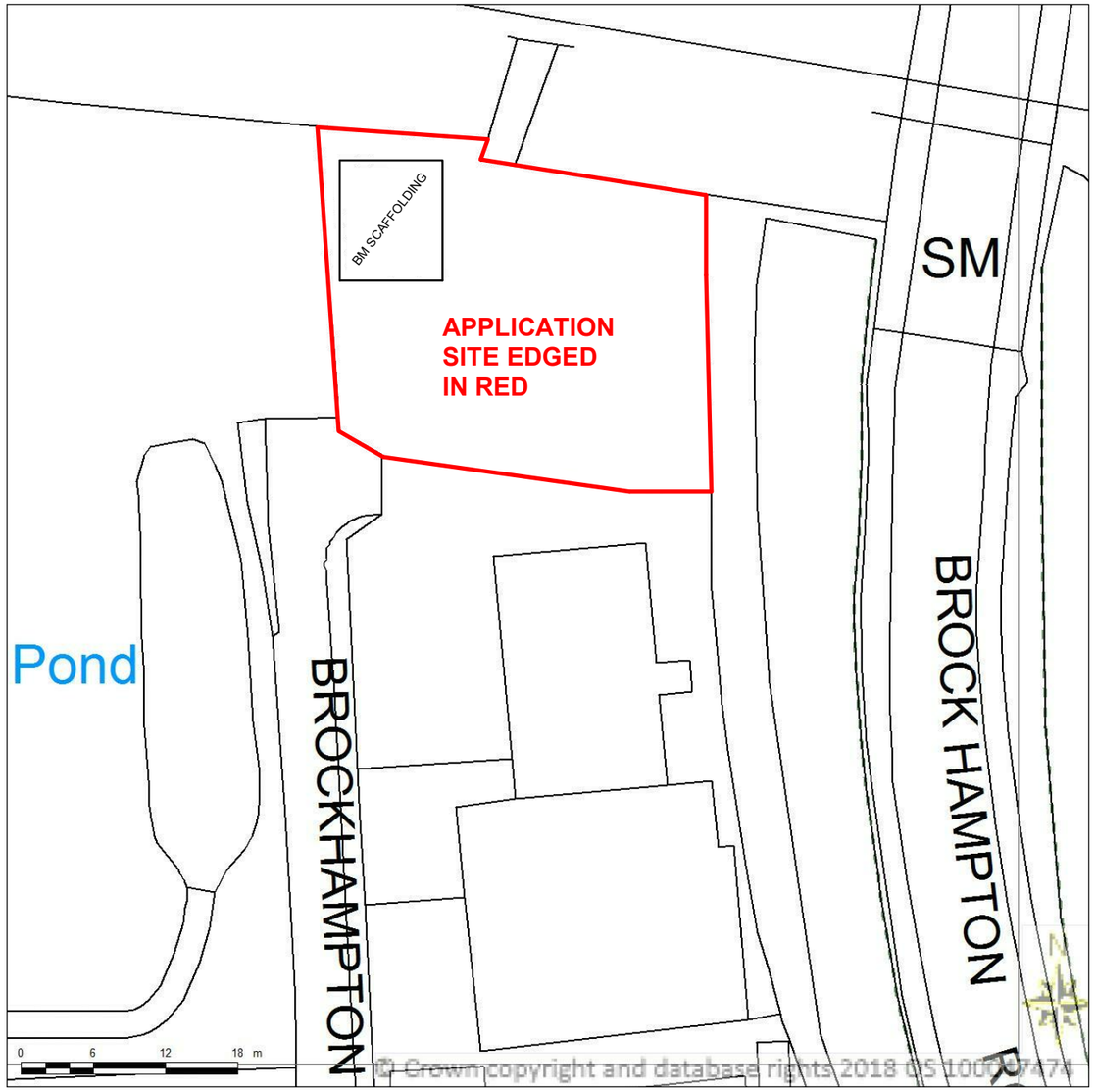

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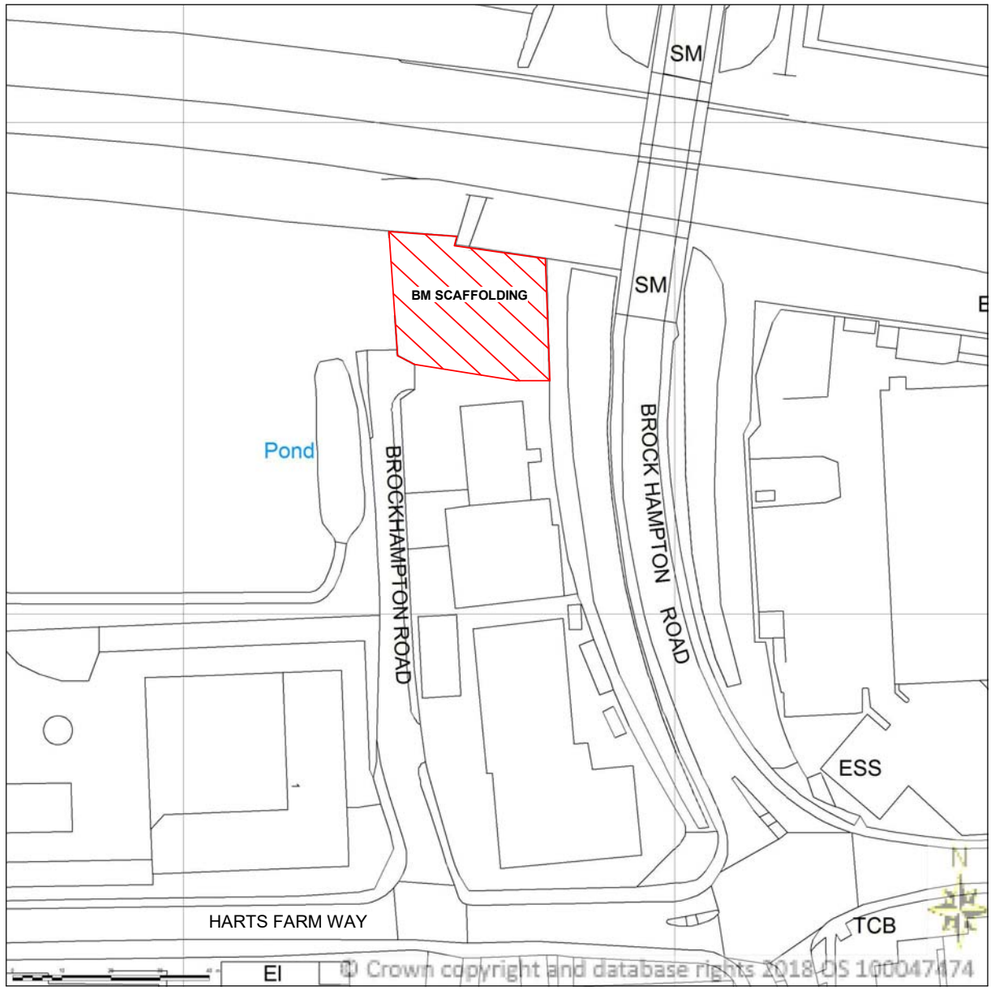

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EXISTING LOCATION & BLOCK PLANS

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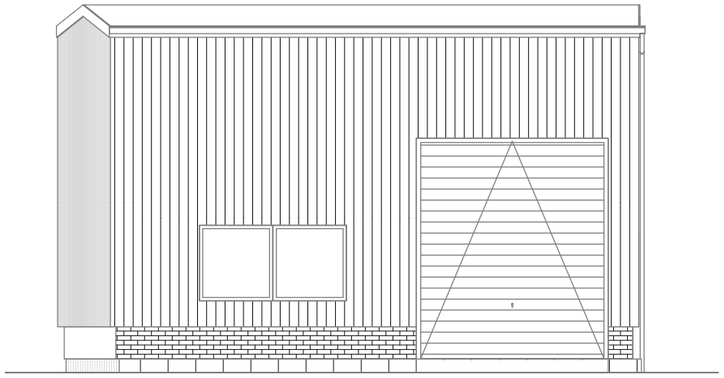

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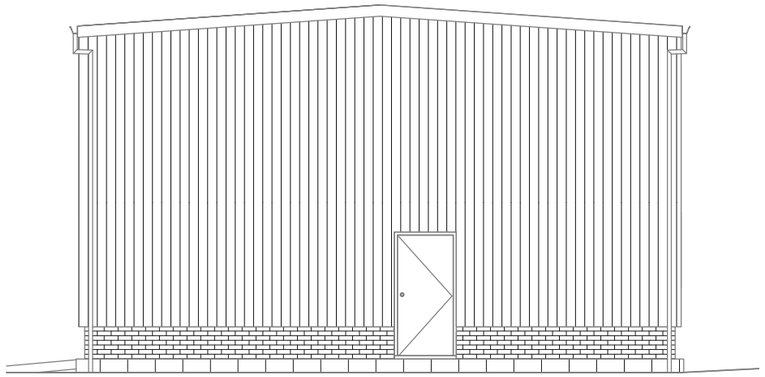

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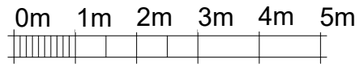

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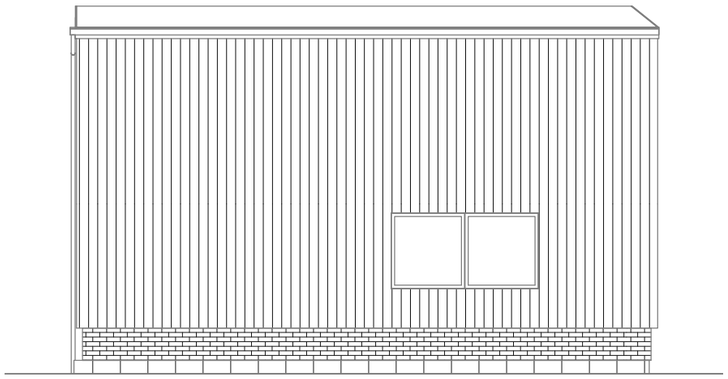

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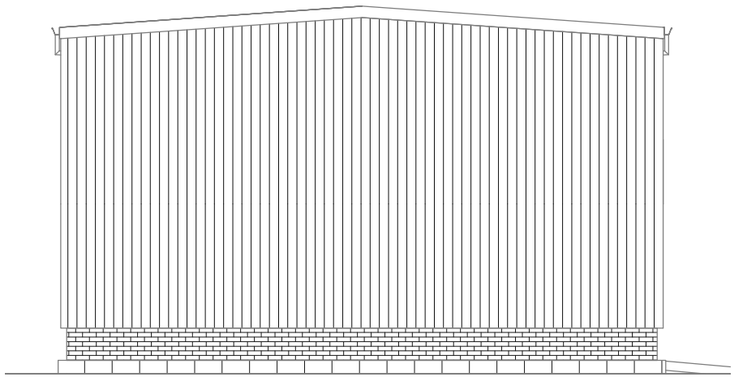

WEST ELEVATION
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EXISTING IMAGES (FROM TOP LEFT, CLOCKWISE)

FRONT SIDE ELEVATION, FRONT ELEVATION, SIDE ELEVATION, REAR ELEVATION

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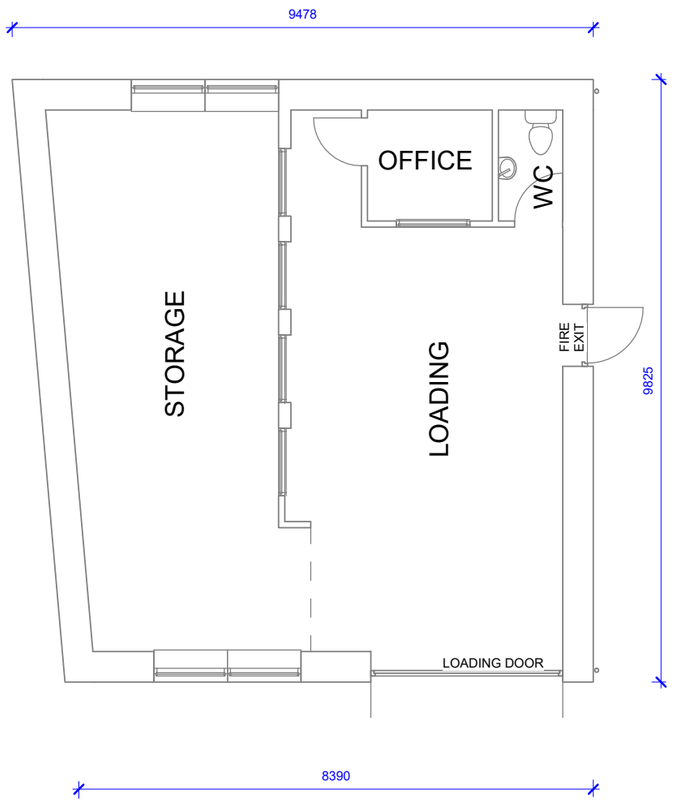

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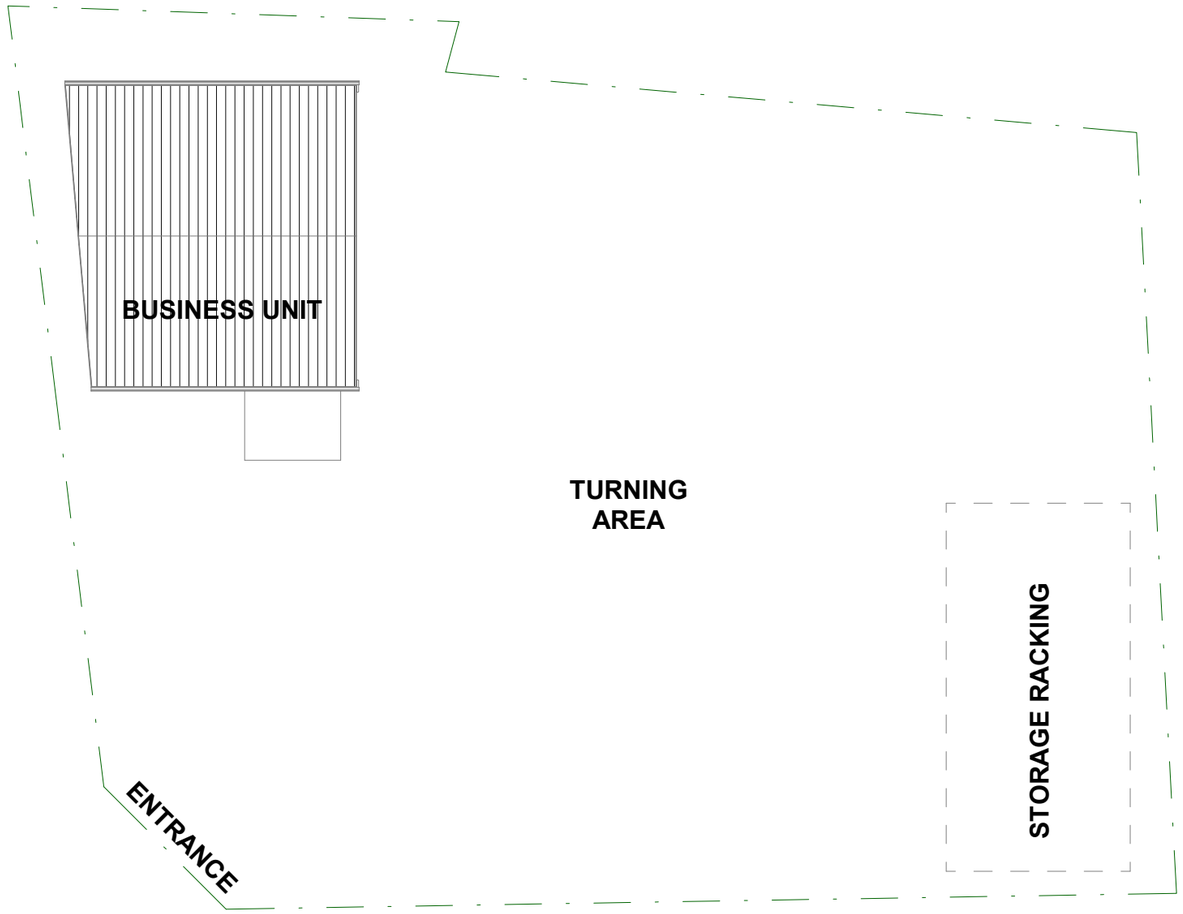

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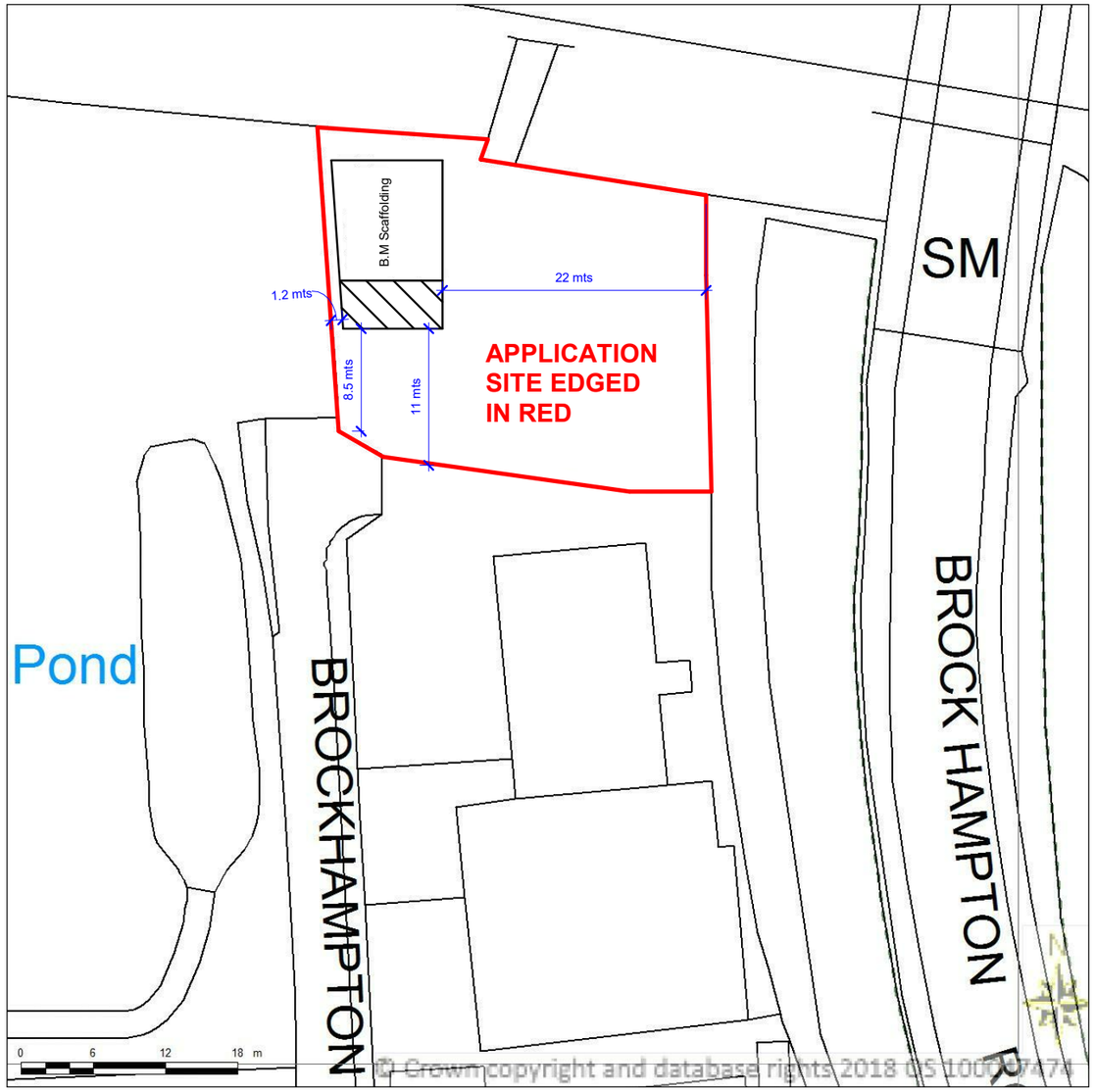

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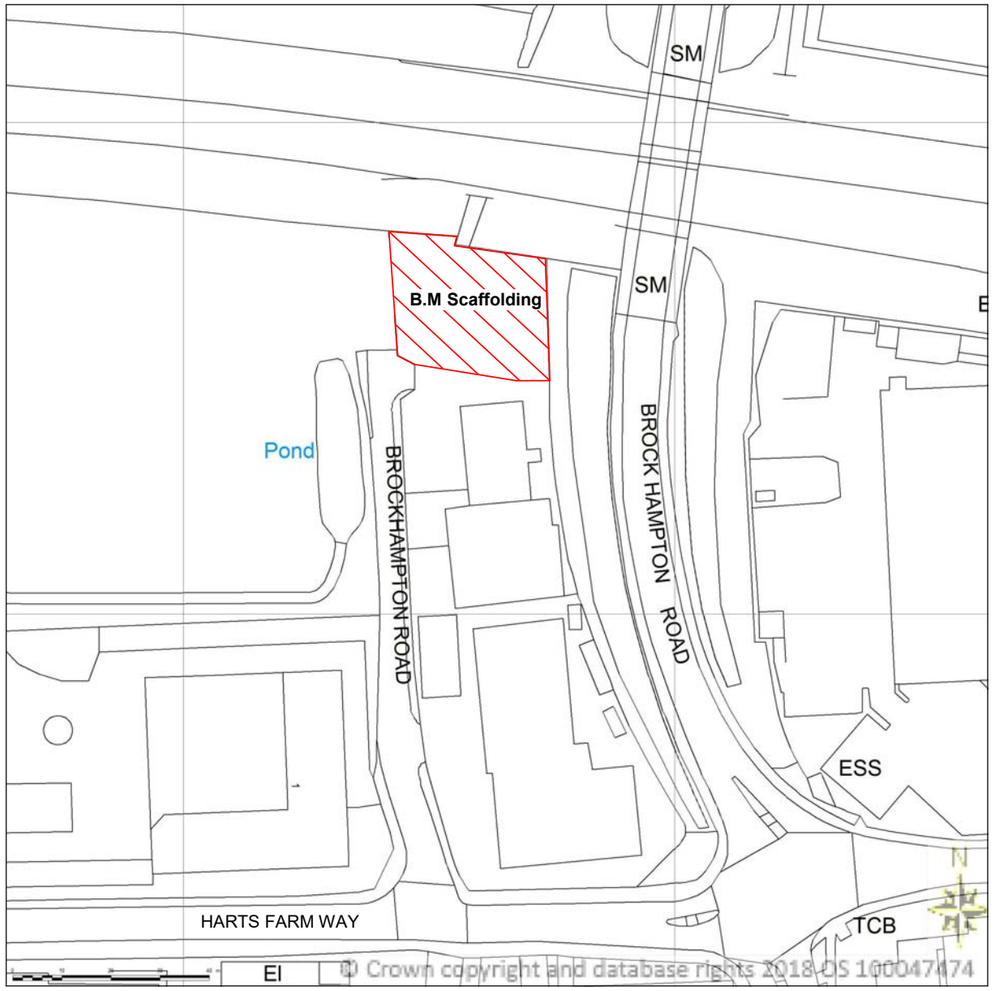

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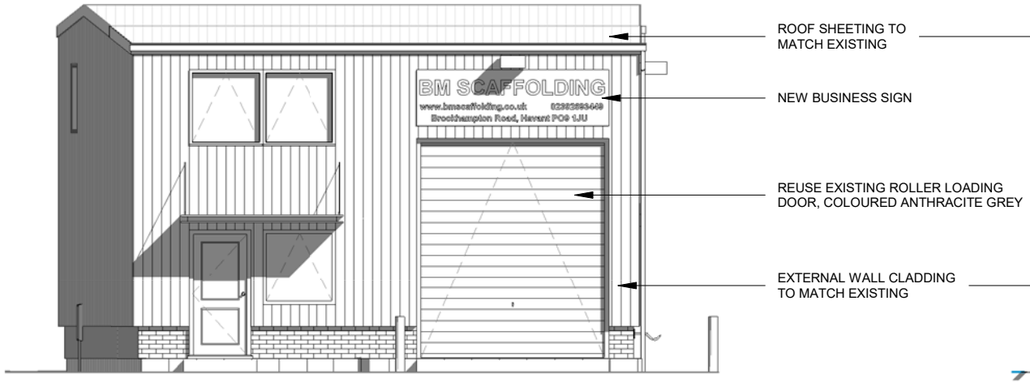

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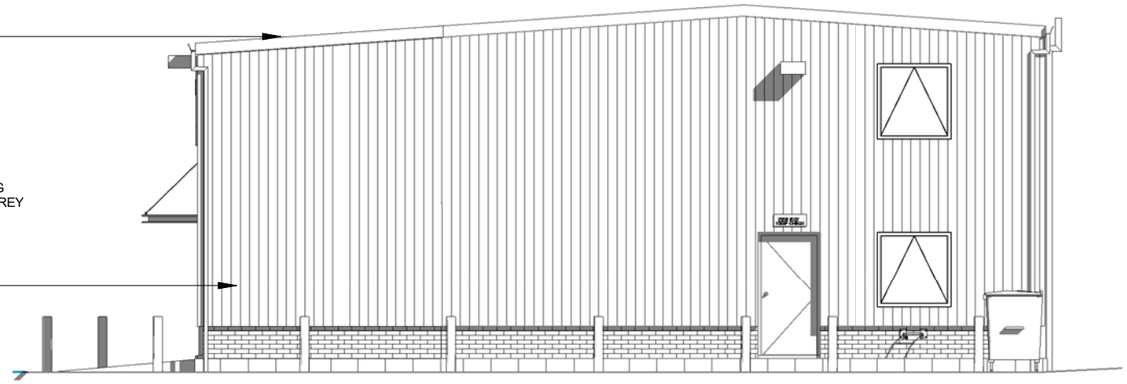

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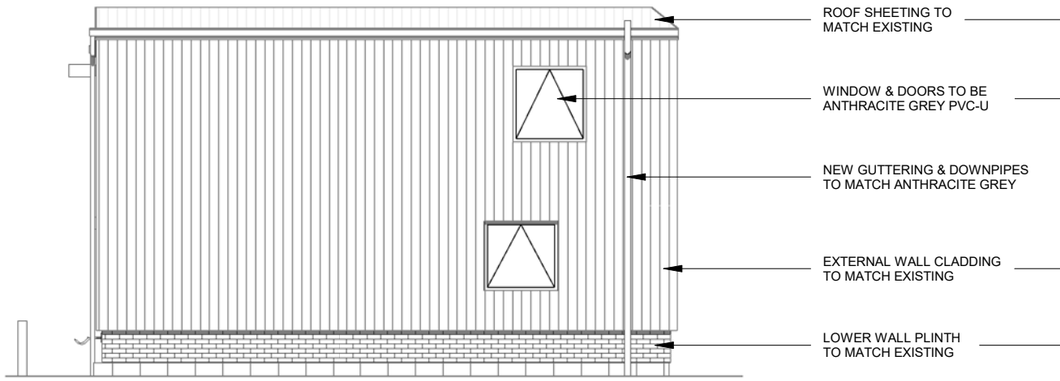

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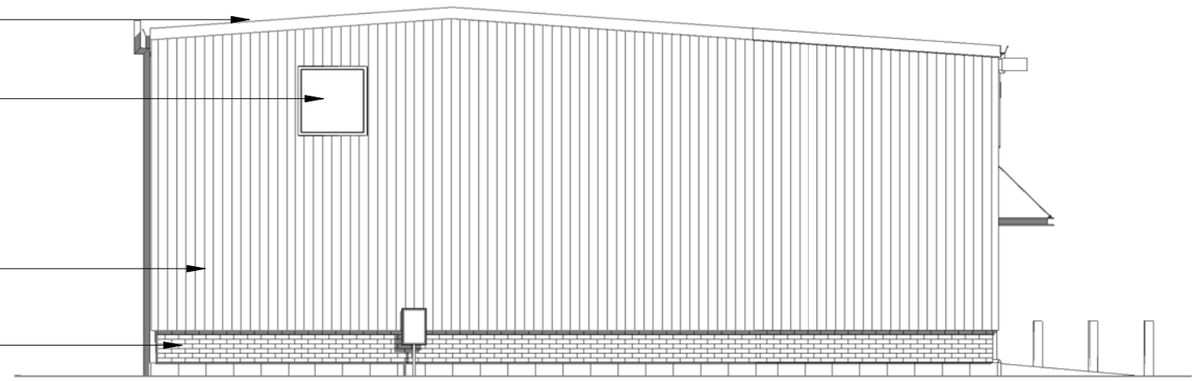

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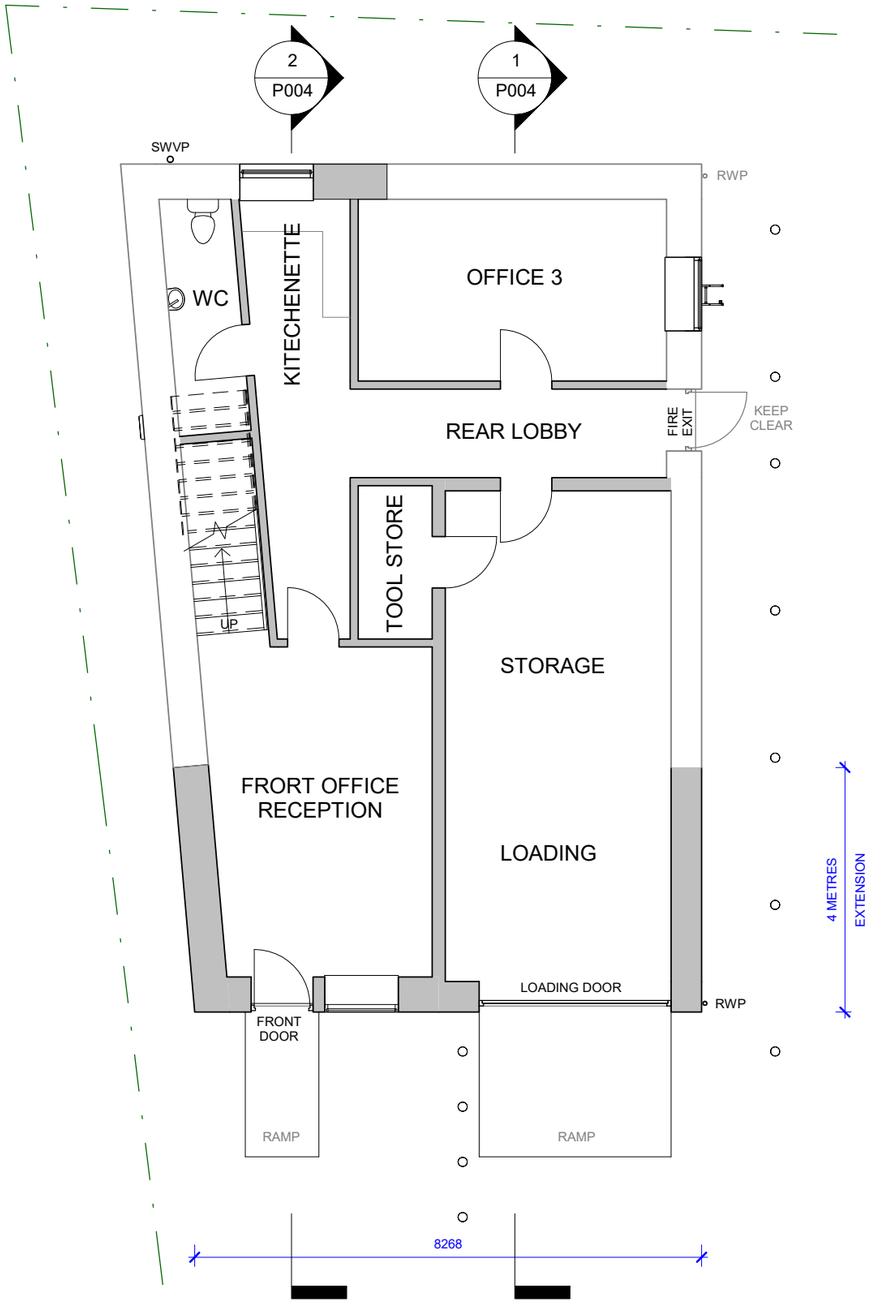

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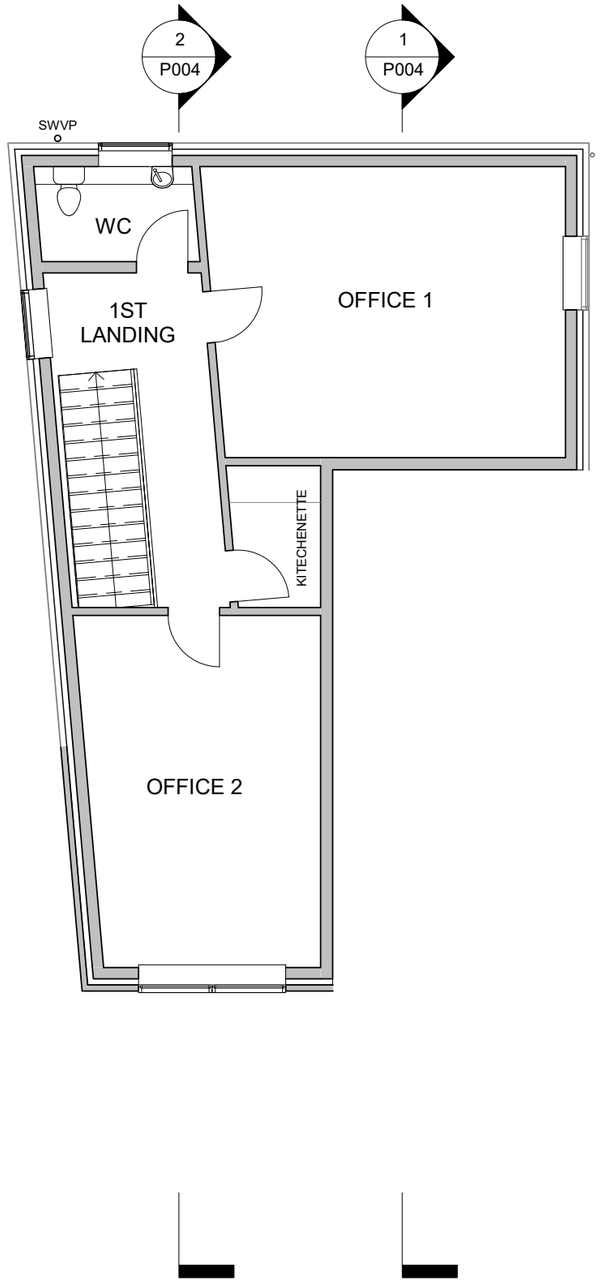

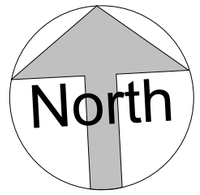

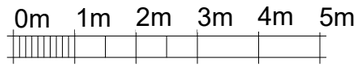

VISUAL SCALE 1:100 @ A3

PROPOSED FOOT PRINT: 122.67M2

PROPOSED GROUND FLOOR INTERNAL FLOOR AREA: 99.45 M2
PROPOSED FIRST FLOOR INTERNAL FLOOR AREA: 72.64 M2

TOTAL PROPOSED INTERNAL FLOOR AREA: 172.1M2

NEW INTERNAL FLOOR AREA: 100.04 M2

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Building Survey & Planning Services

The Planning Service
Studio, Old Flints 134 North Lane
Clanfield, Waterlooville
Hampshire PO8 0RL

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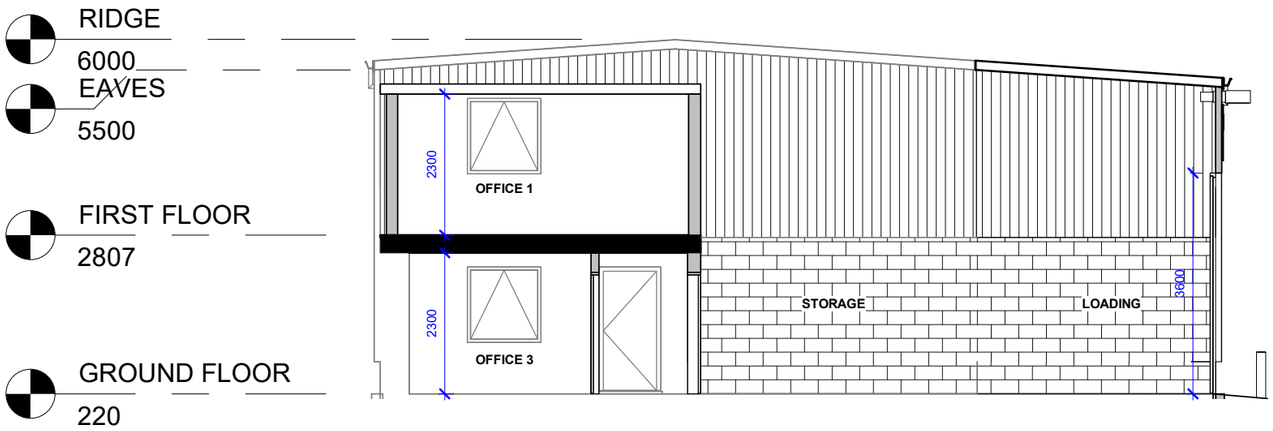
PROPOSED FLOOR PLANS

Project number	220.1 v2.1	P003
Date	10/10/2018	
Drawn by	JJ	
Status	Planning	Scale 100% @ A3 1 : 100

10/10/2018 12:26:16



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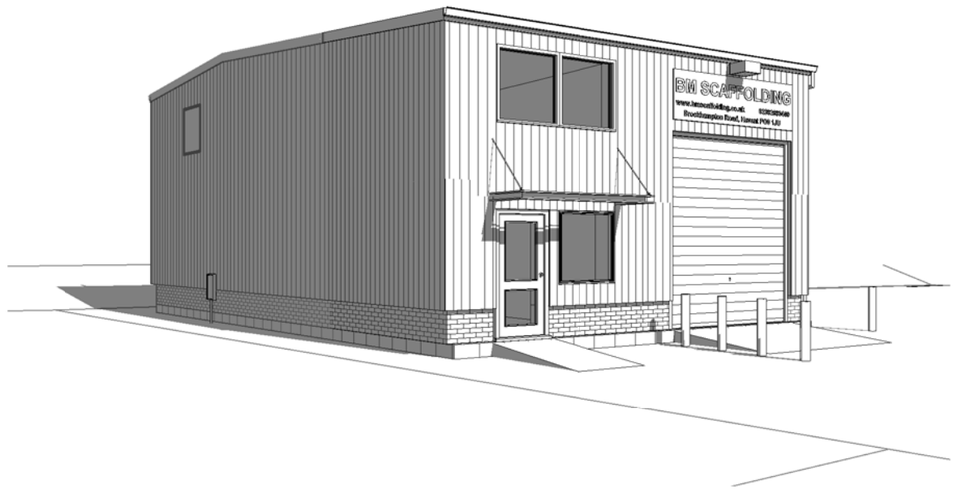
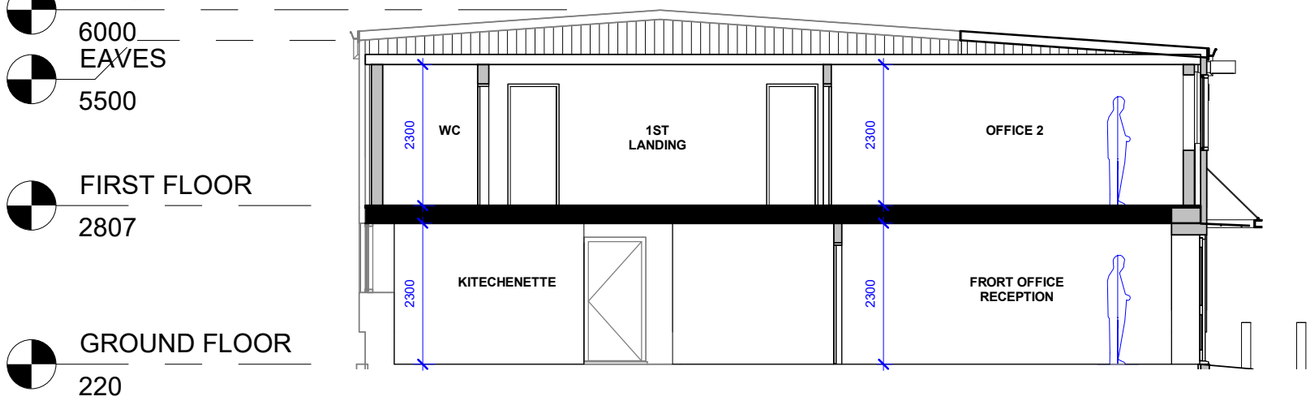


FRONT PERSPECTIVE (W)



CROSS SECTION B

1 : 100

0m 1m 2m 3m 4m 5m

VISUAL SCALE 1:100 @ A3

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The Planning Service
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Clanfield, Waterlooville
Hampshire PO8 0RL

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F: 0845 519 1103
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PROPOSED CROSS SECTIONS

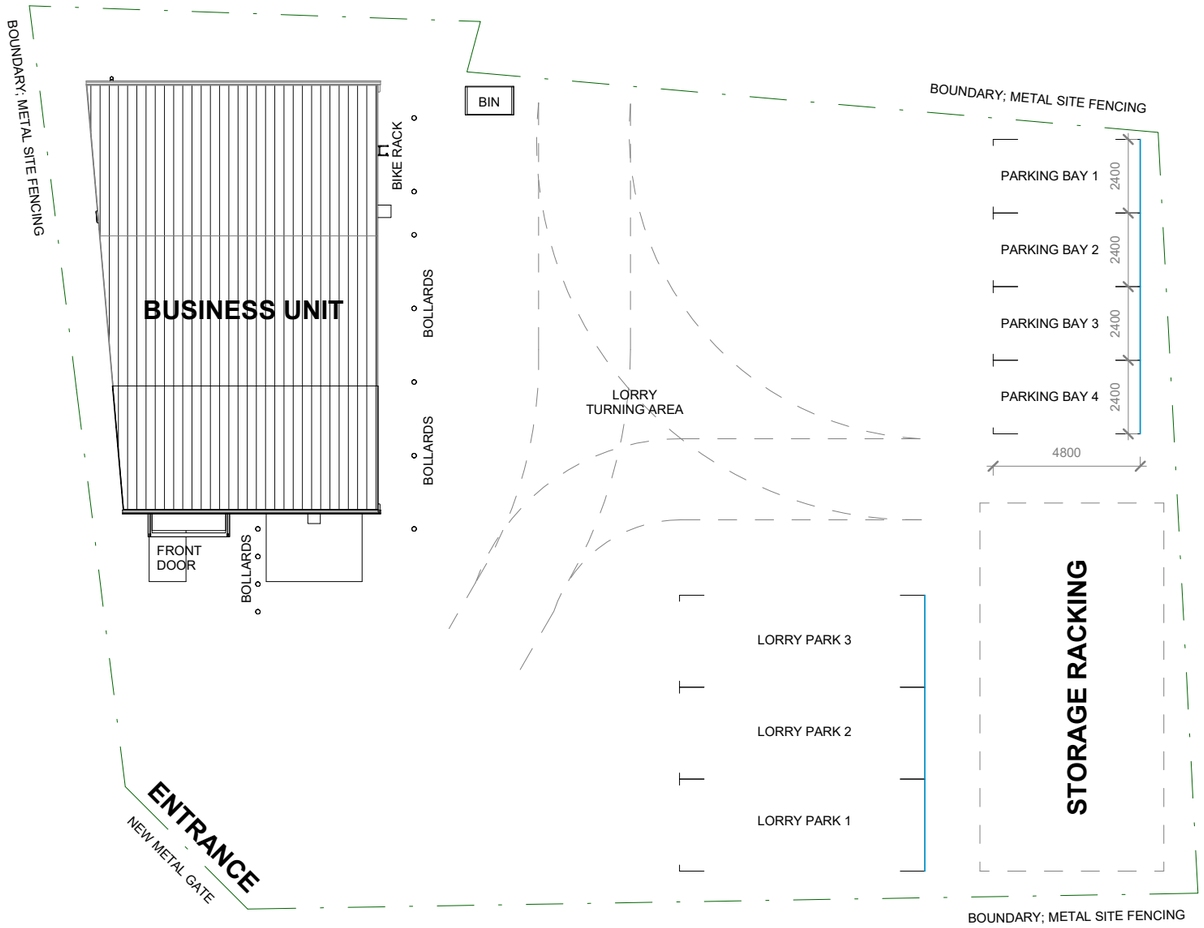
Project number	220.1 v2.1	P004
Date	10/10/2018	
Drawn by	JJ	
Status	Planning	Scale 100% @ A3 1 : 100

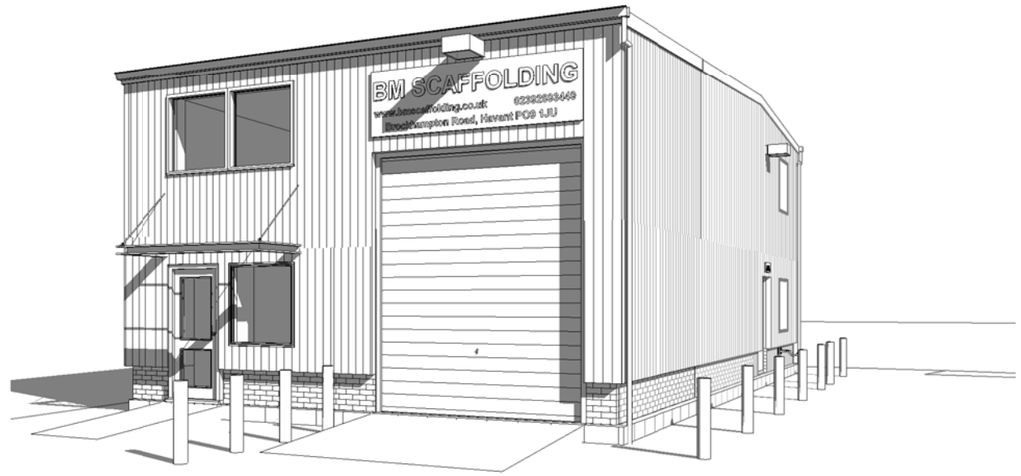
10/10/2018 12:26:35

SITE PLAN

1 : 200

SITE SIZE: 960m2





FRONT PERSPECTIVE (E)

0m 2m 4m 6m 8m 10m

VISUAL SCALE 1:200 @ A3

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The Planning Service
Studio, Old Flints 134 North Lane
Clanfield, Waterlooville
Hampshire PO8 0RL

T: 023 92 597364
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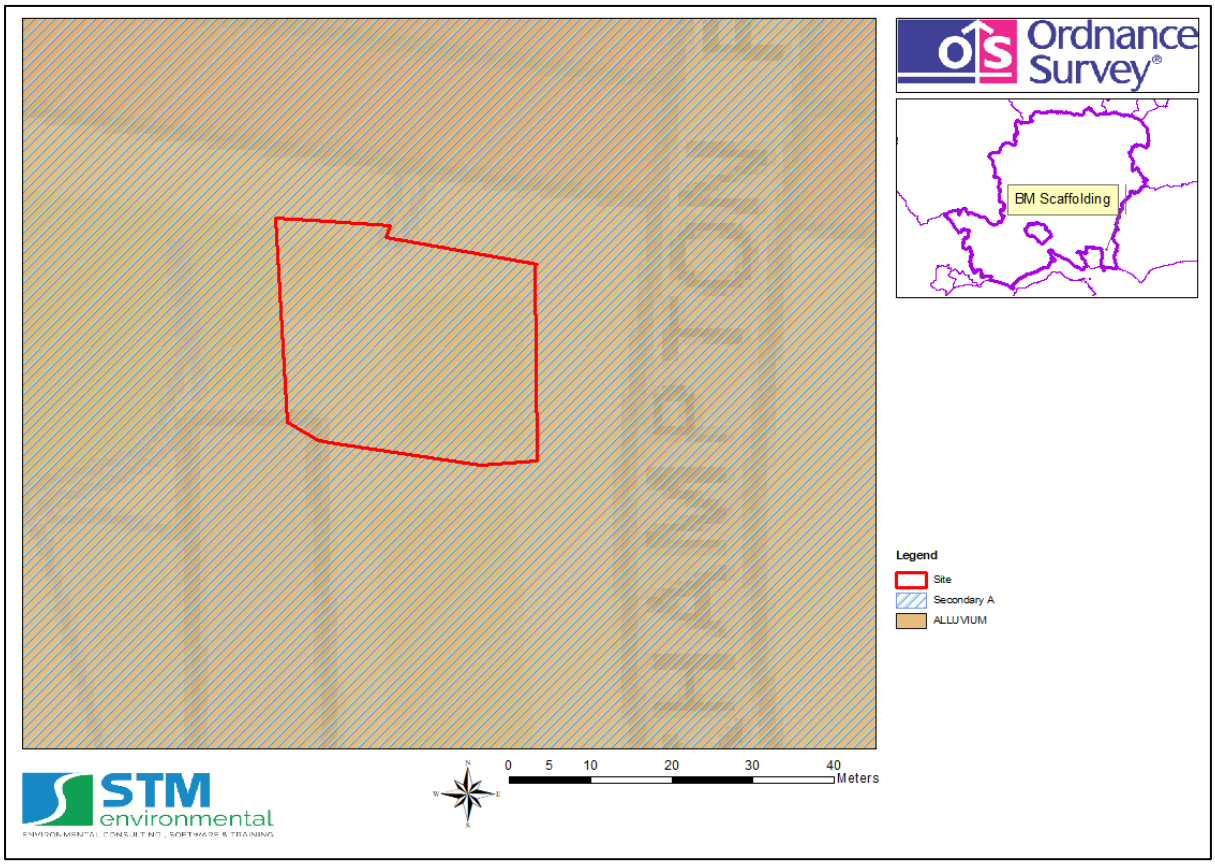
PROPOSED SITE PLAN

Project number	220.1 v2.1	P005
Date	10/10/2018	
Drawn by	JJ	
Status	Planning	Scale 100% @ A3 1 : 200

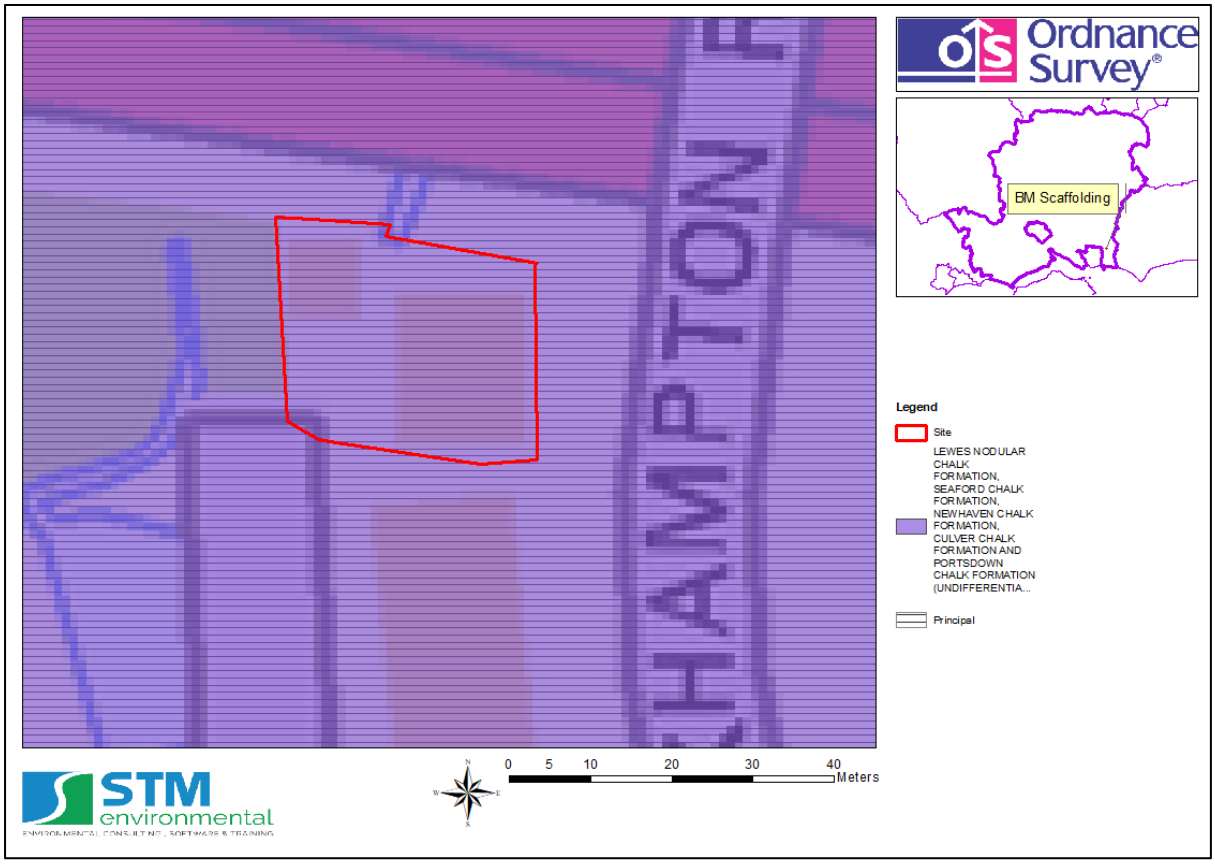
10/10/2018 12:26:48

17.3 Appendix 3 – Environmental Characteristics

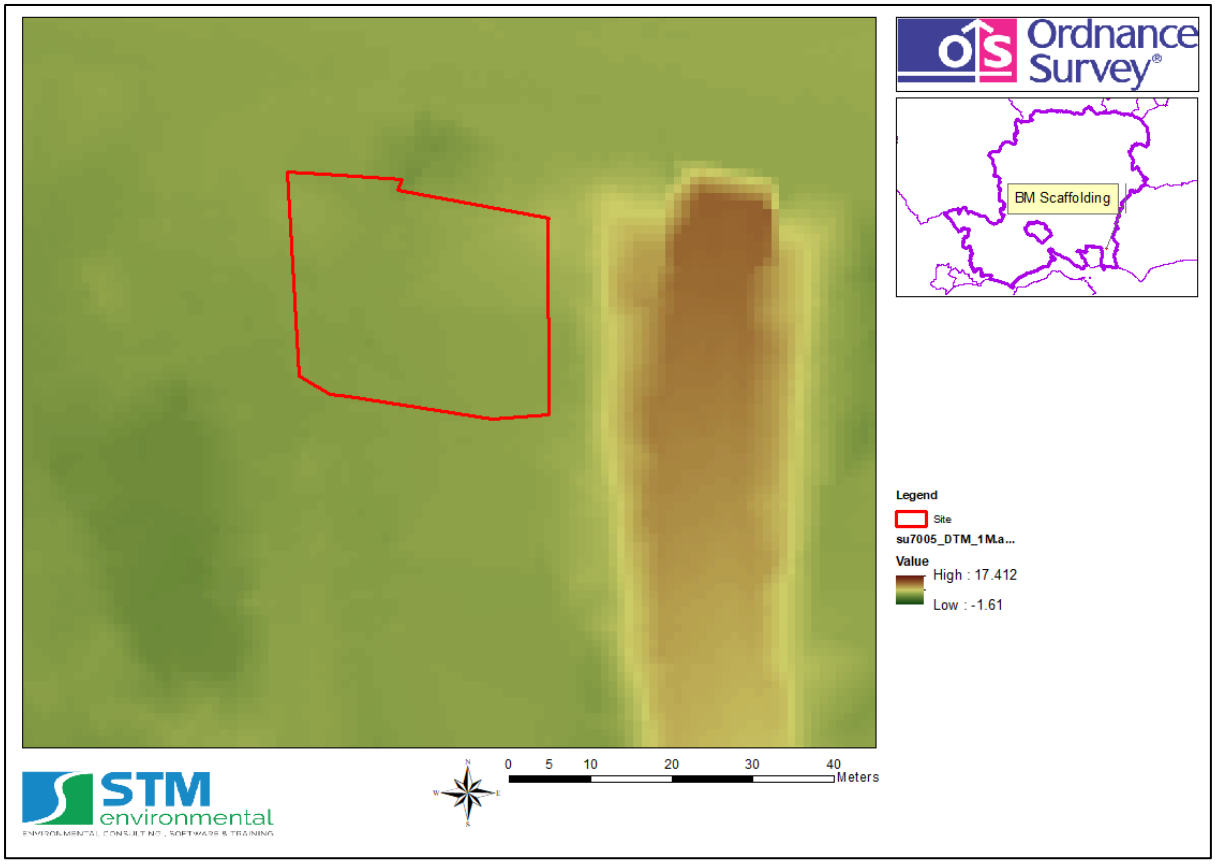
17.3.1 Superficial Hydrogeology Map



17.3.2 Bedrock Hydrogeology Map



17.3.3 Topology Map

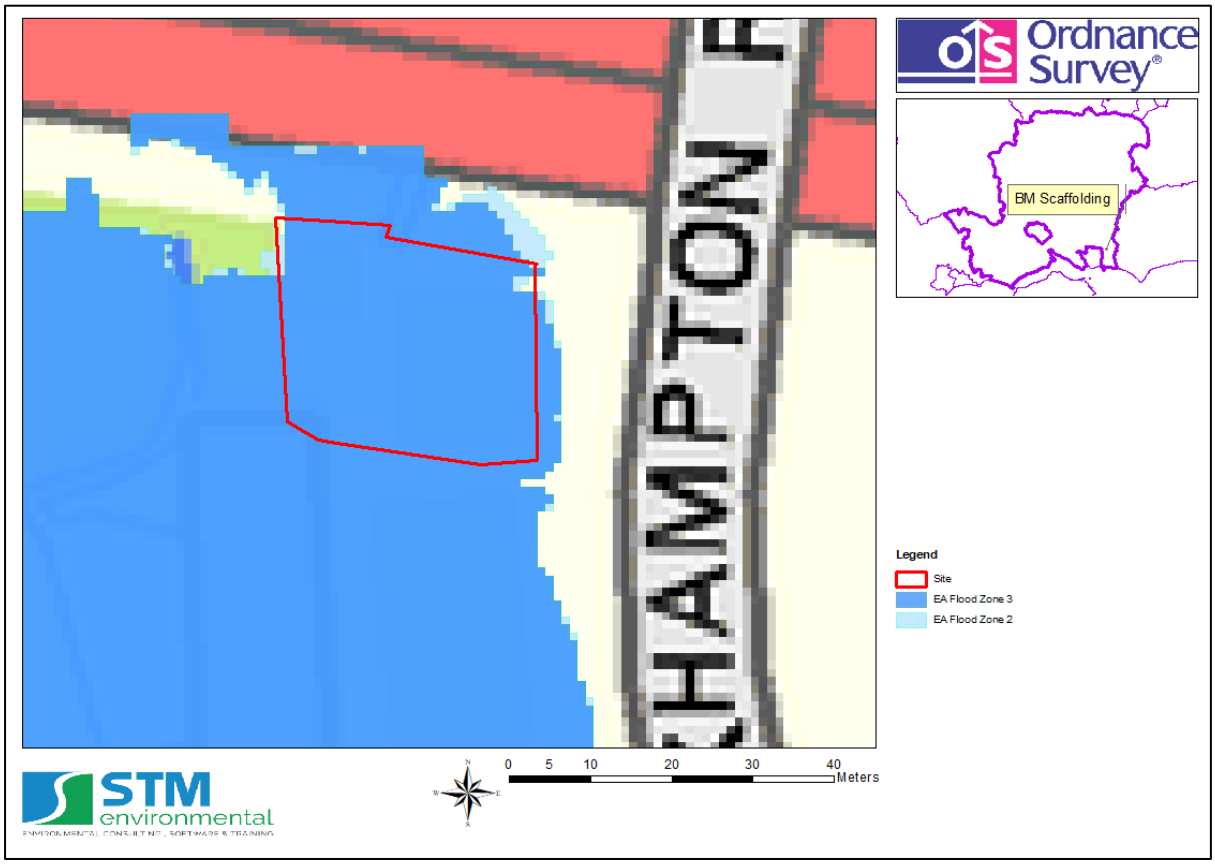


17.4 Appendix 4 – Historical Flood Incident Maps

17.4.1 EA Historic Flood Outlines

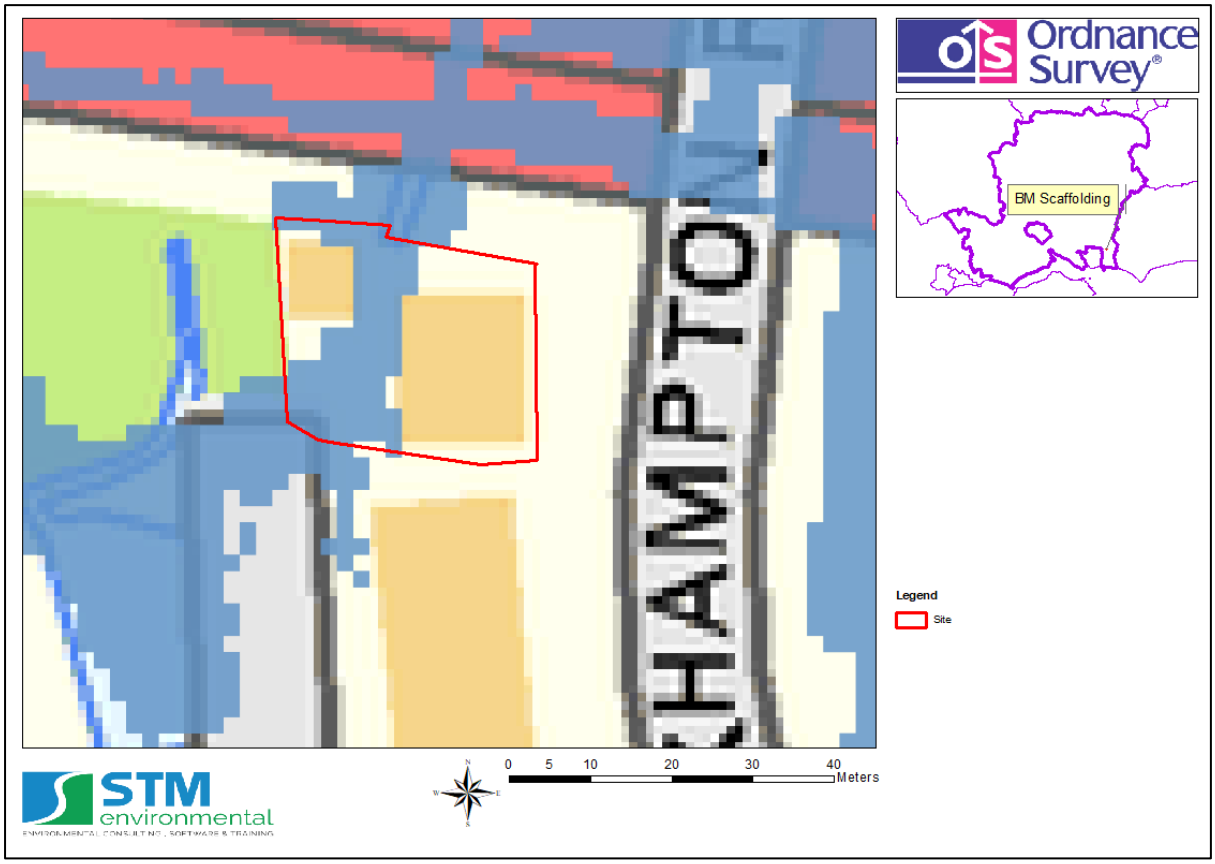
N/A

17.5 Appendix 5 - EA Flood Zone Map

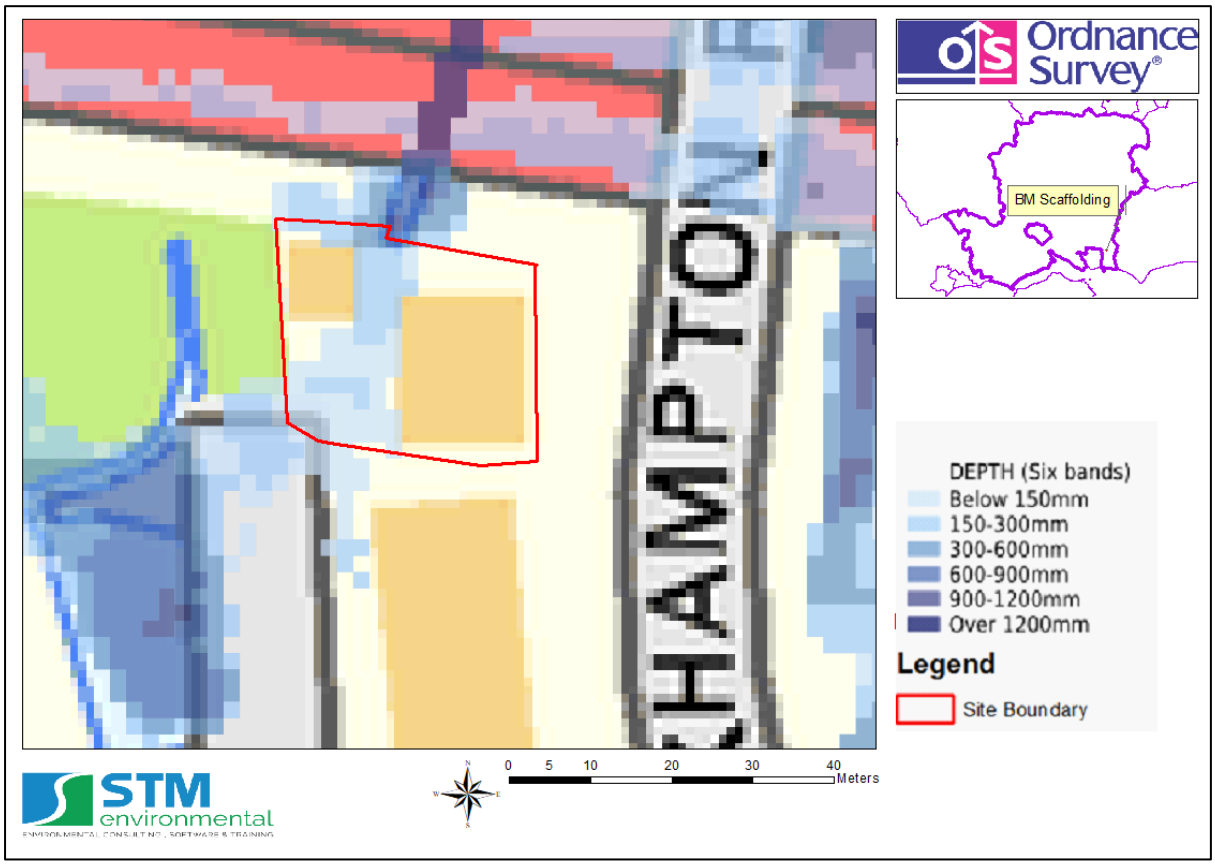


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

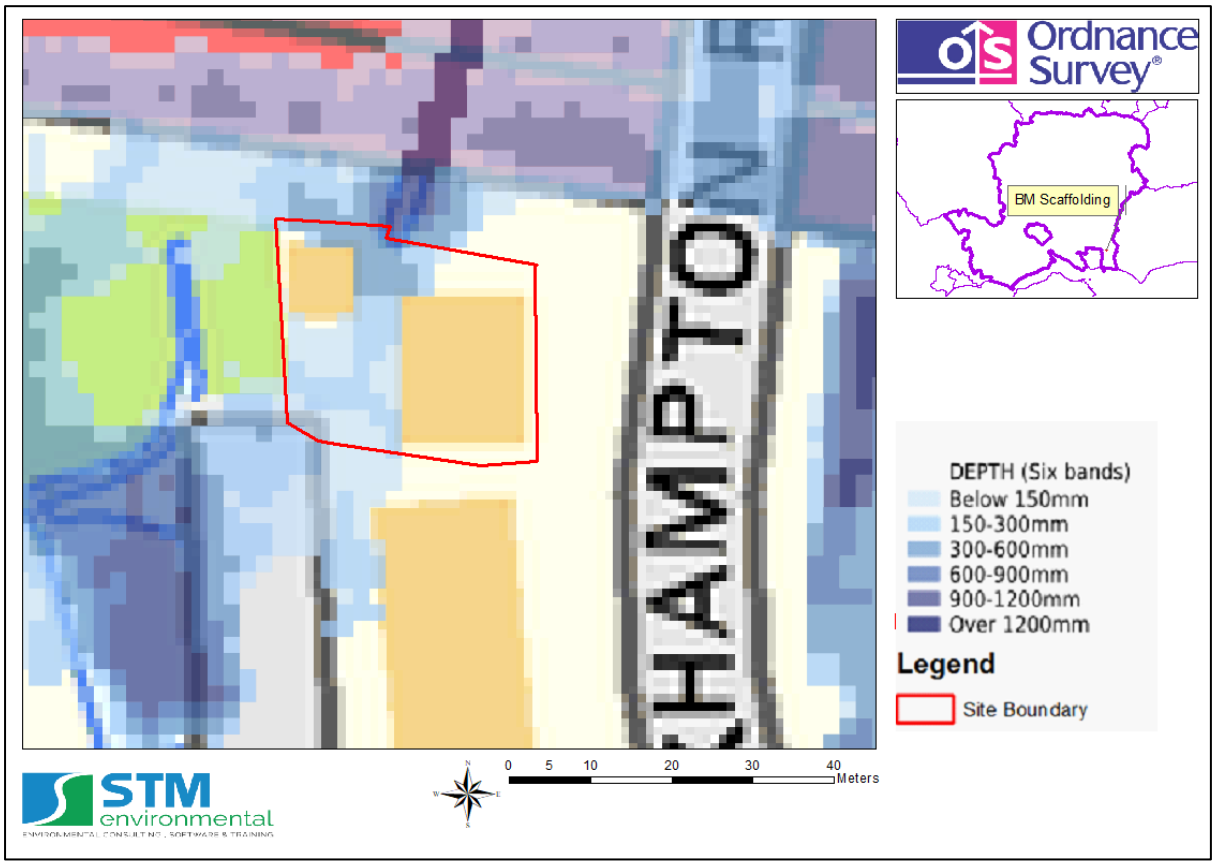
17.6.1 Map showing surface water flood extents during the 1 in 100 year rainfall event (Source: EA, 2016).



17.6.2 Predicted surface water flood depth for the 1 in 100 year return period (Source: EA, 2016).



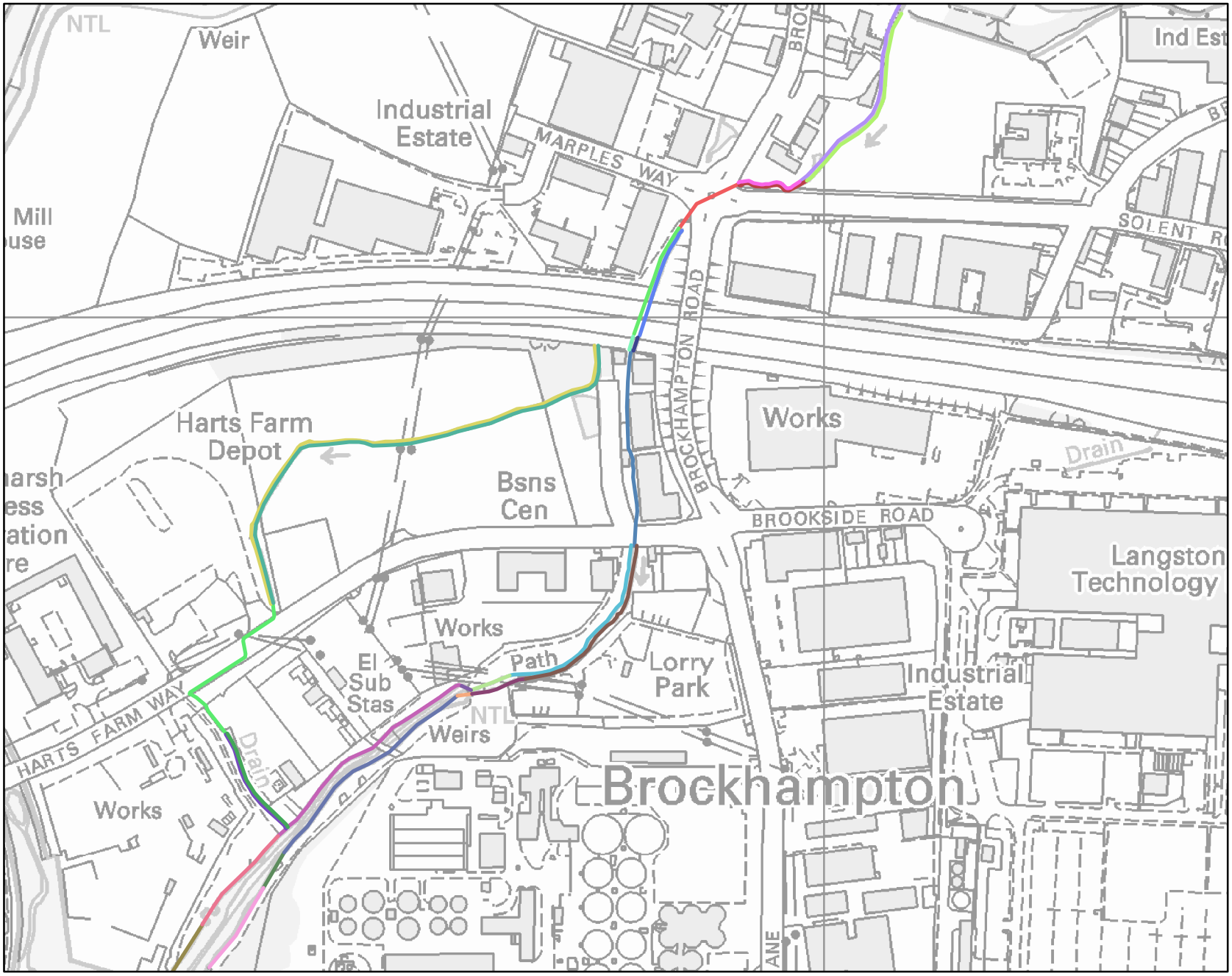
17.6.3 Predicted surface water flood depth for the 1 in 1000 year return period (Source: EA, 2016).



17.7 Appendix 7 –Flood Defence And Reservoir Flood Risk Maps

17.7.1 EA Flood Defence Map

Flood Defences Map Centred on Brockhampton Road - created 16/01/2019



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Legend

ASSET_ID

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- 19073
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- 23310
- 23399
- 23402
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- 49054
- 49553
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- 113661
- 113663
- 119545
- 135510
- 135709
- 178042
- 178043
- 178044
- 178045
- 179215
- 179216
- 179217
- 179218
- 23400
- 49555
- 135511

1:4,137 *

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N

0 80 160

Metres

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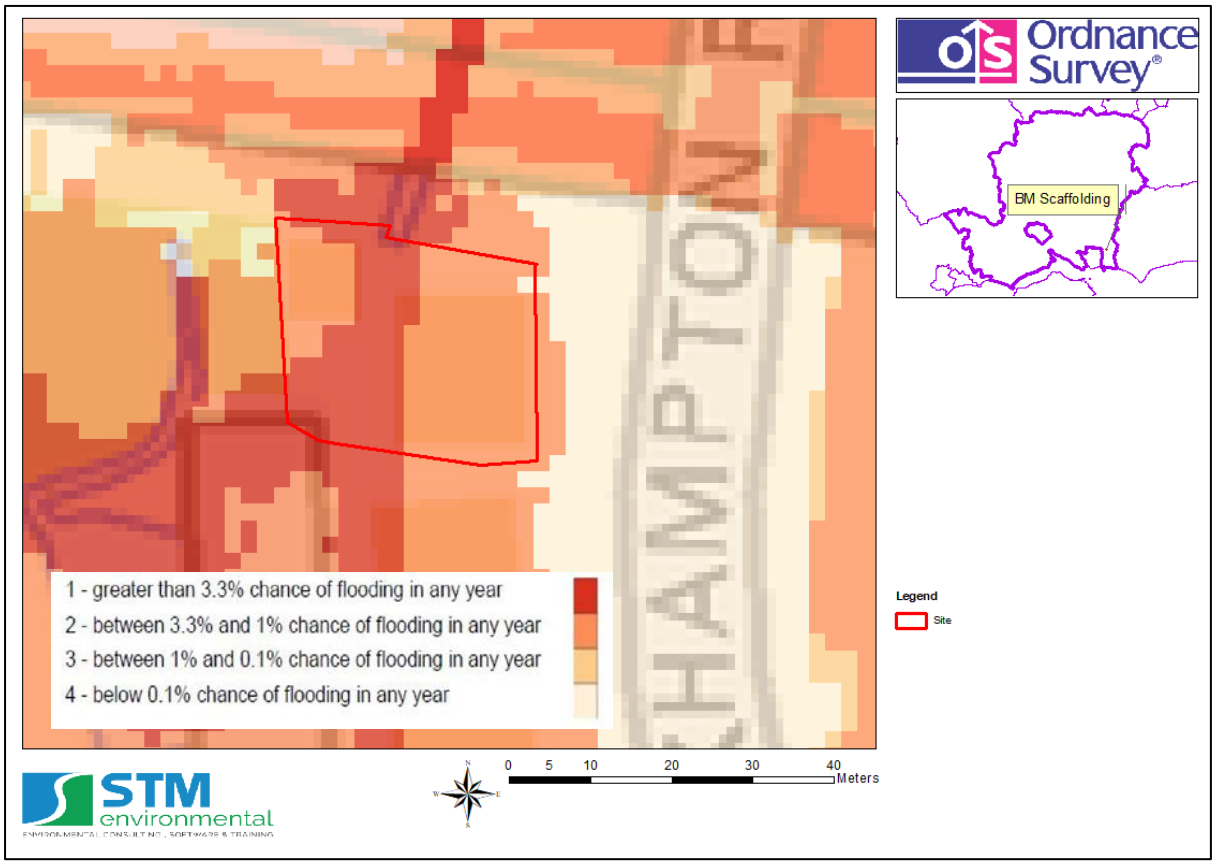
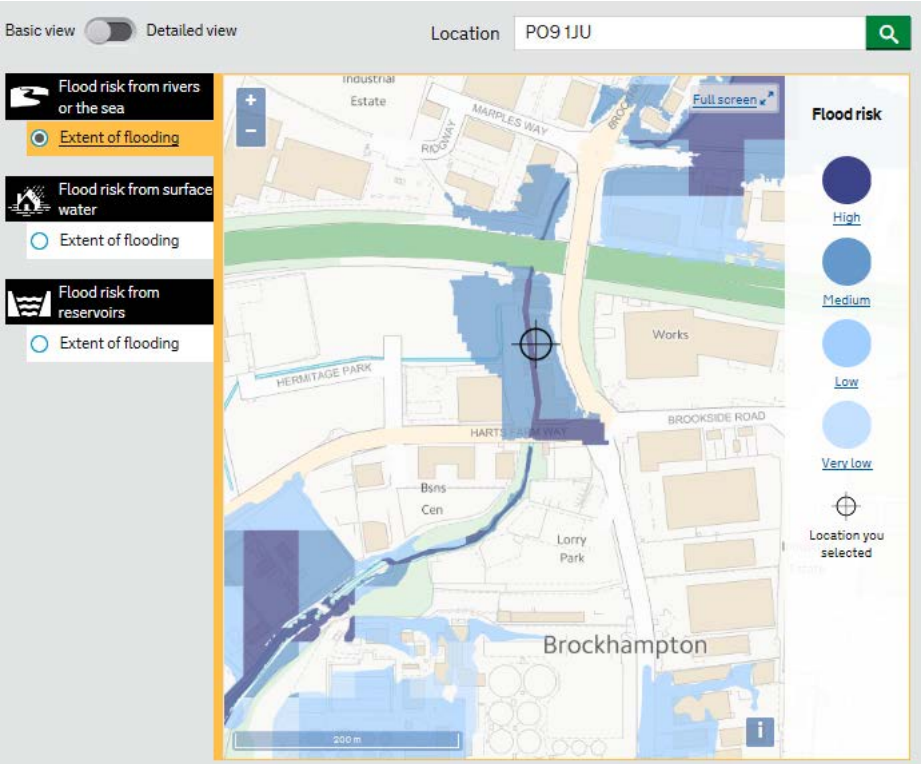
Asset Id	Asset Sub-type	Length (m)	Protection Type	Asset Maintainer	Actual Condition	Estimated SoP	Last Inspection Date
19072	high_ground	148.85	fluvial	private	Good	1:40	02/10/2018
19073	high_ground	85.79	fluvial	private	Fair	1:40	02/10/2018
23309	high_ground	41.94	fluvial	unknown	Fair	1:40	02/10/2018
23310	high_ground	10.32	fluvial	unknown	Good	1:40	03/10/2018
23399	high_ground	30.58	fluvial	unknown	Fair	1:40	02/10/2018
23402	high_ground	54.56	fluvial	unknown	Good	1:40	02/10/2018
49053	high_ground	141.81	fluvial	private	Good	1:40	02/10/2018
49054	high_ground	49.44	fluvial	unknown	Good	1:40	02/10/2018
49553	high_ground	10.01	fluvial	private	Good	1:40	03/10/2018
49554	wall	150.84	fluvial	private	Fair	1:40	02/10/2018
97827	high_ground	159.75	fluvial	private	Fair	1:40	02/10/2018
113661	high_ground	382.88	fluvial	private	Good	1:20	02/10/2018
113663	high_ground	384.85	fluvial	private	Good	1:20	02/10/2018
119545	embankment	84.76	fluvial	private	Good	1:40	02/10/2018
135510	high_ground	84.87	tidal	unknown	Fair	1:20	03/10/2018
135709	high_ground	84.6	tidal	unknown	Fair	1:20	03/10/2018
178042	high_ground	41.01	tidal	private	Fair	1:5	03/10/2018
178043	embankment	87.06	tidal	private	Fair	1:5	03/10/2018
178044	high_ground	179.58	tidal	private	Fair	1:5	02/10/2018
178045	high_ground	8.02	tidal	private	Fair	1:55	02/10/2018
179215	high_ground	71.91	tidal	private	Fair	1:5	03/10/2018
179216	high_ground	30.52	tidal	private	Poor	1:5	03/10/2018
179217	high_ground	176.14	tidal	private	Fair	1:5	02/10/2018
179218	high_ground	10.8	tidal	private	Fair	1:5	02/10/2018
23400	simple_culvert	146.48	fluvial	private	Very Poor	1:40	10/10/2018
49555	simple_culvert	55.81	fluvial	private	Good	1:40	02/10/2018
135511	simple_culvert	142.74	tidal	private	Poor	1:20	10/10/2018

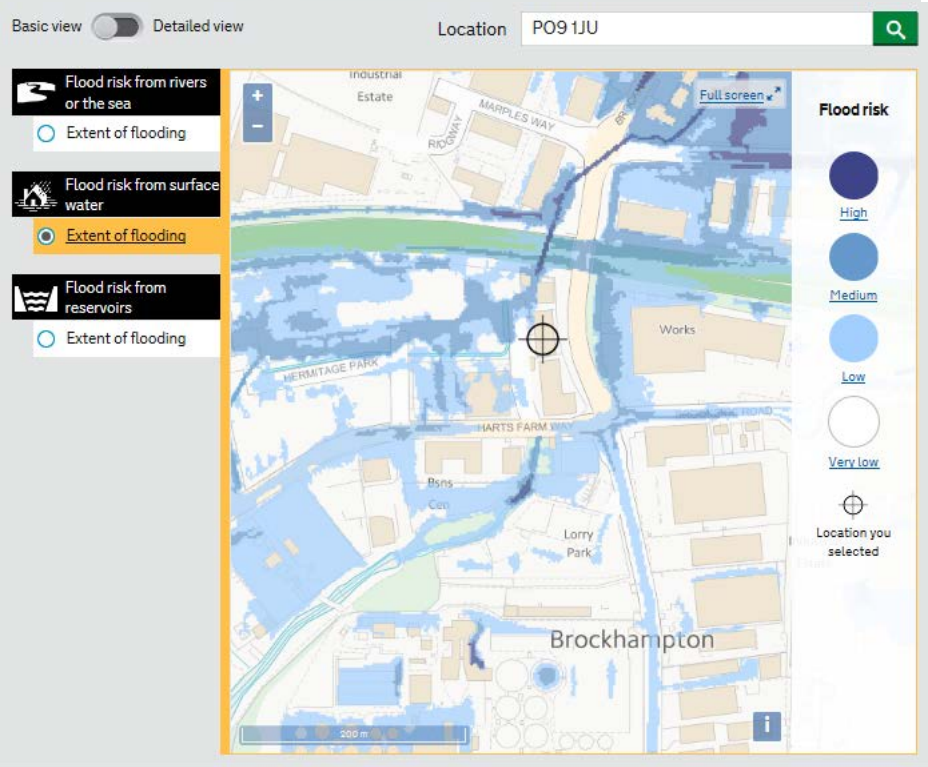
17.8 Appendix 8 – Flood Risk Maps

17.8.1 Risk of Flooding from Multiple Sources Map

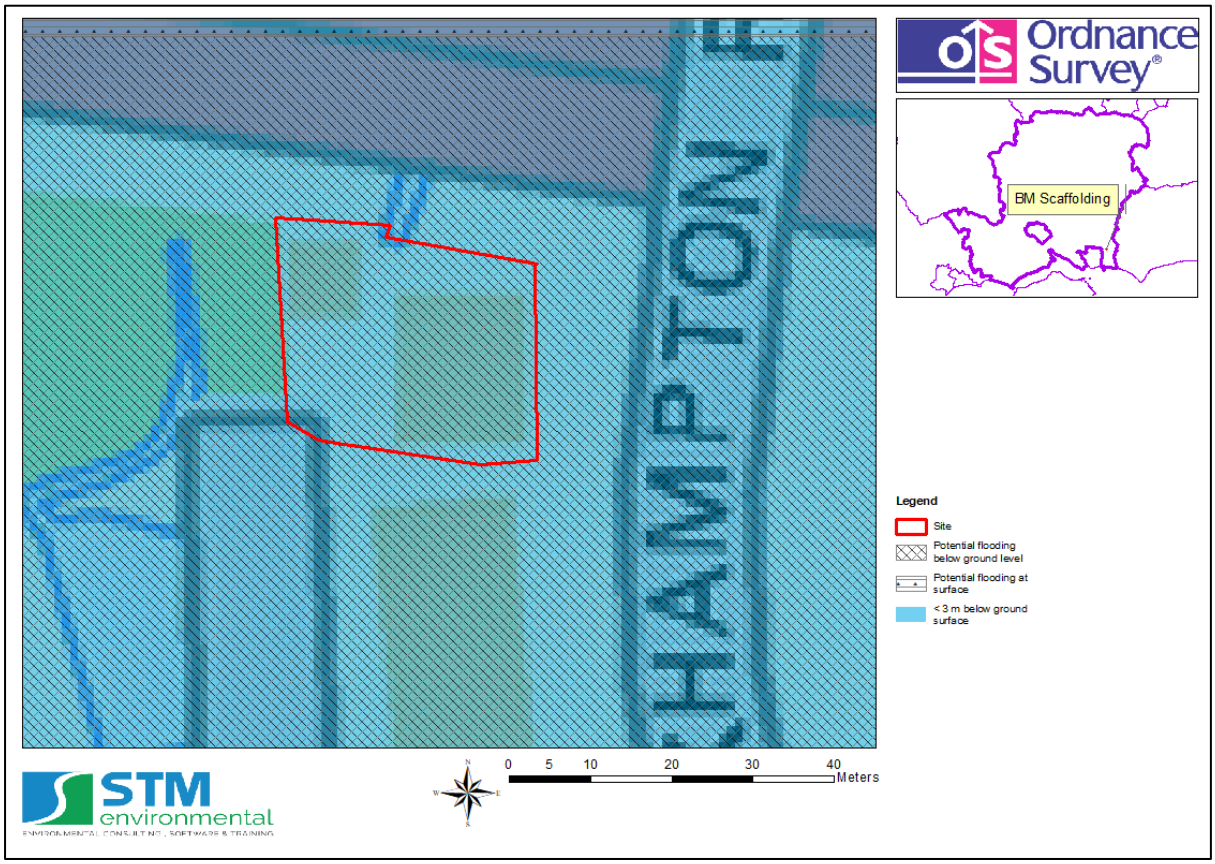


17.8.2 Long Term Flood Risk Maps



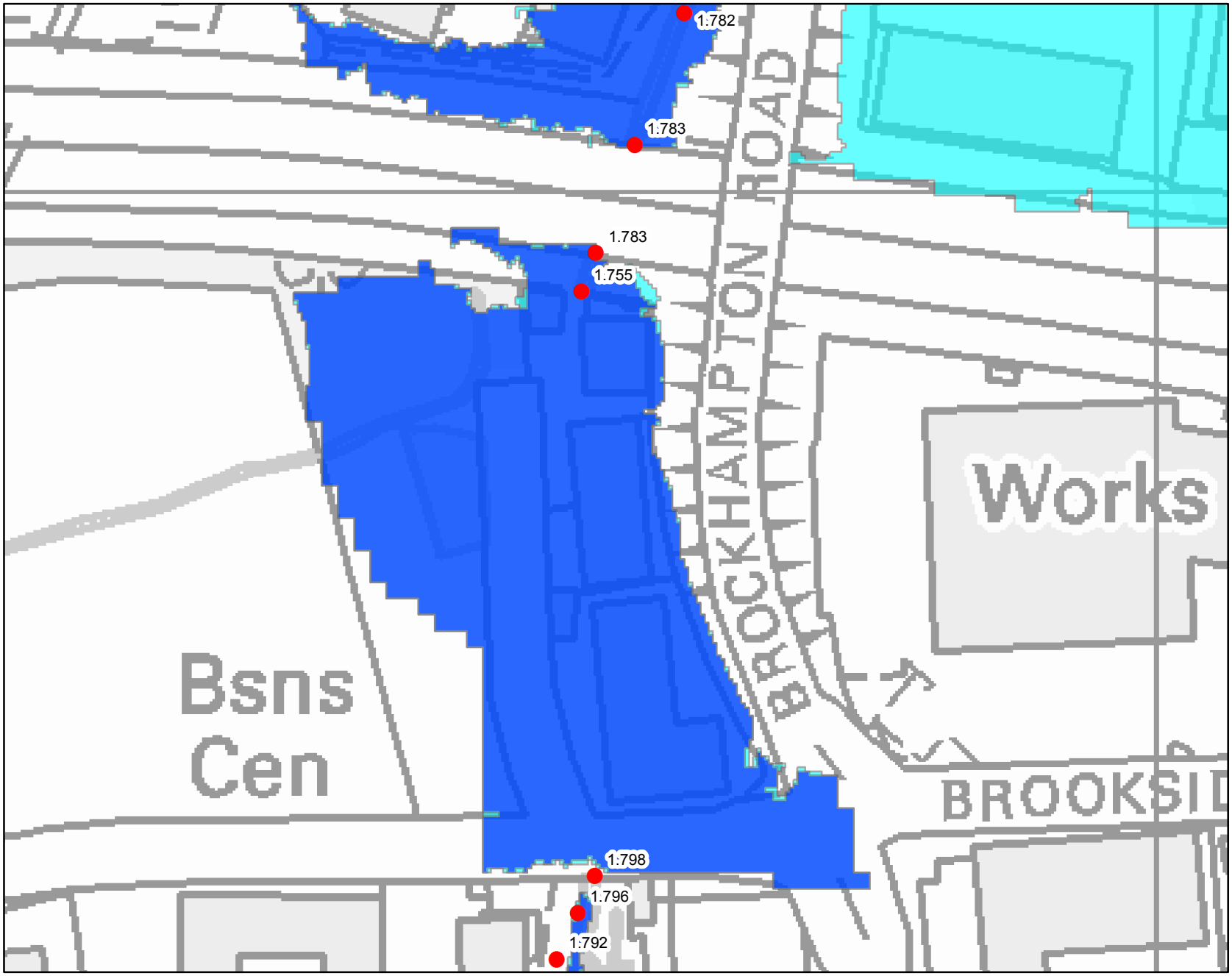


17.9 Appendix 9 – Groundwater Flood Susceptibility Map



17.10 Appendix 10 - EA Product 4 (Detailed Flood Risk) Data

JFLOW 100 Year Flood Levels No Dam Centred on Paradise Lane - Created 16/01/19



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Legend

- Lavant & Hermitage 1D Levels
- Lavant & Hermitage 100Yr (Flood Zone 3)
- Lavant & Hermitage 1000Yr (Flood Zone 2)

1:1,383 *

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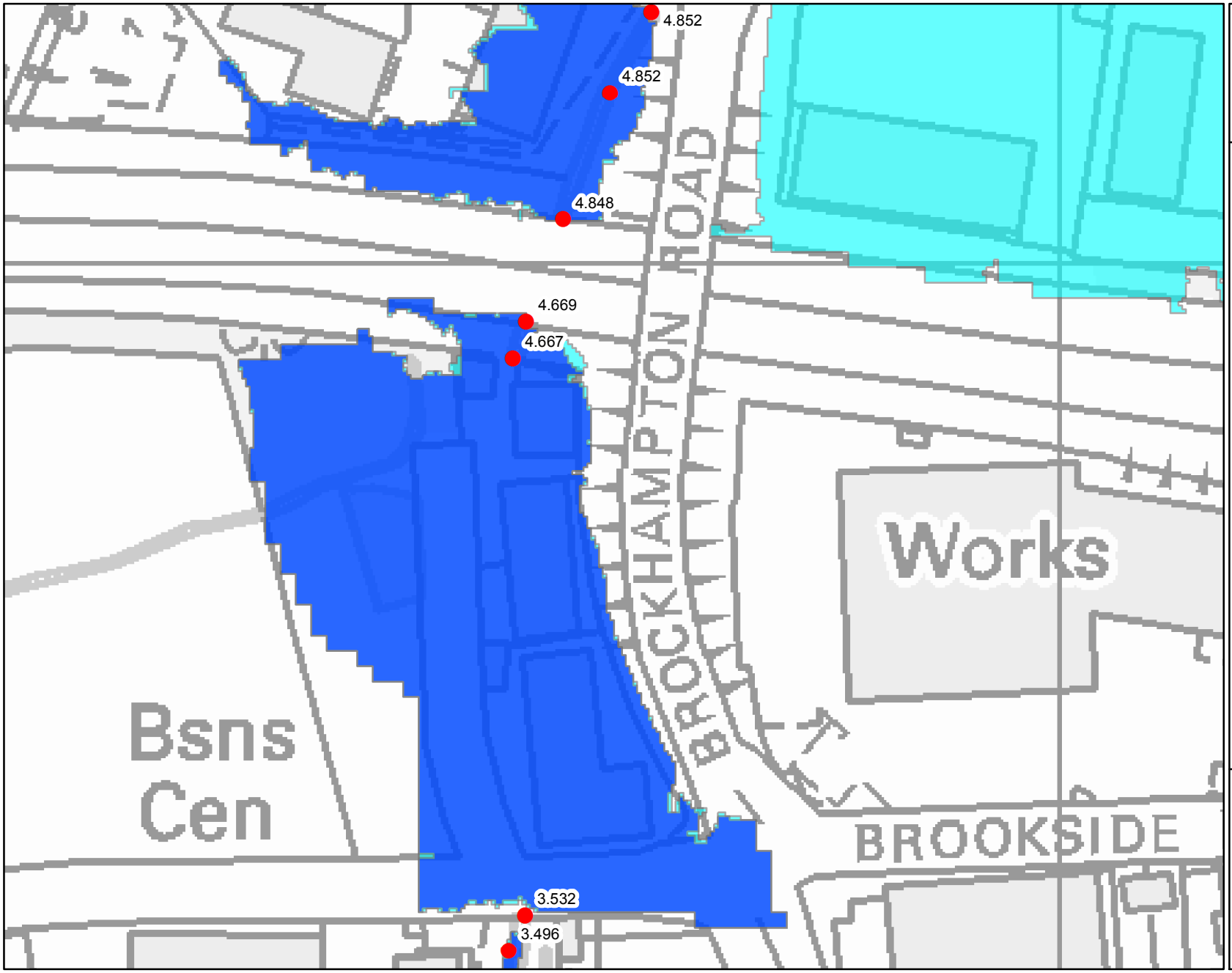
Modelled 100 Year Flood Levels Centred on Brockhampton Road - Created 16 Jan 2019



Environment Agency

Legend

- Lavant & Hermitage 1D Levels
- Lavant & Hermitage 100Yr (Flood Zone 3)
- Lavant & Hermitage 1000Yr (Flood Zone 2)

1:1,444 *

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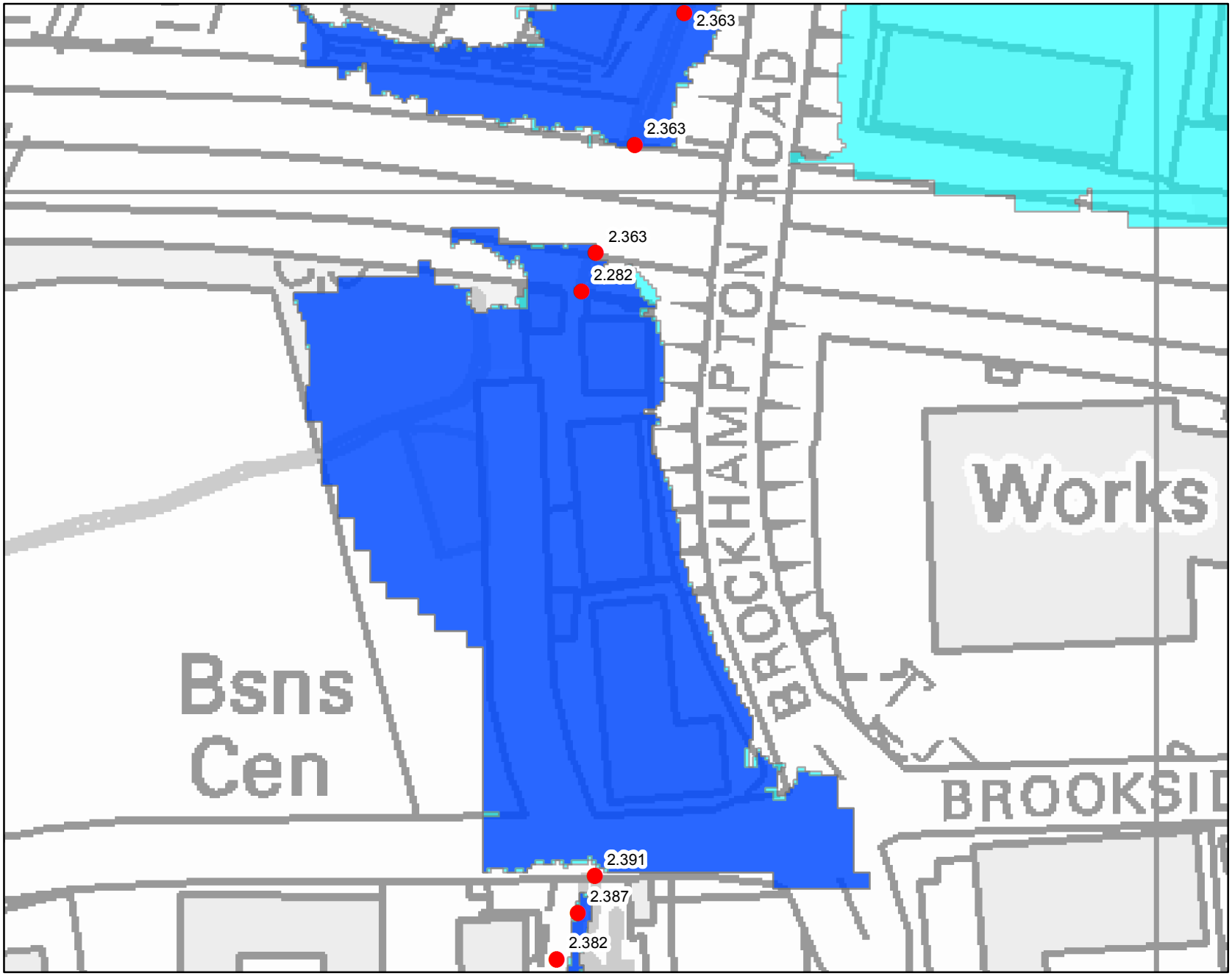
JFLOW 1000 Year Flood Levels No Dam Centred on Paradise Lane - Created 16/01/19



Environment Agency

Legend

- Lavant & Hermitage 1D Levels
- Lavant & Hermitage 100Yr (Flood Zone 3)
- Lavant & Hermitage 1000Yr (Flood Zone 2)

1:1,383 *

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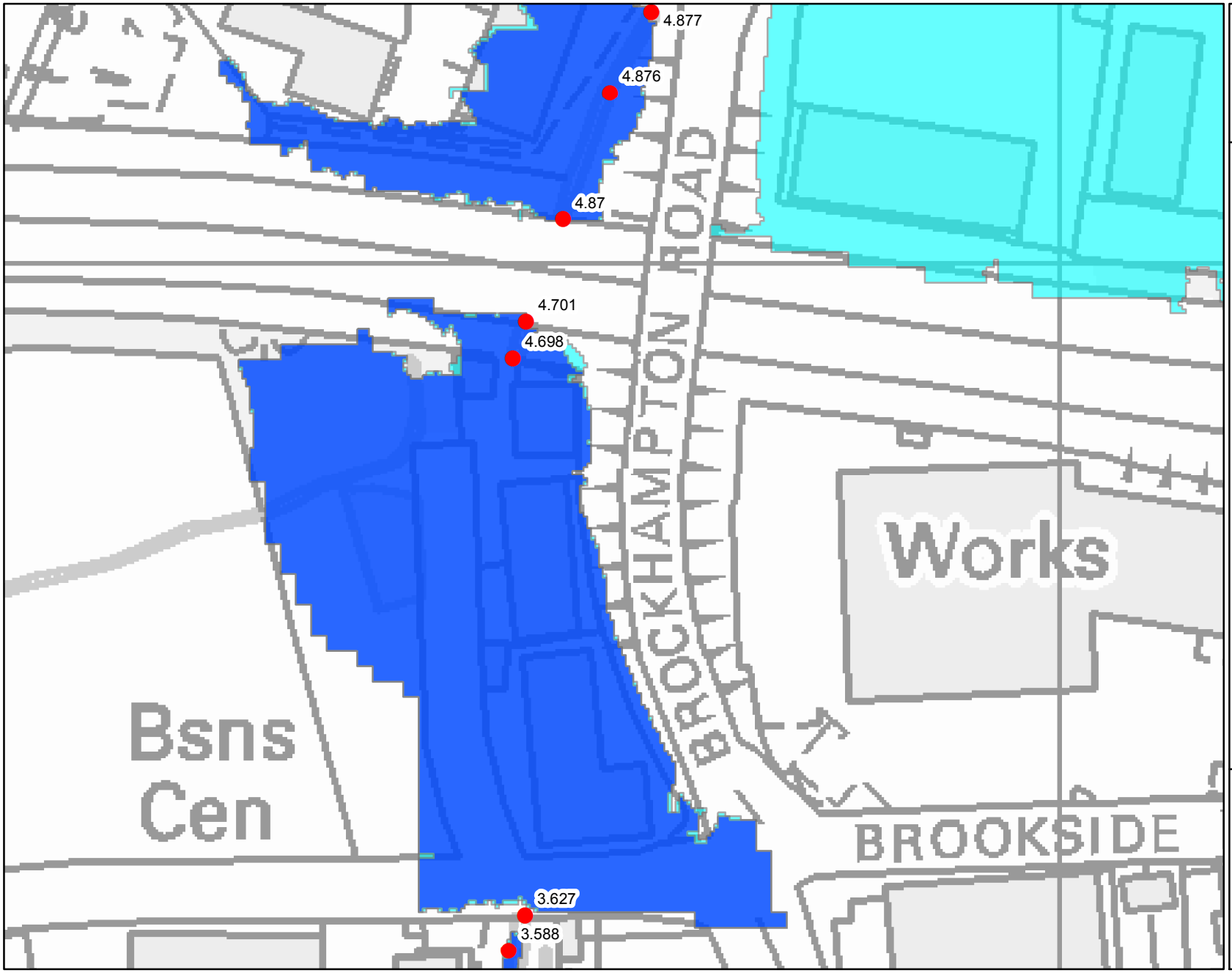
Modelled 1000 Year Flood Levels Centred on Brockhampton Road - Created 16 Jan 2019



Environment Agency

Legend

- Lavant & Hermitage 1D Levels
- Lavant & Hermitage 100Yr (Flood Zone 3)
- Lavant & Hermitage 1000Yr (Flood Zone 2)

1:1,444 *

*when printed at A4.

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0 25 50

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17.11 Appendix 11 – Safe Egress to Flood Zone 1 Map

17.12 Appendix 12 – Calculation of Flood Hazard Rating

Table 5: Flood Hazard Rating Scores – based on DF score of 0

Depth/ Velocity	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.0	2.25	2.50
0.0	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.5	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.0	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.5	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.5	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.0	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.5	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.0	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.5	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.0	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Table 6: Summary of Scores

	Score From	Score To	Flood Hazard	Description
	<0.75	0.75	Low	Exercise Caution
Class 1	0.75	1.5	Moderate	Danger for some
Class 2	1.5	2.5	Significant	Danger for most
Class 3	2.5	20.0	Extreme	Danger for all

Table 7: Values for Debris Factor for different flood depths

Depths	Pasture/Arable Land	Woodland	Urban
0 to 0.25	0	0	0
0.25 to 0.75	0.5	1	1
d>0.75 and/or v > 2	0.5	1	1

- The "danger to some" category includes vulnerable groups such as children, the elderly and infirm. "Danger: Flood zone with deep or fast
- flowing water"
- The "danger to most" category includes the general public.
- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.