STM environmental

ENVIRONMENTAL CONSULTING , SOFTWARE & TRAINING

FLOOD RISK ASSESSMENT

Site Address

Atherington Lodge

Climping Street

West Sussex

BN17 5RN

Client

Mr Gary Bobbe

Date

06/12/2019

ARUN DISTRICT COUNCIL CM/65/19/PL

1 Document Control

FLOOD RISK ASSESSMENT

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Report Author:	Francesca Caggiano (MSc, BSc) **Environmental Consultant / Director**
Authorised by:	Simon Makoni (MSc, BSc) **Environmental Consultant / 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
ADC	Arun District Council
WSCC	West Sussex County 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 Mr Gary Bobbe (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	Atherington Lodge, Climping Street, West Sussex, BN17 5RN Grid reference: 500625, 100875
Proposed Development	Erection of a new dwelling following the demolition of existing house.
Flood Zone	Flood Zone 3a.
Topography	2.6mAOD to 3.3mAOD.
Sequential and Exception Tests	Development is non-minor and more vulnerable. However, as it is a replacement dwelling, Sequential Test should not be required. Exception Test may be required. LLFA to decide.
Main Sources of Flooding	Tidal.
Flood Defences	Sea Wall.
Records of Historic Flooding	Last incident in 1997. The flood extent did not impact the site.
Fluvial (River) and Tidal (Sea) Flood Risk	Medium – Site benefits from flood defences; No significant fluvial/tidal flooding incidents identified.
Pluvial (Surface Water) Flood Risk	Very Low – Site remains dry during all modelled scenarios. 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 surface, no recorded incidents have been identified.
Development Impacts on Local Flood Risk	The development will not increase the site impermeable area. As such it will have no adverse impact on local flood risk.
Proposed Flood Risk Mitigation Measures	• Finished floor levels will be set 300mm above general ground levels and sleeping accommodations will be located on the first floor; • 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 5-minute walk away and safe refuge is available on upper floors.
Surface Water Management (SuDS)	SuDS would reduce current surface water run off rates. Surface water from site currently discharges to a soakaway. The drainage system will be retained.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that the overall flood risk to the proposed development is medium. However, the proposal will reduce the flood risk to its residents to below current levels as it proposes all bedrooms to be located on the first floor and incorporates additional resilience and mitigation measures. Moreover, it will not increase local flood risk.

5 Introduction

STM Environmental Consultants Limited (STM) has been appointed by Mr Gary Bobbe (Client) to provide a Flood Risk Assessment (FRA) at a site located at Atherington Lodge, Climping Street, West Sussex, BN17 5RN.

6 Development Proposal

The FRA is required to support a planning application for the erection of a new dwelling following the demolition of the existing dwelling.

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:

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- 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;
- 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;
- 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 W DM2 of the Arun District Council Local Plan addresses Flood Risk.

Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied:

- The sequential test in accordance with the National Planning Policy Guidance has been met.
- A site-specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.
- The sustainability benefits to the wider community are clearly identified.
- The scheme identifies adaptation and mitigation measures.
- Appropriate flood warning and evacuation plans are in place; and
- New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.
All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood

risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies

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:

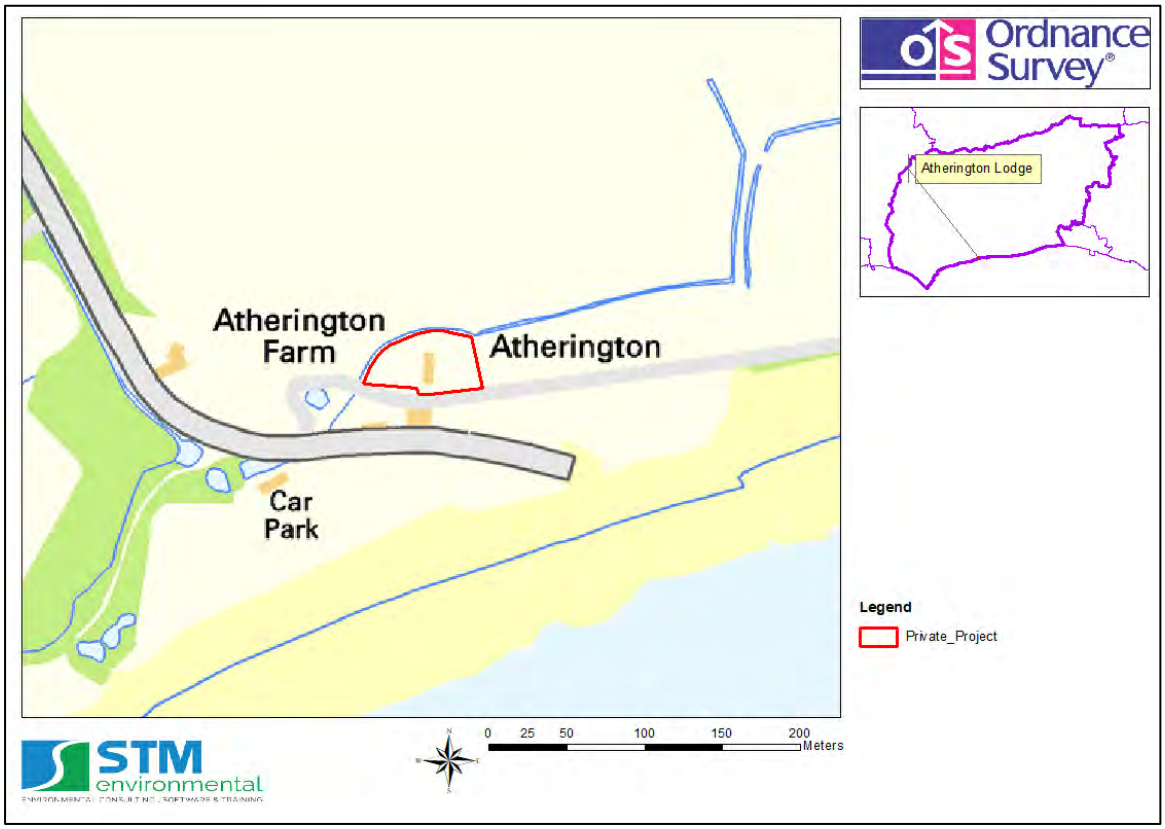
- in flood zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in flood zone 1;
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources 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 Atherington Lodge, Climping Street, West Sussex, BN17 5RN. It is centred at national grid reference 500625, 100875. The site has an area of 2270m^2.

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



10.2 Site Access

The site is accessed via Climping Street.

10.3 Local Planning Authority

The site falls within the jurisdiction of Arun District Council in terms of the planning process.

10.4 Lead Local Flood Authority

West Sussex is the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3a 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 a residential property.

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	Open Field	Open Field
Eastern	Open Field	Open Field
Southern	Residential	Sea
Western	Open Field	Open Field

10.7 Hydrology

The nearest main watercourse is the Ryebank Rife which is located approximately 375m to the north of the site. an unnamed watercourse runs along the northern boundary of the site.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Raised Beach Deposits. The underlying bedrock geology is characterized as Lewes Nodular 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 2.6mAOD to the north west to 3.3mAOD to the south east. The ground level at the location of the proposed dwelling is approximately 3.2mAOD.

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 e.g. subdivision of houses into flats.

The development is considered to be non minor. However, as it is a replacement dwelling should not require the Sequential Test to be undertaken. LLFA to decide.

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 2 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	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Based on its scale and nature, the development is considered to be “more vulnerable”. As such the Exception Test may 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 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) 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 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

12.1.3 Main Potential Sources of Local Fluvial Flooding

The nearest potential source of fluvial flooding to the site is considered to be the Ryebank Rife.

12.1.4 Records of Historic Fluvial Flooding Incidents

The EA informed that they do not have any information on recorded flood incidents at the site.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within flood zone 3a as defined by the Environment Agency and the LLFA indicating that it has more 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 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding;
- Flood zone 3: Greater 1 in 200 (0.5%) annual probability of tidal flooding.

12.1.8 Potential Sources of Tidal Flooding

The nearest potential source of tidal flooding to the site is considered to be the Sea.

12.1.9 Records of Historic Tidal Flooding Incidents

Maps showing the locations and extents of historic tidal flooding at and in the vicinity of the site are available in Appendix 4. These show that a flooding event occurred in 1997. The flood extent did not impact the site. The source of flooding was stormy sea conditions, which subsequentially lead to overtopping of the Climping Frontage at Poole Place and Atherington car park including the bottom of Climping Street.

12.1.10 Designated Tidal 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 200 annual probability of tidal flooding.

12.1.11 Flood Defences

The EA's Areas benefitting from flood defences and current flood defences map which is available in Appendix 7 shows indication of flood defences in the form of a sea wall to the south of the site. The EA Product 4 Data confirms the presence of flood defences in the form of a sand and shingle beach. The estimated standard of protection is 1 in 100 years.

12.1.12 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 3 below. The model used was the River Arun to East Head (2D) which was completed by JBA Consulting in 2016.

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

Modelled Flood Levels in Metres AOD

	Undefended AEP				Defended			
	0.5%	0.5% (2070)	0.5% (2115)	0.1%	0.5%	0.5% (2070)	0.5% (2115)	0.1%
Node	**3.94**	**4.43**	**5.04**	**4.14**	**-**	**-**	**3.65**	**-**

The location of the proposed replacement dwelling sits at an elevation of approximately 3.2mAOD. It witnesses significant flood depths during the undefended scenario.

However, when considering the defended scenario and therefore the functionality of the flood defences such as the sand and shingle beach, the development will remain dry during the majority of the modelled scenarios. Only during the 1 in 200-year event (2115), the development would witness approximately 450mm of flooding.

12.1.13 Long Term Flood Risk from Rivers and Sea 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 flood risk from rivers and the sea taking into account flood defences is classified as medium.

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 pluvial 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

Examination of the LLFA's Level 1 SFRA revealed no evidence of records of pluvial flooding on or within 500m from the site.

A map showing the location of surface water flooding incidents is available in Appendix 4 .

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

An examination of OS mapping and the EA's mapping revealed no indications of significant reservoirs or canals in the area of the site.

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-year rainfall return periods provided by the EA are available in Appendix 6.

The maps show that the site would remain dry during both precipitation events.

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 very low.

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 0.1% and 1% chance of flooding at the site in any year. 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 Historic Records of Groundwater Flooding

A map showing the locations of historic groundwater flooding incidents within the LLFA's SFRA indicates that there have been no recorded incidents of groundwater flooding at or within 500m of the site.

12.4.2 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 the surface exists. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at approximately less than 3mbgl.

12.5 Critical Drainage Area

A Critical Drainage Area (CDA) 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 available information to determine whether the site is located 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

The change to the impermeable area of the site is considered to be insignificant.

As the development will not significantly alter the site impermeable area, it is considered unlikely that it will impact upon surface water runoff rates

Moreover, as it will not change the site's built up area, it is will not impact upon local flood storage.

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 the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 4 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.

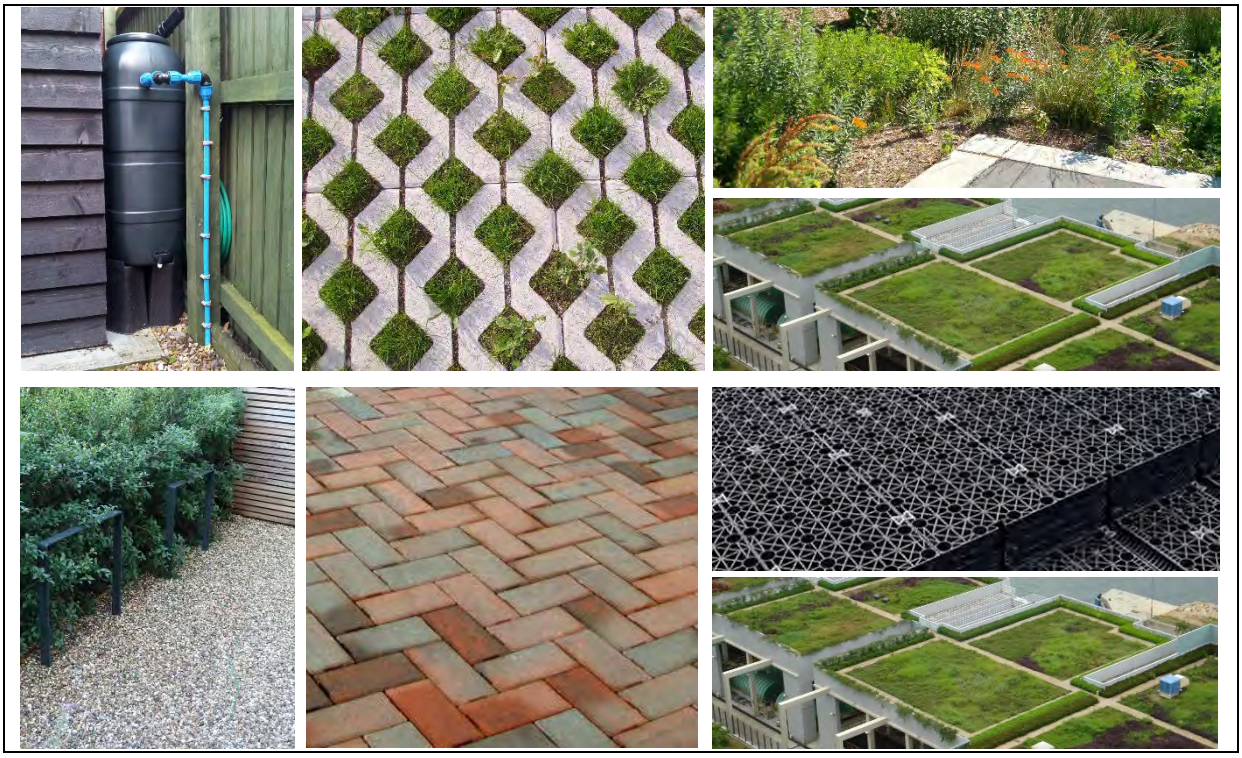


Figure 1: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

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 good opportunities for implementing SuDS. Surface water runoff of the existing dwelling is currently disposed through an existing soakaway. The drainage layout will be retained as the proposal will not increase surface water rates at the site.

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 proposed dwelling is 3.2mAOD.

As outlined in section 12.2.4 the EA's maximum predicted flood level at the site for the defended 0.5% AEP (2115) event is 3.65mAOD (see Appendix 10).

Following consultation with the EA, they recommended that, although this is a replacement dwelling, finished floor levels will need to be raised 300mm above ground levels. Moreover, all bedrooms will be located on the first floor. This would reduce vulnerability to the residents to below current levels.

The first floor will be approximately 2.9m above external ground level and therefore set to approximately 6.12mAOD which is more than 1m above the 0.5% AEP 2115 undefended event.

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.

As the building footprint will not be affected, flood displacement storage is not considered to be required for this development.

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 0.6m 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:

- Include in the external face of the extension a damp – proof course to prevent damp rising through the wall;
- Use rigid closed – cell material for insulation above the DPC;
- Spread hardcore over the site within the external walls of the building to such thickness as required to raise the finished surface of the site concrete. The hardcore should be spread until it is roughly level and rammed until it forms a compact bed for the oversite concrete. This hardcore bed will be 100 mm thick and composed by well compacted inert material, blinded with fine inert material.

Doors:

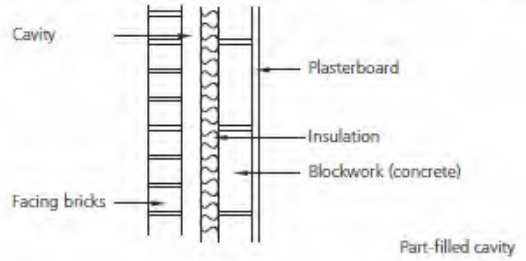
- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

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.

The scoring methodology and calculation matrix for this is summarised in Appendix 12.

The EA Product 4 data does not provide the flood flows at the site. It is therefore not possible to calculate the flood hazard rating at the site.

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 Climping Street.

Safe egress to Flood Zone 1 is available by a 5-min walk away on Climping Street to the north. 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 as the first floor will be more than 1m higher than the flood level during the 0.5% AEP 2115 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 more vulnerable non-minor development. However, as the proposal is for a replacement dwelling, sequential should not be required. Exception test may be required; LLFA to decide;
- The main sources of potential flooding to the site the sea and the Ryebank Rife;
- The EA define the site as being within flood zone 3a;
- No records of fluvial, tidal, surface water, groundwater or artificial flooding incidents were identified at the site;
- The development will not result in a significant change in the impermeable area of the site and therefore is unlikely to increase local flood risk;

- There is opportunity for implementing SuDS mitigation measures. The existing soakaway will be retained as way to dispose of surface water runoff from the development;
- 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 accessible;
- In the event that evacuation is not possible, safe refuge is available in the upper floors of the building which are accessible via an internal staircase.

Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that the overall flood risk to the proposed development is medium. However, the proposal will reduce the flood risk to the residents to below current levels as it proposes bedrooms on the first floor and incorporates additional resilience and mitigation measures. Moreover, it will not increase local flood risk.

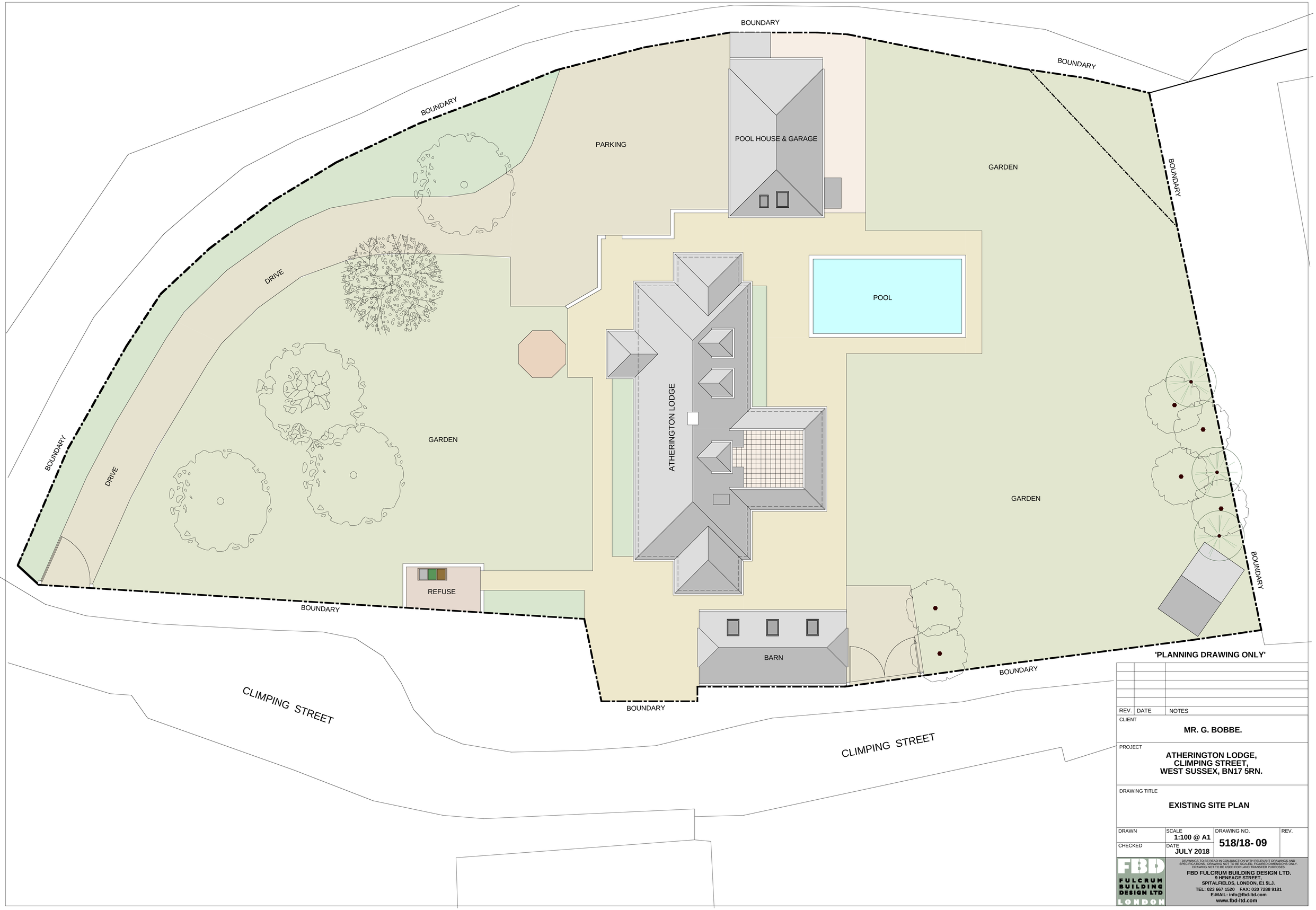
16 References

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 – Arun District Council, 2016.
4. Arun Local Plan, 2018.
5. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
6. Google Maps accessed December 19.

17 Appendices

17.1 Appendix 1 – Site Photographs

17.2 Appendix 2 – Development Plans



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MR. G. BOBBE.

PROJECT

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DRAWING TITLE

EXISTING SITE PLAN

DRAWN	SCALE	DRAWING NO.	REV.
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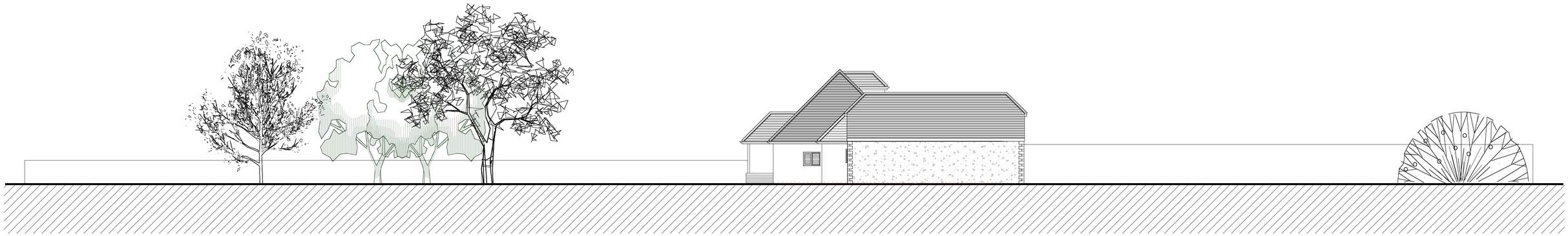

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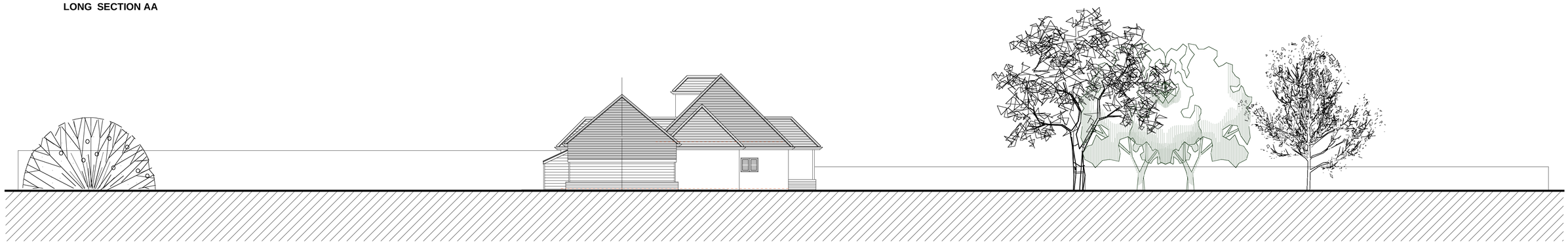

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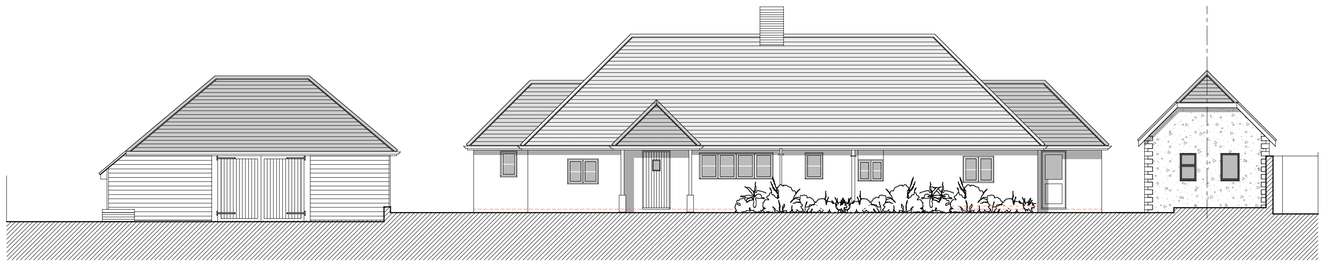

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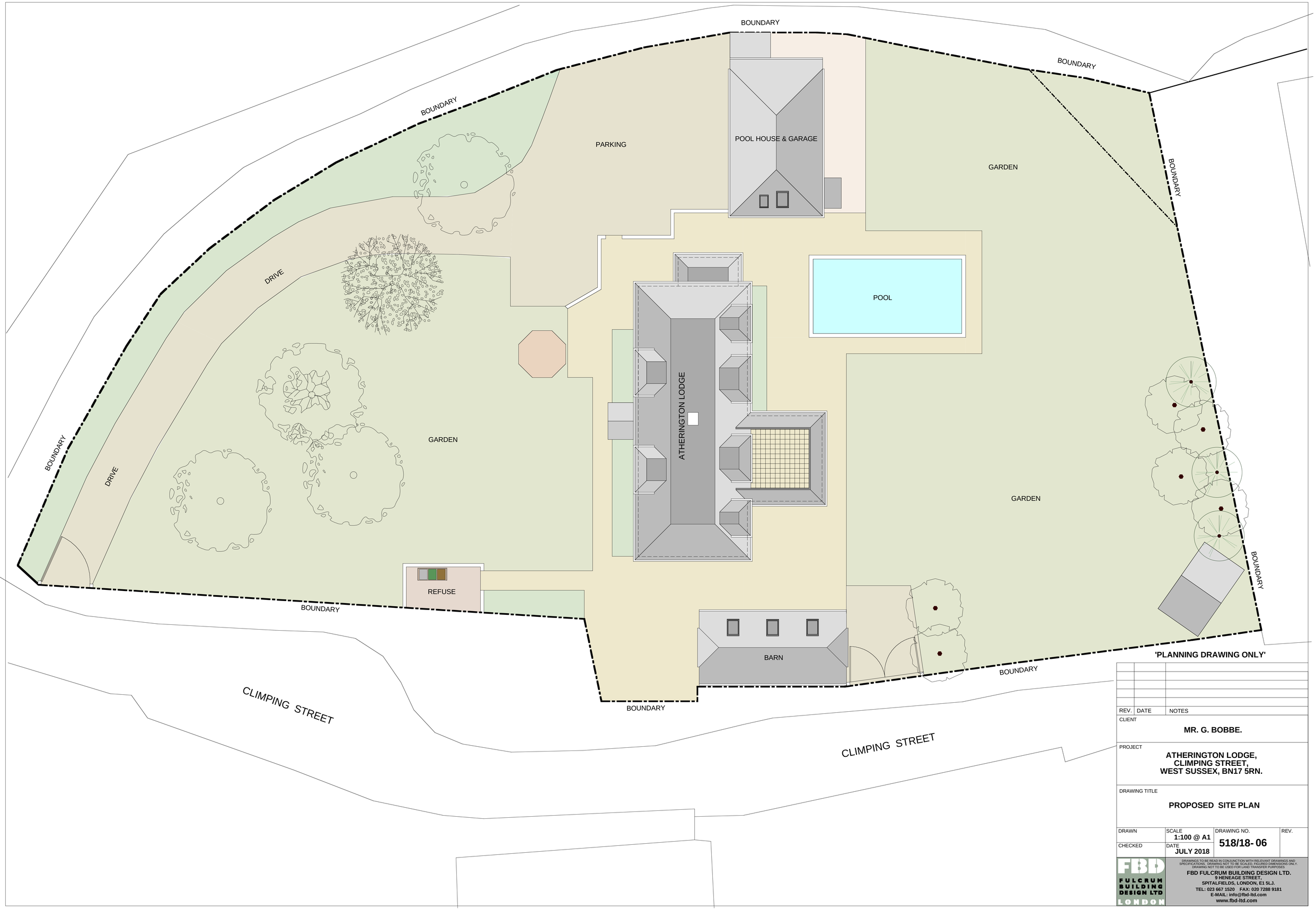

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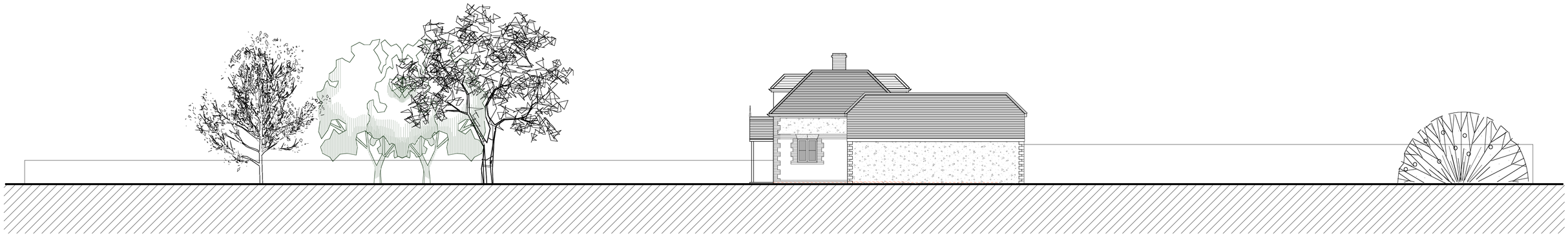

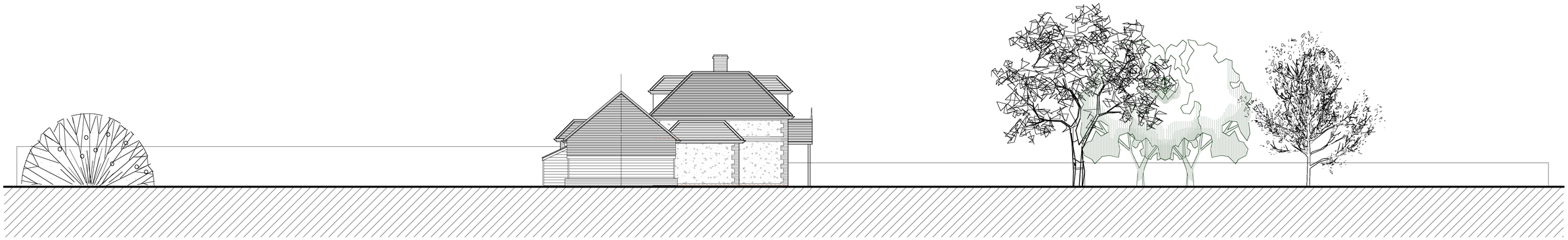

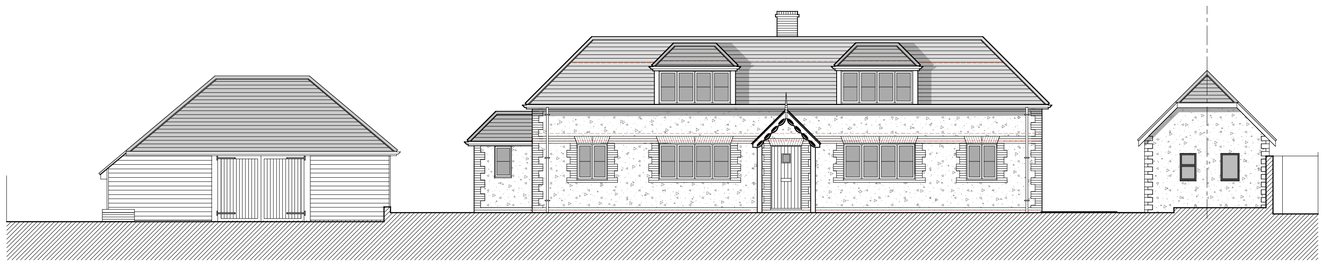

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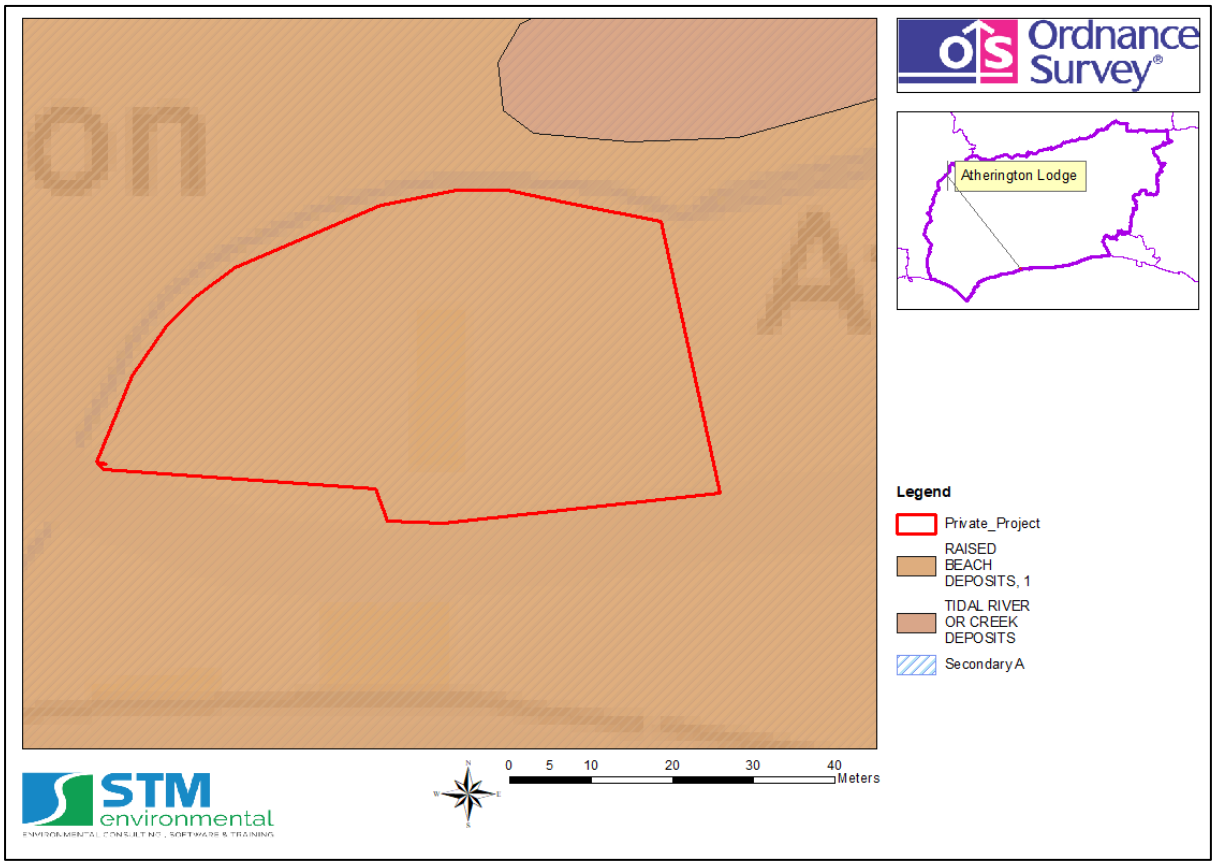
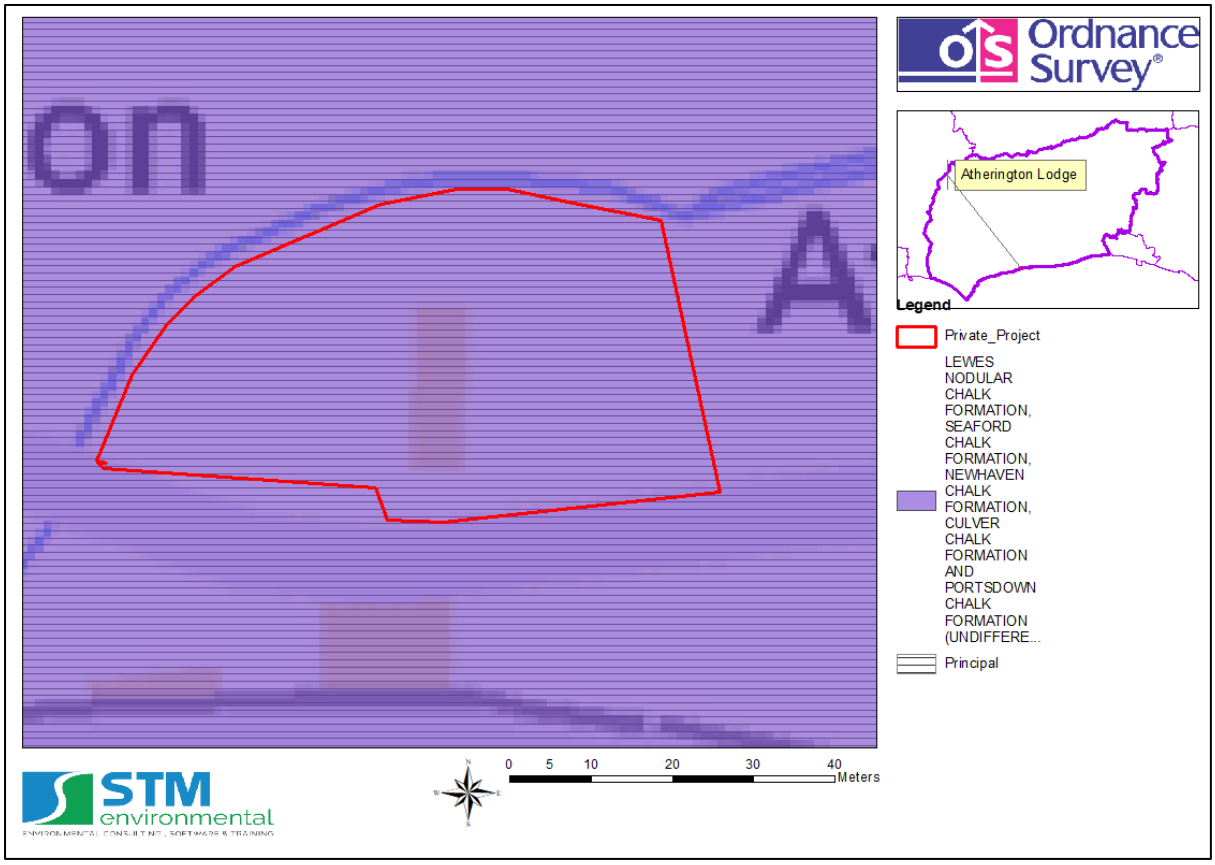
17.3 Appendix 3 – Environmental Characteristics

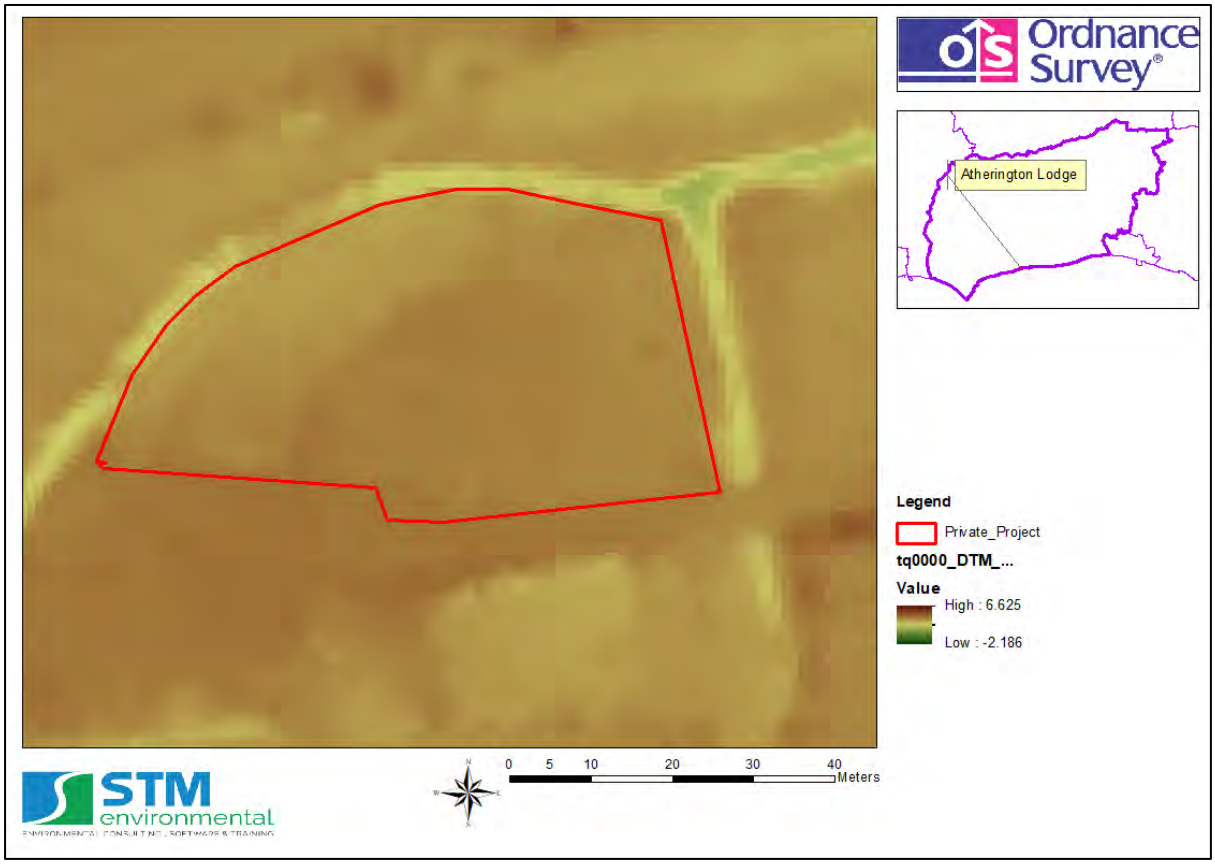
17.3.1 Superficial Hydrogeology Map



17.3.2 Bedrock Hydrogeology Map

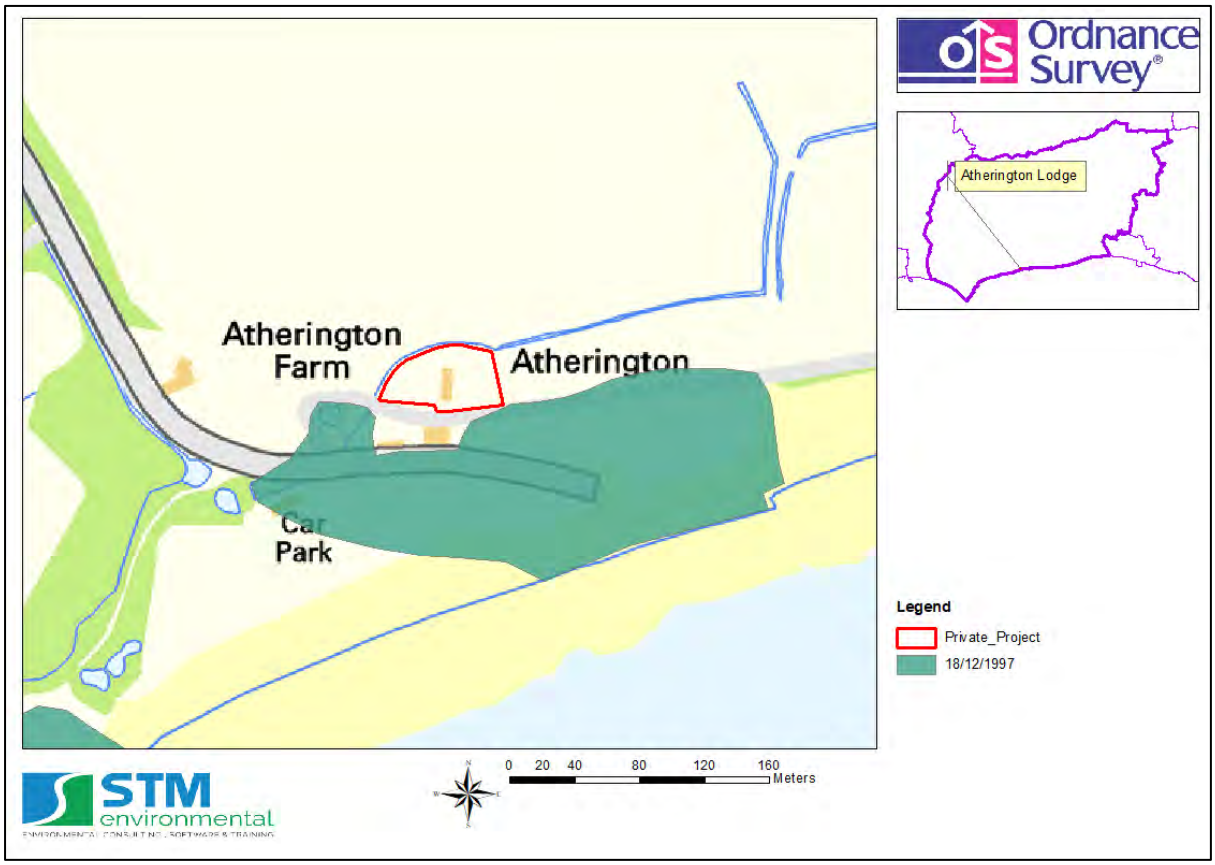


17.3.3 Topology Map

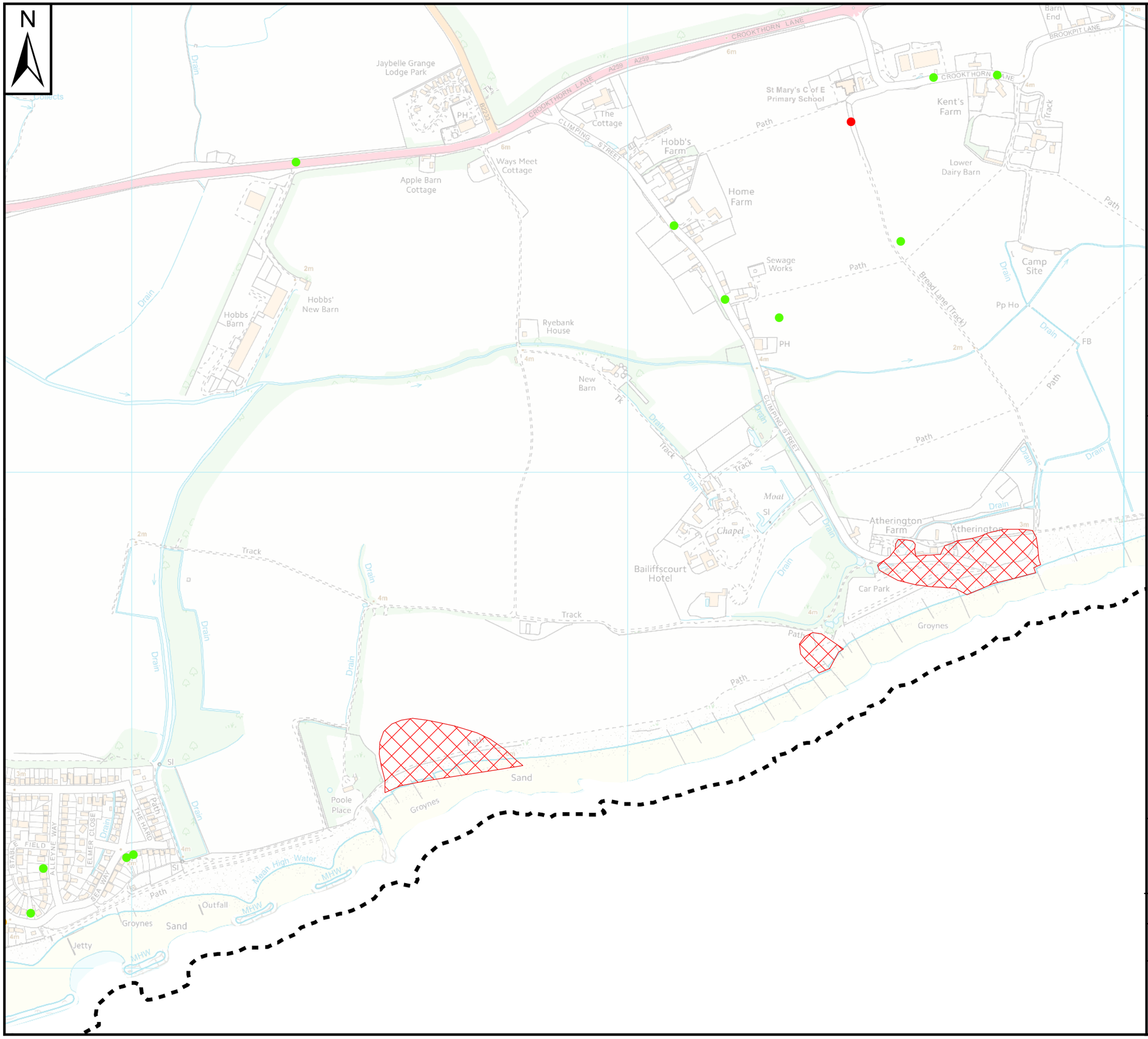


17.4 Appendix 4 – Historical Flood Incident Maps

17.4.1 EA Historic Flood Outlines



17.4.2 LLFA'SFRA Historic Flooding Map



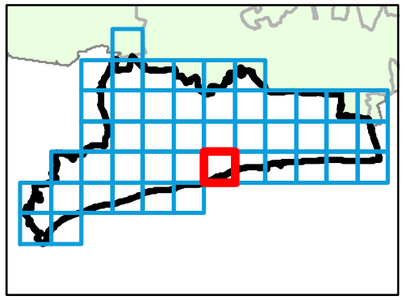
Notes

The Historic Flooding Map shows the recorded incidents and flood outlines provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency.

Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources.

Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun Distrcit Council for updated information post 2015.

Key Plan



Legend

- Arun District SFRA boundary
- Historic flood outline

Source of flooding

- Fluvial
- Coastal
- Tidal
- Surface Water
- Failure
- Unknown

0 0.125 0.25 0.5 km

REF	Date	Comments
A	June 2016	-
B		
C		

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LEVEL 1 SFRA: APPENDIX H
HISTORIC FLOODING RECORDS

Sheet No: 14 of 46 Index Number: ADC_14

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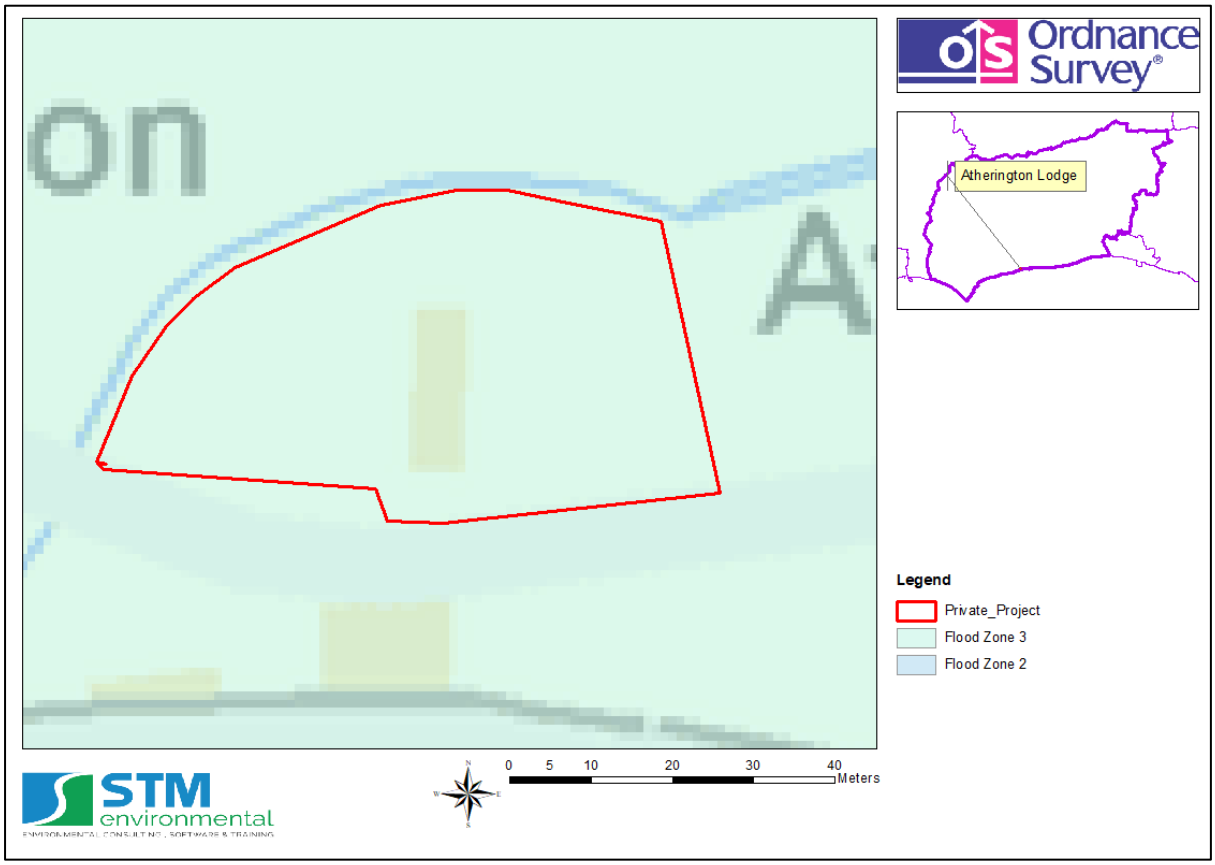
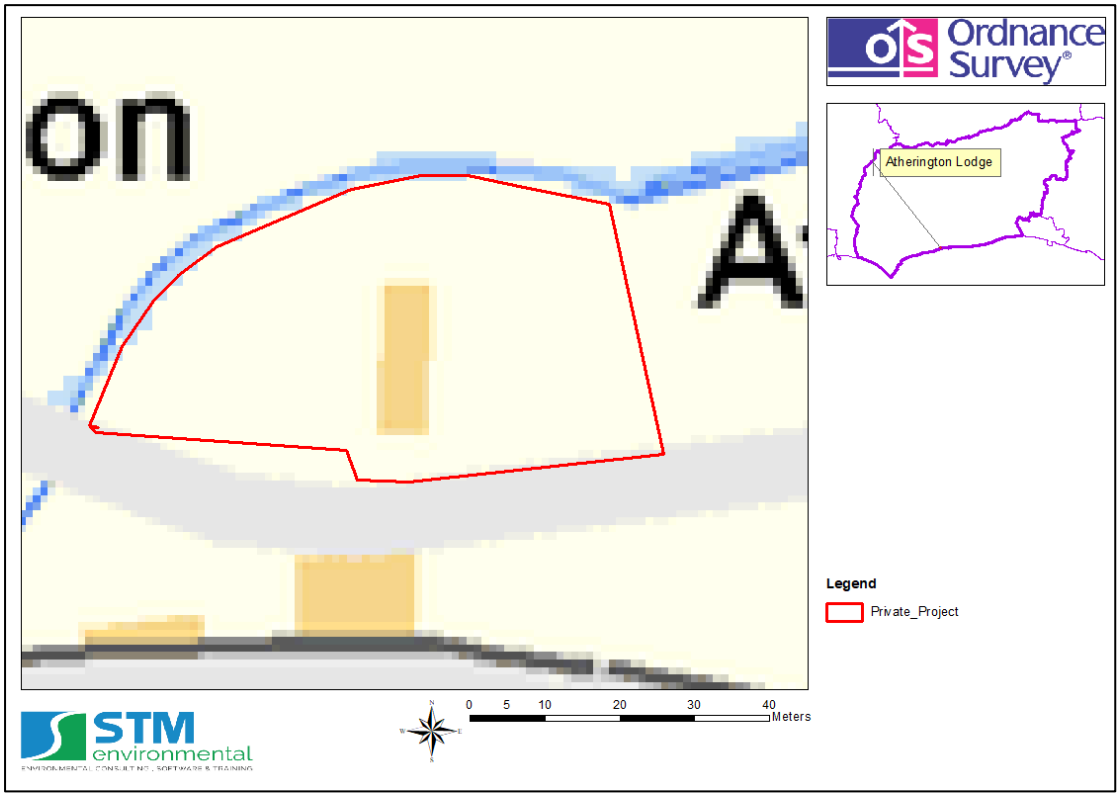
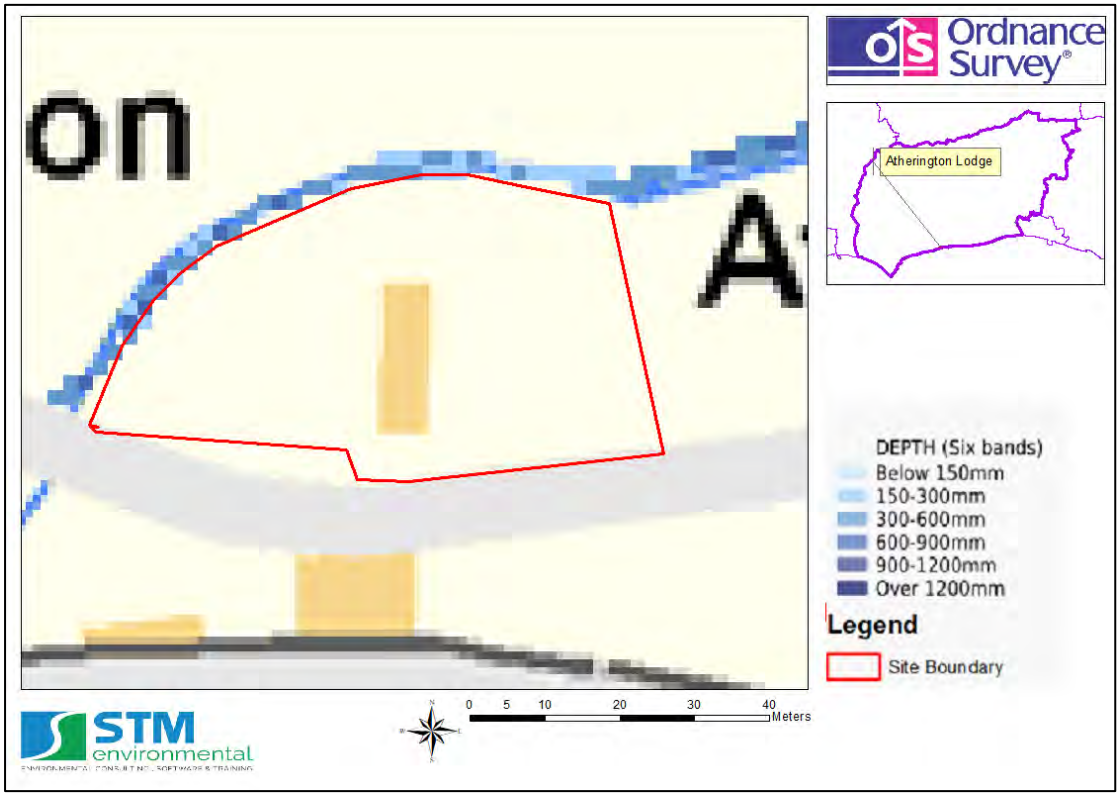
17.5 Appendix 5 - EA Flood Zone Map



17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

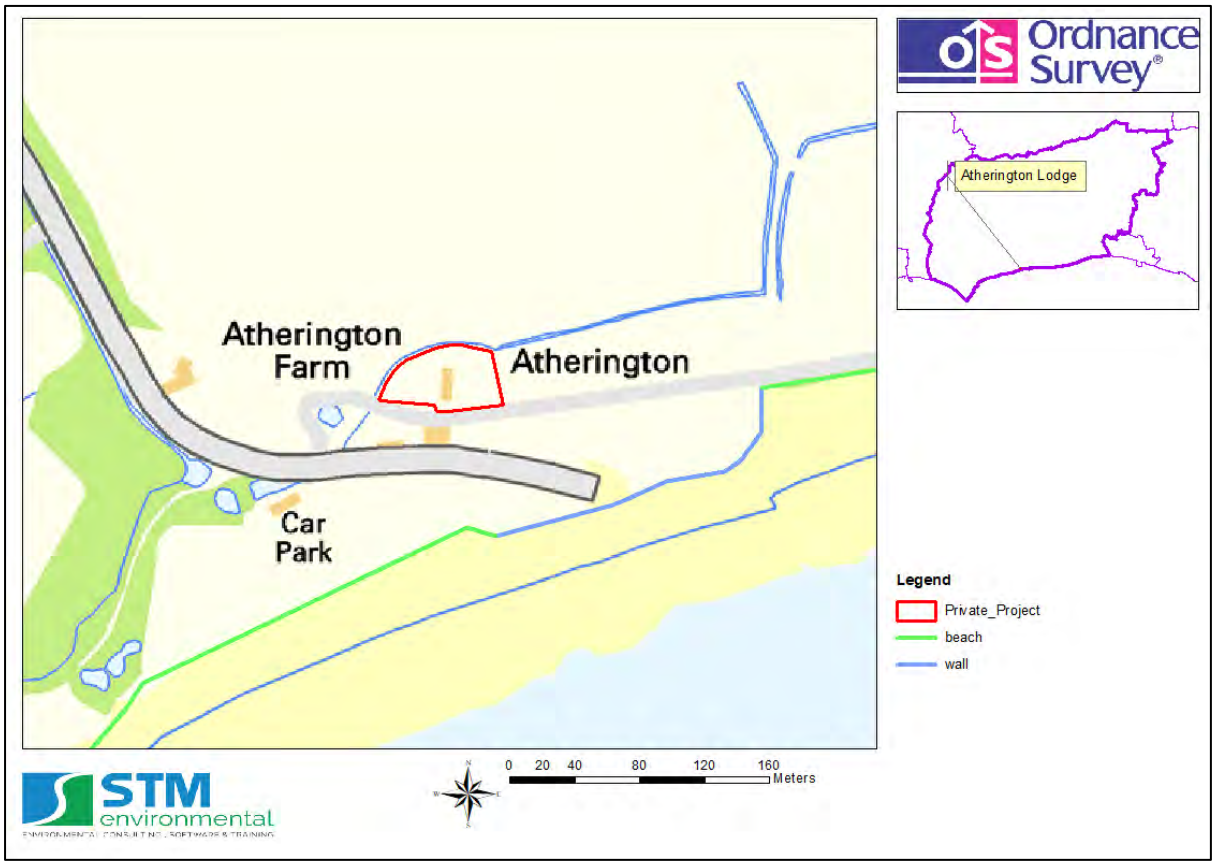
17.6.1 Map showing surface water flood extent and depth for the 1 in 1000-year rainfall return period (Source: EA, 2016).





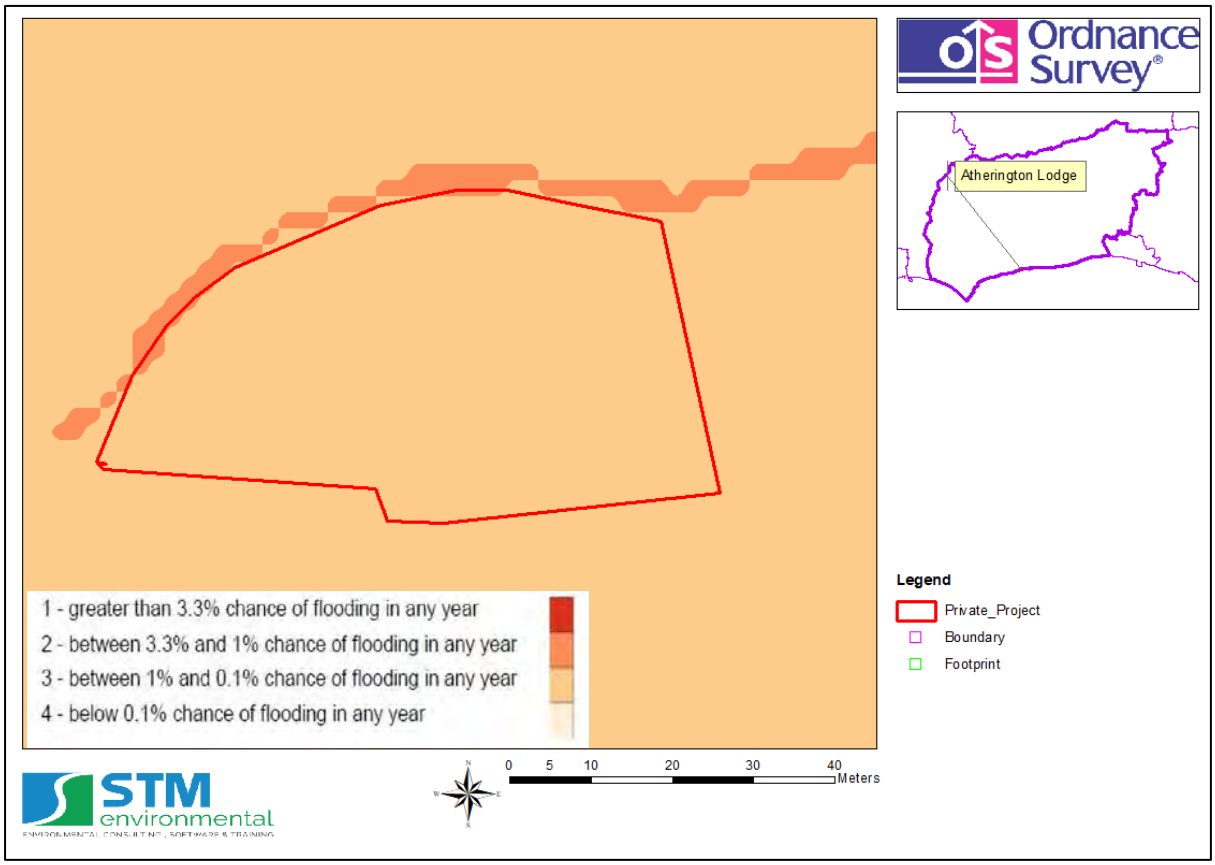
17.7 Appendix 7 –Flood Defence Flood Risk Maps

17.7.1 EA Map showing areas benefitting from flood defences

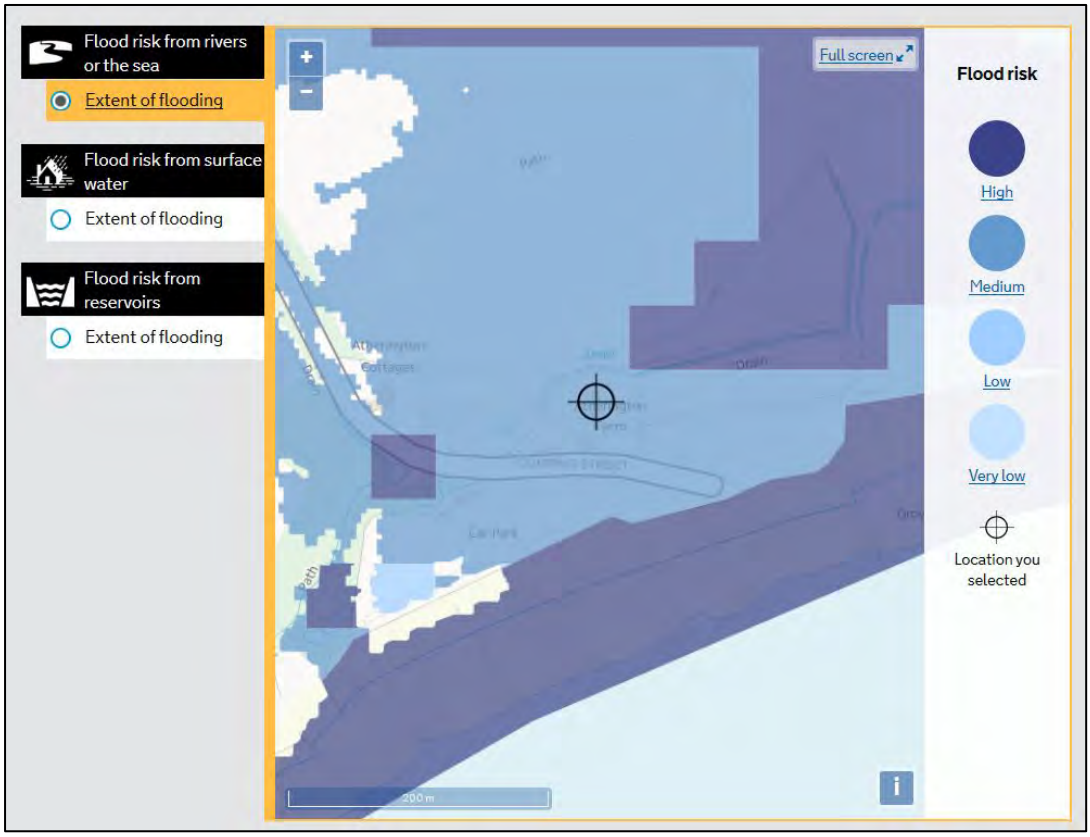


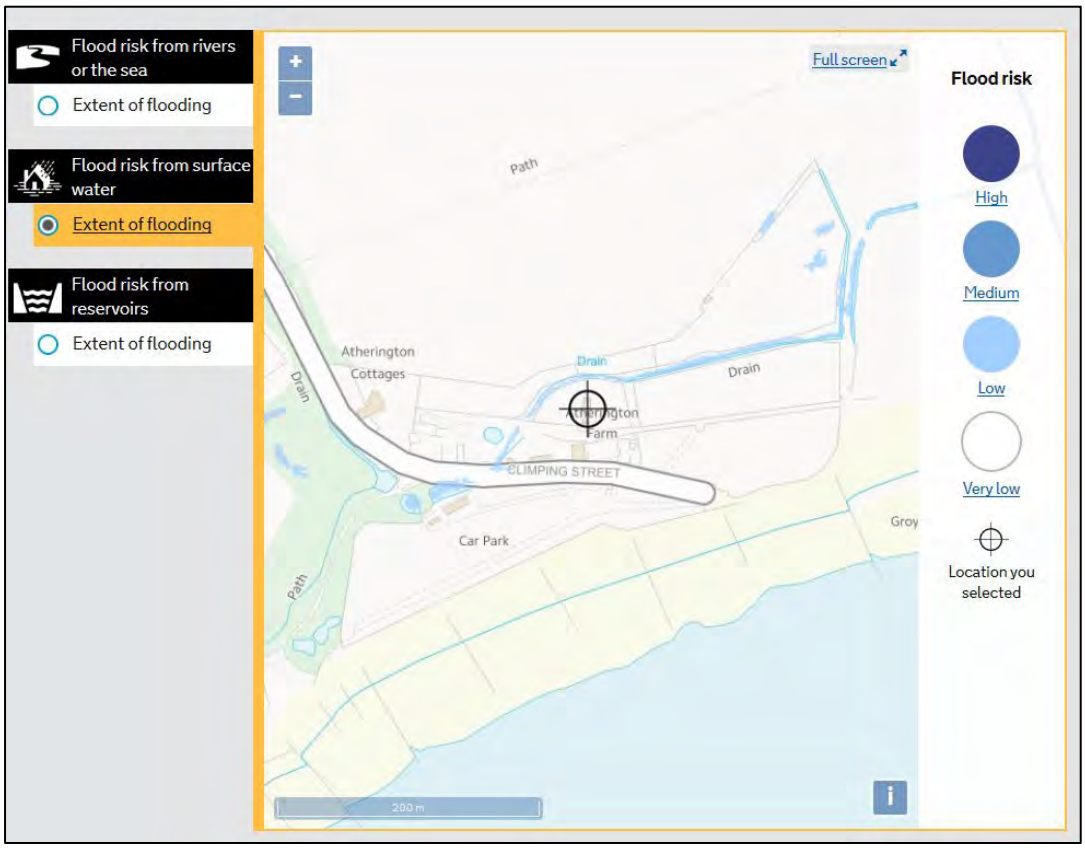
17.8 Appendix 8 – Flood Risk Maps

17.8.1 Risk of Flooding from Multiple Sources Map

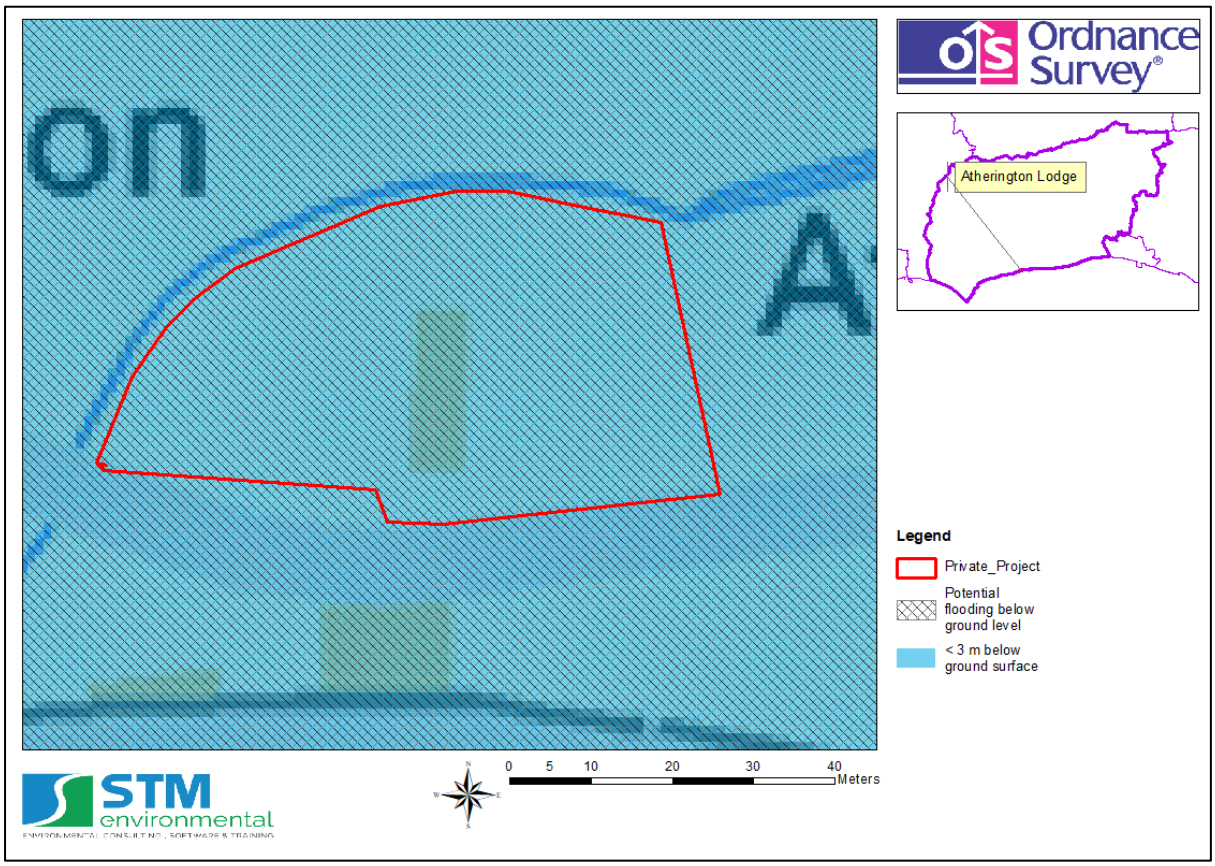


17.8.2 Long Term Flood Risk Maps





17.9 Appendix 9 – Groundwater Flood Susceptibility Map



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

Francesca Caggiano
Unit 6
Crane Mews
32 Gould Road
Twickenham
London
TW2 6RS

Our ref: SSD141332
Date: 10/09/2019

Dear Francesca Caggiano,

Enquiry Regarding Product 4 for Flood Risk Assessment for Atherington Lodge, Climping, West Sussex, BN17 5RN.

Thank you for your enquiry which was received on 02 September 2019.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zone 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences
There are flood defences in the form of a sand and shingle beach. The estimated standard of protection is 1 in 100 years (1% AEP).

Model Information
The model used was the River Arun to East Head (2D) which was completed by JBA Consulting in 2016.

Flood History
We hold no record of flooding events affecting this site, but a nearby area was previously flooded in 1997 (Flood Event Code: 2038). The source of the flooding was stormy sea conditions, which subsequently lead to overtopping of the Climping Frontage at Poole Place and Atherington car park, including the bottom of Climping Street.

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Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for **Atherington Lodge, Climping, West Sussex, BN17 5RN.**
Licence	Open Government Licence
Information Warning - OS background mapping	*The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.*
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2018 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)
- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

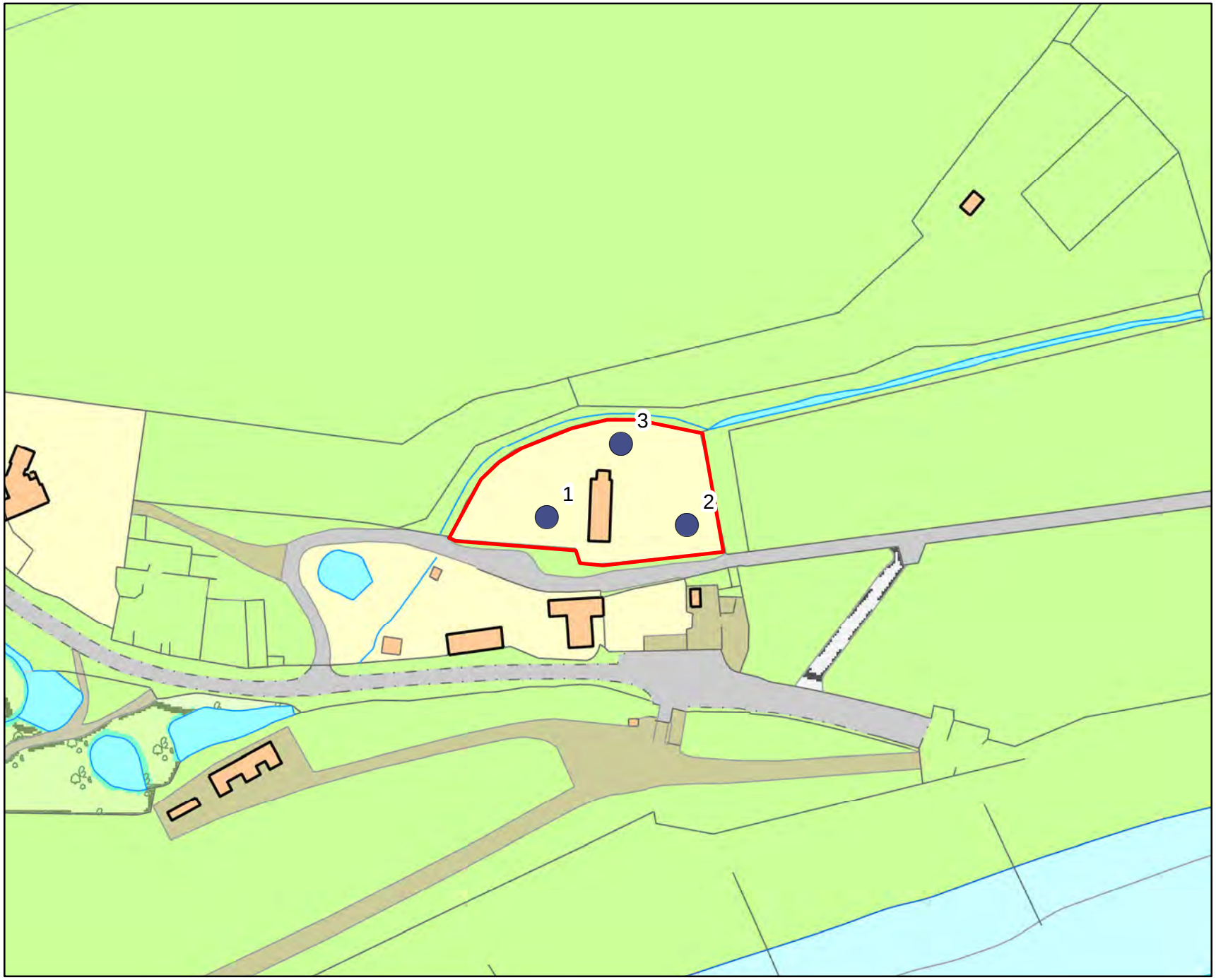
Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Tom Lamboo
FCRM Officer, PSO West Sussex | Solent and South Downs
Environment Agency | Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD

ARUN DISTRICT COUNCIL CM/65/19/PL

FRA Site Boundary & Node Points. Centred BN17 5RN. Created 09/09/2019.



Environment Agency

N

Legend

Site_Nodes

Site_Boundary

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:1,500

0 0.0325 0.065

Kilometers

ARUN DISTRICT COUNCIL CM/65/19/PL

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Contact us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506. Email:enquiries@environment-agency.gov.uk

Product 4 Flood Risk Data Requested by: STM

Site: Atherington Lodge, Climping, West Sussex, BN17 5RN

Table 1: Water Levels: Tidal Undefended

	NGR		Modelled Flood Levels in Metres AOD			
			Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	500608	100871	3.94	4.43	5.04	4.14
2	500648	100869	3.94	4.43	5.04	4.14
3	500629	100892	3.94	4.43	5.04	4.14

Table 2: Water Levels: Tidal Defended

	NGR		Modelled Flood Levels in Metres AOD			
			Defended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	500608	100871	-	-	3.65	-
2	500648	100869	-	-	3.65	-
3	500629	100892	-	-	3.65	-

Table 3: Water Depths: Tidal Undefended

	NGR		Modelled Flood Depths in Metres			
			Undefended Annual Exceedance Probability			
Node Ref	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	500608	100871	0.72	1.21	1.82	0.92
2	500648	100869	0.93	1.42	2.03	1.13
3	500629	100892	1.05	1.54	2.15	1.25

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

Table 4: Water Depths: Tidal Defended

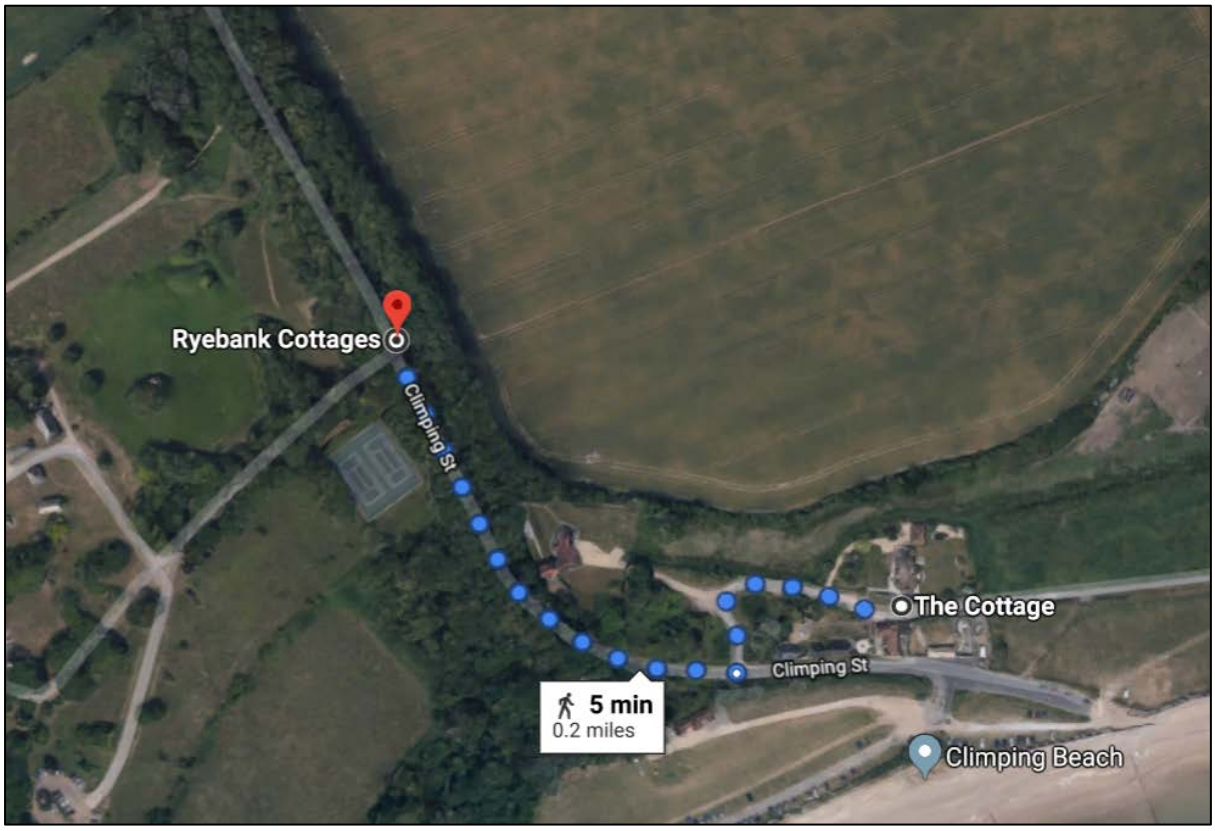
	NGR		Modelled Flood Depths in Metres			
			Defended Annual Exceedance Probability			
Node Ref	**Eastings**	**Northings**	**0.5%**	**0.5% (2070)**	**0.5% (2115)**	**0.1%**
1	500608	100871	-	-	0.43	-
2	500648	100869	-	-	0.64	-
3	500629	100892	-	-	0.76	-

All levels taken from: River Arun to East Head (2D) (2016)

Produced on: 10/09/2019

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

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”.