

12 East Front Road, Pagham, PO21 4SU

Flood Risk Appraisal

1.0 Introduction

- 1.1 This document has been prepared on behalf of Keith & Jan Hawtree in relation to the proposed residential development at 12 East Front Road, Pagham, PO21 4SU. It seeks to confirm the Flood Zone classification of the site in planning terms and also to establish appropriate flood levels to be used as a basis for the design of flood resilience and resistance measures as part of a full Flood Risk Assessment report in support of a future planning application.
- 1.2 Reference has been made in this appraisal to the following national and local policy and guidance documents:
- National Planning Policy Framework (NPPF), March 2012;
 - Planning Practice Guidance (PPG) to the NPPF, March 2014;
 - Arun District Council Strategic Flood Risk Assessment (SFRA) Level 1, August 2016; and
 - Arun District Council Local Plan 2011-2031 (July 2018).
- 1.3 The following maps, surveys and documents have also been referred to in this appraisal:
- Environment Agency (EA) Product 4 Data Ref. SSD228191 obtained August 2021;
 - Flood Risk Assessment undertaken by Robert Clark Associates Ltd in July 2012 (Reference: 1431-R2) associated with the approved planning application Ref. P/62/12/ for the proposed residential development at 8 East Front Road;
 - Flood Risk Assessment undertaken by UK Flood Risk Consultants in November 2019 (Reference: QFRA 1512) associated with the planning application Ref. P/117/19/PL for the proposed residential development at 36 East Front Road;
 - Topographical Survey undertaken by Moon Geospatial Ltd in March 2020 (Reference 20031055);
 - Site Plan from Twenty-20 (Reference 2020 / P0096-SK01); and
 - Arun District Council Report to and Decision of Planning Policy Committee on 6 October 2021.

2.0 Site Description

- 2.1 The site is located on the southern side of East Front Road, approximately 85m to the north-east of the junction with Beach Road. The site extends to around 440m² on which there is an existing residential dwelling. The approximate centre of the site is at Ordnance Survey (OS) National Grid Reference (NGR) SZ 89186 97298. A plan showing the existing site layout is provided at Appendix A.
- 2.2 The site is immediately adjacent to the foreshore and bounded by residential development to the west and east and is accessed via East Front Road along the northern boundary of the site, while a bund is located along the southern side of the site associated with the shingle coastal defence between the proposed development site and the foreshore.

- 2.3 A topographical survey carried out by Moon Geospatial Ltd (ref. 20031055, dated March 2020) indicates that the site falls from a high point of 5.79m AOD to the south to a low point of 3.15m AOD to the north, adjacent to the site entrance. The topographical survey also shows a floor level of 5.78m AOD for the existing dwelling.

Development Proposals

- 2.4 The proposal comprises the replacement of the existing residential unit with a single storey dwelling with a mezzanine level, along with associated infrastructure including garage, private garden and car parking area. The proposed finished floor level will be 5.48m AOD. A plan showing the proposed site layout is provided at Appendix B.

3.0 Flood Zone Classification

- 3.1 An extract from the EA's Flood Map for Planning is provided in Figure 1 below. This indicates that the site is entirely located within Flood Zone 3 (1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding). The existing access to the site via East Front Road is also within Flood Zone 3.

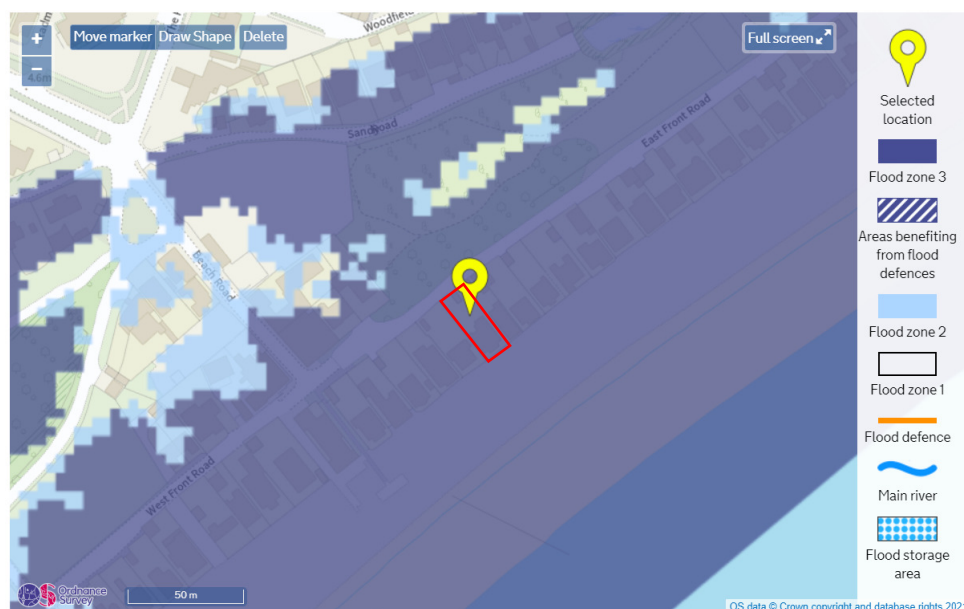


Figure 1: Environment Agency Flood Map for Planning

- 3.2 The Arun District Council Strategic Flood Risk Assessment (August 2016) indicates that the site is located within Flood Zone 3a, outside of any functional floodplain but within a coastal risk area. As a result, detailed flood level data and mapping as Product 4 data have been requested from the Environment Agency (EA) to allow the extent of the flood zones to be more accurately defined.

Environment Agency Product 4 Modelled Flood Data

- 3.3 Environment Agency (EA) Product 4 Data used in conjunction with topographical survey data is considered to give a more accurate assessment of flood risk on a site-specific scale than the broad-scale Flood Map for Planning, given the greater accuracy of the levels provided by the topographical survey.

- 3.4 Product 4 (detailed Flood Risk) data has been provided by the EA and is included in Appendix C. This data includes a flood map centred on the application site and modelled flood levels for two points within the site. The tidal model used was the River Arun to East Head Coastal Modelling (2D) which was completed by JBA Consulting in 2016. Tidal flood levels for the site will lie within the ranges given in Table 1.

Table 1: Modelled tidal flood levels (mAOD)

Scenario	Return Period			
	1 in 200 year	1 in 200 year (2070)	1 in 200 year (2115)	1 in 1,000 year
Tidal Undefended	3.75	4.24	4.84	3.94
Tidal Defended	N/A	N/A	4.27 – 5.20	N/A

- 3.5 The data associated with the 'tidal undefended' flood levels are consistent with increasing levels as the return period increases. However, the 1 in 200 year (2115) 'tidal defended' flood levels appears anomalous, given the proximity of the points.
- 3.6 The contours associated with the 1 in 200 year (Flood Zone 3a), in 200 year including climate change allowances (2070 and 2115) and 1 in 1,000 year (Flood Zone 2), have been overlain on the topographical survey using AutoCAD Civil 3D software to establish the extent of these flood zones. The modelled flood levels used in conjunction with ground levels from the topographical surveys provide a more accurate representation of flood risk in comparison with the broad scale mapping used as the basis of the Flood Map for Planning (Figure 1). A plan showing the resulting flood extensions is included in Appendix D.
- 3.7 According to the flood extension analysis, the southern side of the site is located in Flood Zone 1, beyond the limits of the 1 in 1,000 year flood event (<0.1%), while the northern side of the site and East Front Road fall within 1 in 200 year (Flood Zone 3a) and 1 in 1,000 year (Flood Zone 2) tidal flood extensions, while 1 in 200 year tidal flood extensions, including climate change allowances, extend further south towards the existing residential building. The existing building floor level of 5.78m AOD establishes the entire building footprint within Flood Zone 1.

Coastal Defence

- 3.8 The Arun District Council SFRA indicates that soft engineering methods along the Arun District coast are in the form of shingle beaches and rock defences, supported by a combination of hard engineering. The coastline is protected by shingle beaches, and the majority of the coastal defences offer a standard of protection from an event with an annual probability of 1 in 200 and are of 'Good' to 'Fair' condition grade.

- 3.9 The EA Product 4 data indicates the presence of flood defences adjacent to the south of the proposed development site, in the form of a sand and shingle beach, which is currently maintained by the Local Authority. The National Coastal Erosion Risk Mapping indicates that the Shoreline Management Plan (SMP) policy of this flood defence is Hold the Line. According to the Arun District Council SFRA, Hold the Line indicates an aspiration to build or maintain artificial defences so that the position of the shoreline remains so that current assets are defended. The approach to implementing this SMP policy is articulated in the Rivers Arun to Adur flood and erosion management strategy (2010). This also raises the issue of the standard of flood protection that is afforded by the defences and the areas that benefit from the presence of defences.

Historical Flood Events

- 3.10 The EA Product 4 data indicates that there are no historical records of previous flooding events affecting the development site. The EA acknowledge that flood records are not comprehensive and may not include all events, recommending in turn to access to the Lead Local Flood Authority's records for a more comprehensive flood history check. The Arun District Council Strategic Flood Risk Assessment (August 2016) includes historical flood records and indicates that no historical flood incidents have been recorded within the site boundary either.

Flood Risk to Development Proposals

- 3.11 The proposal comprises the replacement of the existing residential unit with a single storey dwelling with a mezzanine level established at the same location. On this basis, the proposed residential building is located within land that has been established to be within Flood Zone 1, i.e. less than 1 in 1,000 annual probability of fluvial or tidal flooding, thus demonstrating that a sequential approach has been followed with development located within land at the lowest risk of flooding.

4.0 Finished Floor Levels

- 4.1 The Arun District Council Strategic Flood Risk Assessment (August 2016) recommends that floor levels of new developments are set a minimum of 600mm above the modelled 1 in 200 year tidal flood level with an appropriate allowance for climate change.
- 4.2 According to the Arun District Council SFRA, residual risks include the consideration of flood events that exceed the design thresholds of the flood defences or circumstances where there is a failure of the flood defences. As shown in paragraph 3.4, EA Product 4 data indicates a 1 in 200 year (2115) 'tidal undefended' flood level of 4.84m AOD.
- 4.3 In order to provide a consistent and robust design, it is proposed that finished floor level for the proposed new-build dwelling will be set no lower than 5.44m AOD, i.e. 600mm above the worst case 1 in 200 year (2115) 'tidal undefended' flood level of 4.84m AOD, associated with residual risks.
- 4.4 As shown in paragraph 2.4, the finished floor level for the proposed new-build dwelling will be 5.48m AOD, which is around 640mm above the worst case 1 in 200 year (2115) 'tidal undefended' flood level of 4.84m AOD, exceeding the standard 600mm freeboard recommended by the Arun District Council SFRA.

5.0 Safe Access Arrangements

- 5.1 The Arun District Council SFRA states that safe access and egress from the site should be provided to reduce the residual risks to a development. The developer should seek to incorporate an emergency plan and a safe refuge point, as appropriate, given that the development site has been identified to be at risk of flooding.
- 5.2 The EA's Flood Map for Planning and Product 4 data show East Front Road affected by the 1 in 200 year tidal flood event (Flood Zone 3a), when there is a failure of the flood defences (i.e. residual risks). On this basis, a Flood Warning & Evacuation Plan is proposed for the development, which could be controlled by an appropriately worded planning condition.
- 5.3 It should be noted that the proposed development site is located within an established 'Flood Alerts Area' and 'Flood Warning Area'. Residents of the proposed residential unit would therefore register for the EA's Flood Warning System, which would provide them with free early warnings of flooding via phone, email, or text.
- 5.4 Documentation related to flood warning and evacuation could be provided to residents of the development prior to occupation. Safe refuge would be provided within the proposed dwelling, which are all to be located within Flood Zone 1, with floor levels raised above the relevant flood levels.

6.0 Analogous Planning Applications

- 6.1 The planning application (Ref. P/62/12/) for the proposed residential development at 8 East Front Road, located adjacent to the south of 12 East Front Road, involved the demolition of the previous 3-bedroom dwelling and the construction of a new 3-bedroom detached dwelling on a slightly enlarged footprint with no increase in the occupancy of the building. The Flood Risk Assessment undertaken by Robert Clark Associates Ltd (1431-R2) in July 2012 proposed the use of finished floor levels above the predicted 1 in 200 year off-shore sea level including climate change allowance as a suitable flood mitigation measure, along with the use of flood resilient materials and surface water drainage techniques. Both the Environment Agency and Arun District Council approved the planning application.
- 6.2 It should be noted that the proposed development at 12 East Front Road will follow an identical approach as the former planning application (Ref: P/62/12/) based on the principle of no intensification of the development and the use of flood mitigation measures including a finished floor level above the worst case 1 in 200 year (2115) 'tidal undefended' flood level.

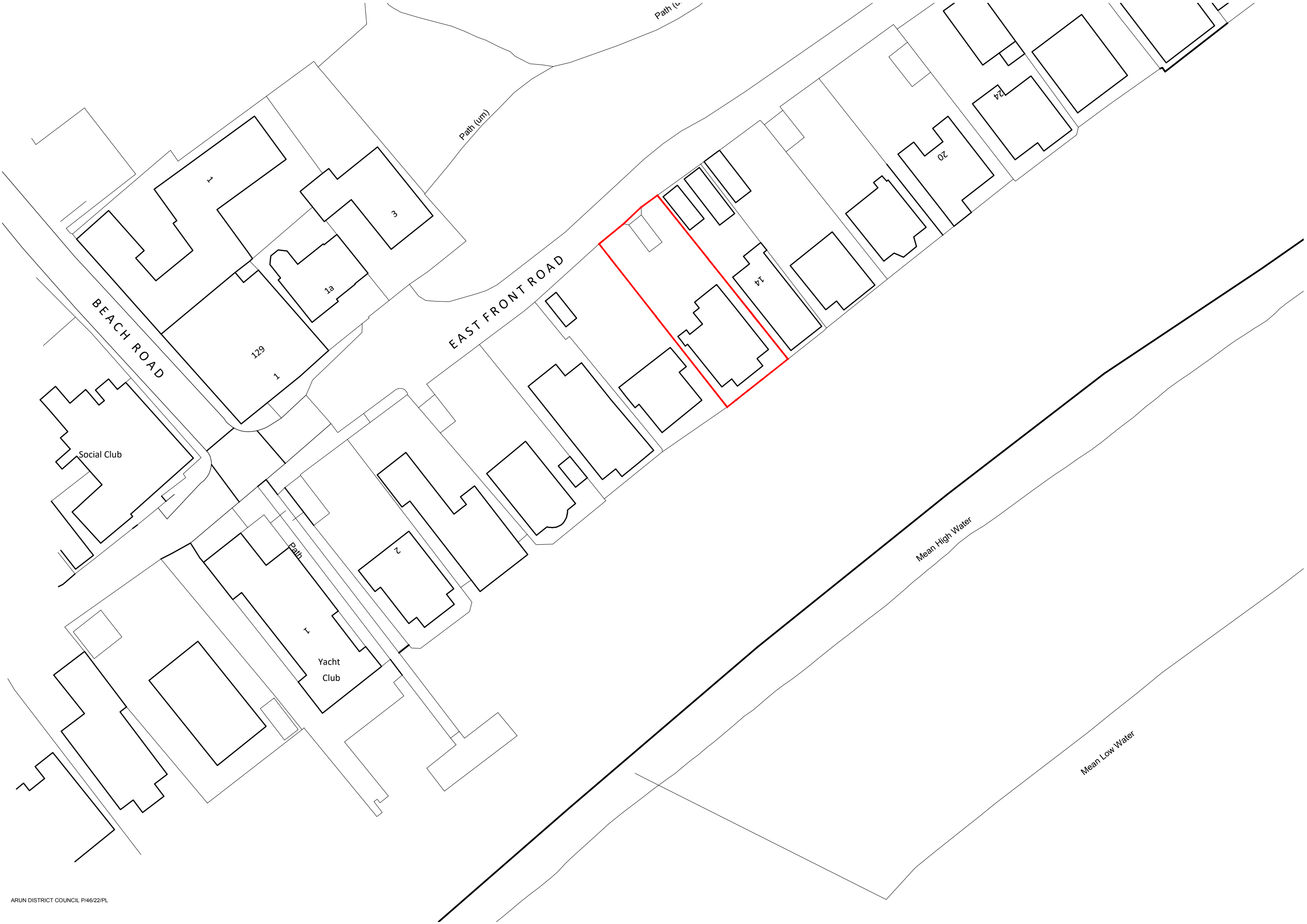
- 6.3 The planning application (Ref. P/48/20/PL) for the proposed residential development at 129 East Front Road involved the change of use and conversion of part of the building to form a separate dwelling. The Flood Risk Assessment for this planning application acknowledged the location of the site in Flood Zone 2 and 3, where Coast Protection Works in the area are administered by Arun District Council who have permissive powers to carry out works to prevent erosion and inundation by the sea. The Flood Risk Assessment indicated that Arun District Council currently have a 'hold the line' approach and will thus carry out works that have a positive cost/benefit ratio with the aid of government grant and will maintain the existing defences. In addition, the FRA stated that major erosion of the shingles foreshore is therefore not expected and overtopping rates would not be significant. The Environment Agency and Arun District Council approved this planning application in August 2020.
- 6.4 Planning permission was recently granted for the planning application (Ref. P/143/21/PL) in November 2021 for the demolition of the existing dwelling at 25 West Front Road and erection of 1 No. replacement dwelling and detached garage/boat store. The site falls within 400m of the Pagham Harbour Special Protection Area and Flood Zone 3. The Arun District Council decided that this planning application falls into category 3 of the interim framework agreed by the Planning Policy Committee on 6th October 2021 in relation to the Coastal Change Management Area (CCMA), whereby all redevelopment (new structure), with FFLs to be at least 300mm above predicted flood levels in all cases, will only be permitted where there is no raised level of risk now or in predictions covering the ensuing 5 years and no occupier density increase.
- 6.5 Given that the proposed development site at 12 East Front Road involves the replacement of the existing dwelling (i.e. no erection of additional residential units) and follows an identical approach to the aforementioned planning applications and consequently approved by the Environment Agency and Arun District Council, in terms of no increase in number of bedrooms (i.e. people at risk) and the use of flood mitigation measures, including finished floor levels above the worst case 1 in 200 year (2115) 'tidal undefended' flood level, it is therefore concluded that the site is not at an unacceptable risk of flooding and can be developed safely without increasing flood risk on-site or elsewhere.
- 6.6 In addition, it is concluded that the proposed redevelopment at 12 East Front Road falls into category 3 of the interim framework agreed by the Planning Policy Committee on 6th October 2021 in relation to the Coastal Change Management Area (CCMA) and as such the proposed redevelopment should be permitted accordingly.

7.0 Summary

- 7.1 The development proposals comprise the replacement of the existing residential unit with a single storey dwelling with a mezzanine level, along with associated infrastructure including garage, private garden and car parking area. Access to the site would be via the existing access from East Front Road.
- 7.2 Through comparing modelled flood levels with ground levels from a topographical survey it has been established that the southern side of the site is located in Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%), while the northern side of the site and East Front Road fall within 1 in 200 year (Flood Zone 3a) and 1 in 1,000 year (Flood Zone 2) tidal flood extensions, while 1 in 200 year tidal flood extensions, including climate change allowances, extend further south towards the existing residential building. The existing building floor level of 5.78m AOD establishes the entire building footprint within Flood Zone 1.
- 7.3 The proposal comprises the replacement of the existing residential unit with a single storey dwelling with a mezzanine level established at the same location. On this basis, the proposed residential building is located within land that has been established to be within Flood Zone 1, i.e. less than 1 in 1,000 annual probability of river flooding, thus demonstrating that a sequential approach has been followed with development located within land at the lowest risk of flooding.
- 7.4 Finished floor level for the proposed new-build dwelling will be 5.48m AOD, which is around 640mm above the worst case 1 in 200 year (2115) 'tidal undefended' flood level of 4.84m AOD, exceeding the standard 600mm freeboard recommended by the Arun District Council SFRA.
- 7.5 A Flood Warning & Evacuation Plan is proposed for the development, which could be controlled by an appropriately worded planning condition. The site is located within an established 'Flood Alerts Area' and 'Flood Warning Area'. Relevant documentation could be provided to residents of the development prior to occupation. Safe refuge would be provided within the proposed residential units, which are all to be located within Flood Zone 1 with floor levels raised above the relevant flood levels.
- 7.6 The proposed redevelopment at 12 East Front Road falls into category 3 of the interim framework agreed by the Planning Policy Committee on 6th October 2021 in relation to the Coastal Change Management Area (CCMA) and as such the proposed redevelopment for which this application is made is favourably supported by precedent.
- 7.7 It is therefore concluded that the site is not at an unacceptable risk of flooding and can be developed safely without increasing flood risk on-site or elsewhere.

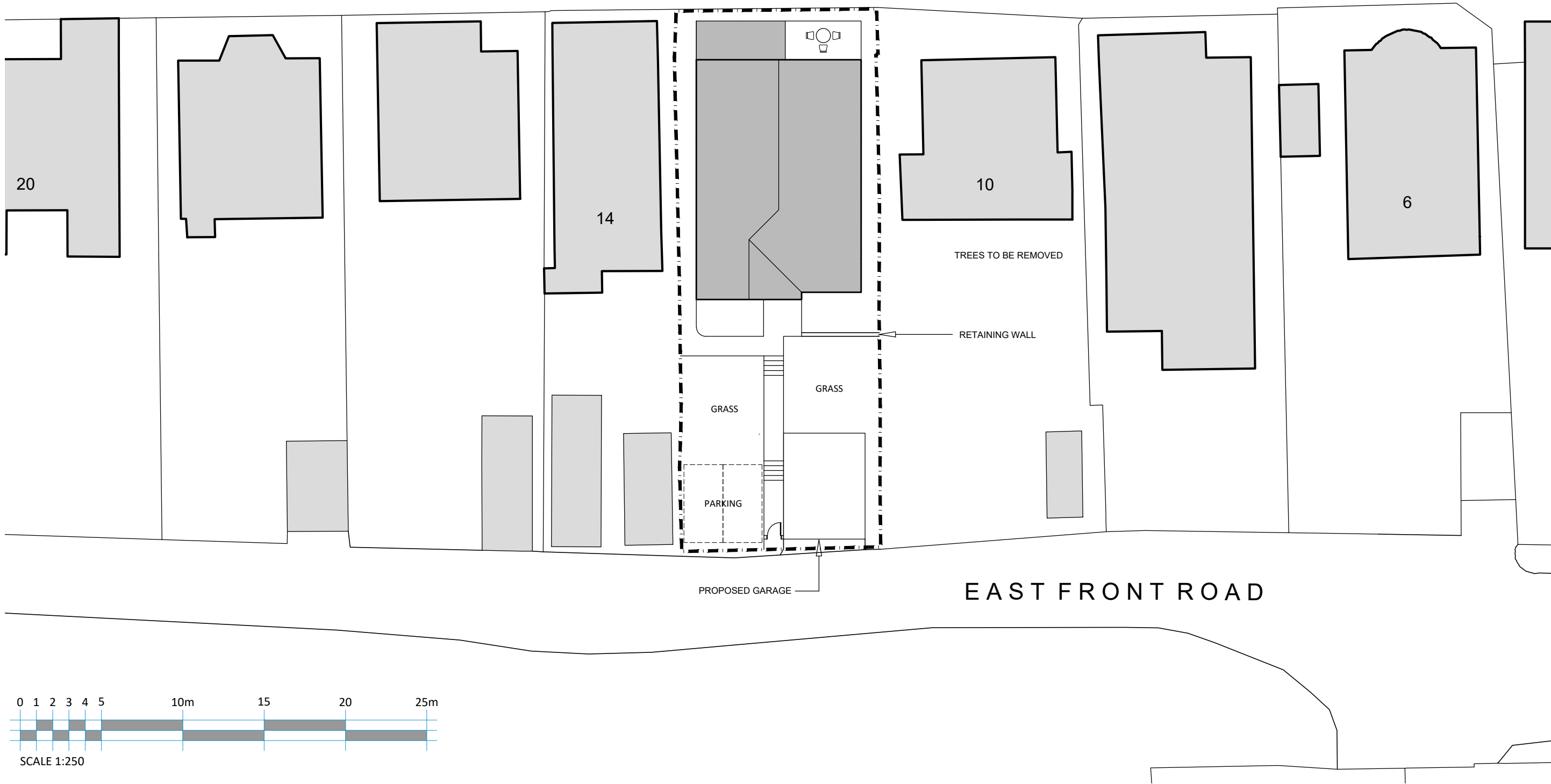
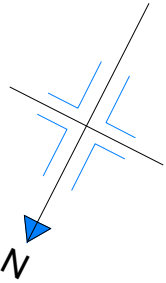
Appendix A

Location Plan



Appendix B

Site Proposals

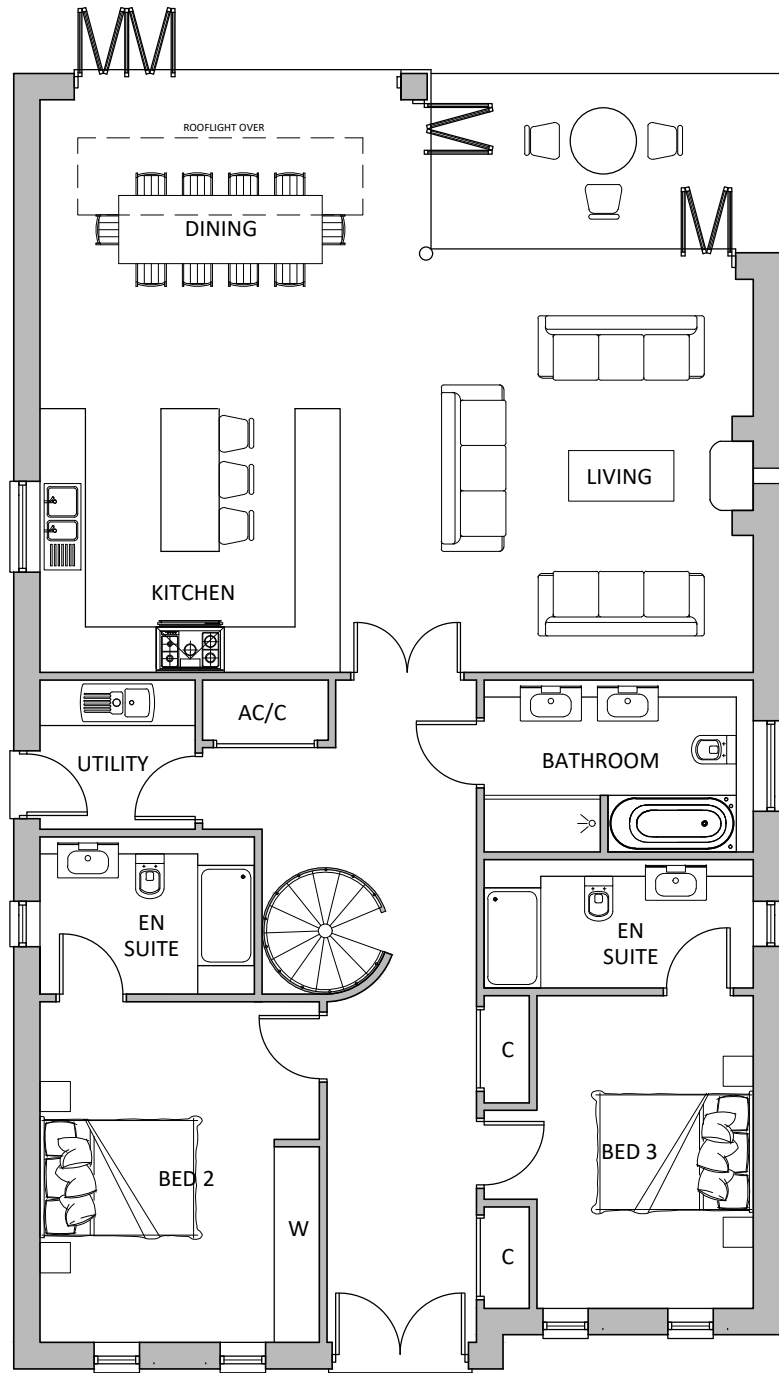
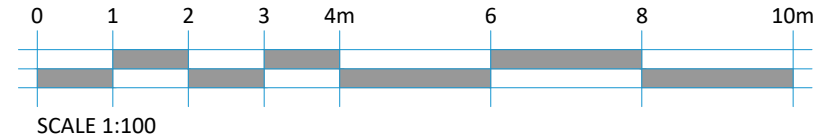


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						SCALE: 1:250 (A3 ORIGINAL)		DRAWING: DRAFT SITE LAYOUT		
						DRAWN:	JOB NO:	DRAWING NO:	REVISION:	
						DATE: JULY 2020	2020 / P0096	SK01	-	

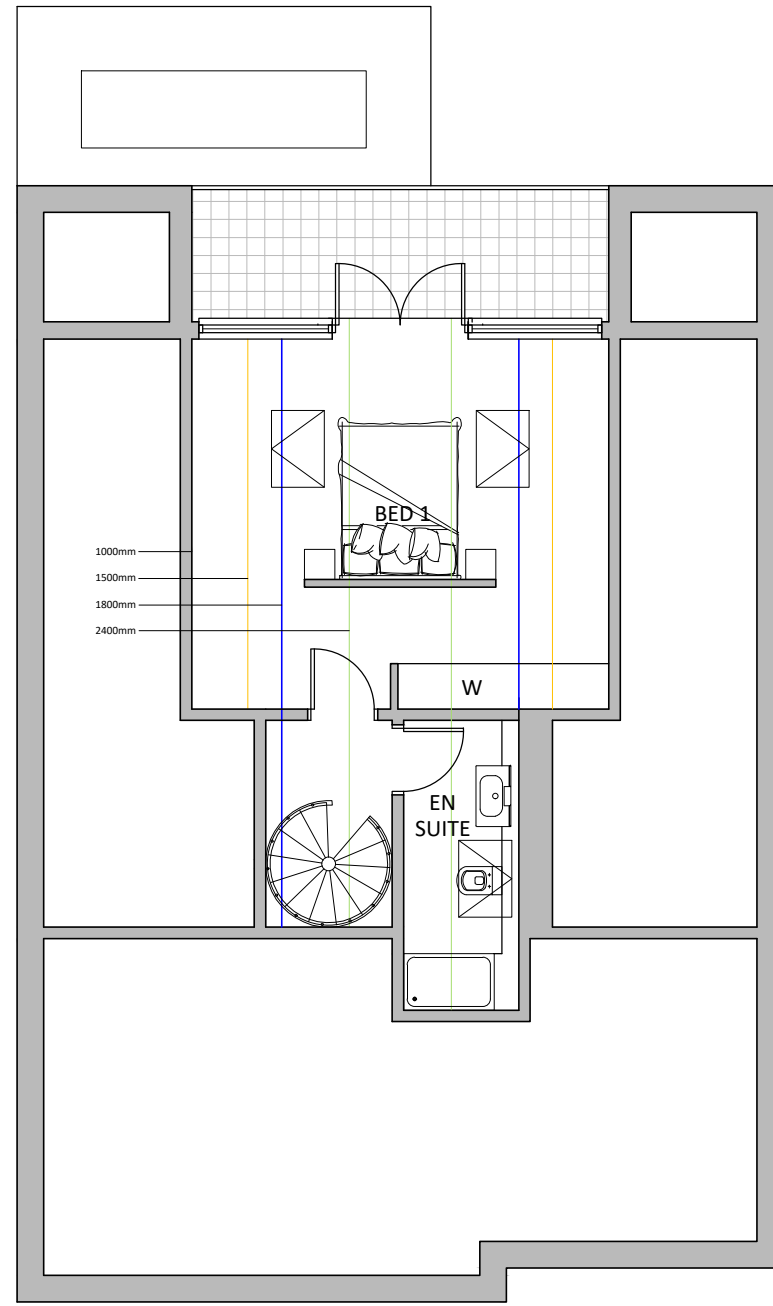
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FLOOR LAYOUT



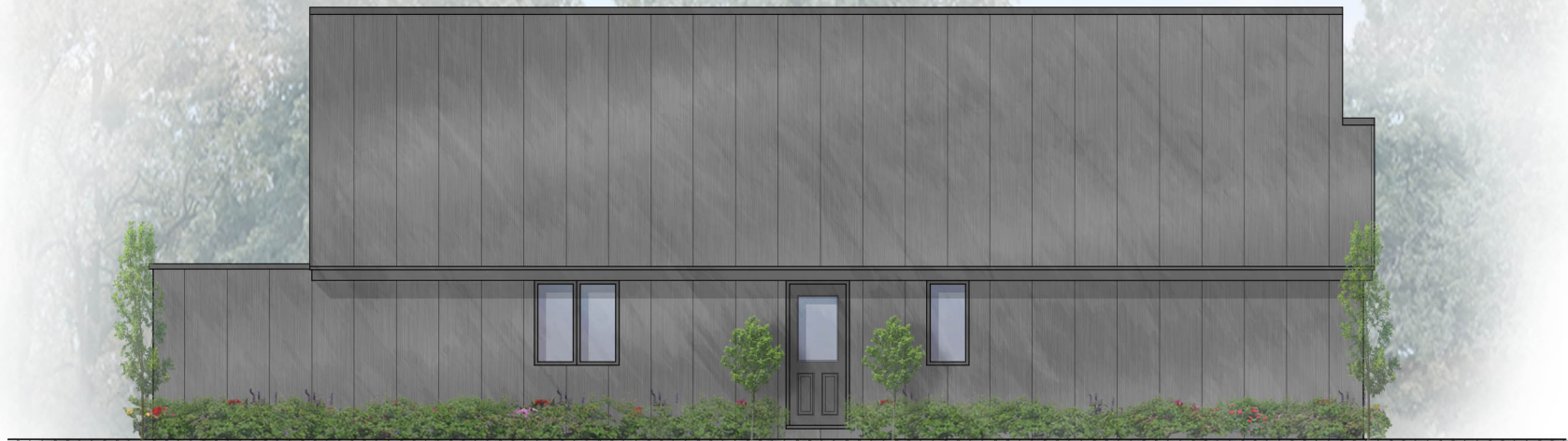
MEZZANINE LEVEL

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						MR K HAWTREE	12 EAST FRONT ROAD, PAGHAM, BOGNOR REGIS		
						SCALE:	DRAWING:		
						1:100 (A3 ORIGINAL)	DRAFT FLOOR PLANS		
						DRAWN:	JOB NO:	DRAWING NO:	REVISION:
							2020 / P0096	SK02	
						DATE:			
						JULY 2020			

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FRONT ELEVATION



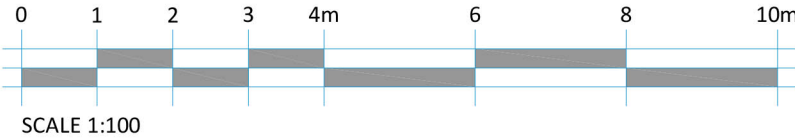
SIDE ELEVATION



REAR ELEVATION



SIDE ELEVATION



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										MR K HAWTREE		12 EAST FRONT ROAD, PAGHAM, BOGNOR REGIS			
										SCALE:		DRAWING:			
										1:100 (A3 ORIGINAL)		DRAFT ELEVATIONS			
										DRAWN:		DRAWING NO:			
										JOB NO:		REVISION:			
										DATE:		SK03			
										MAY 2020		2020 / P0096			

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Appendix C

Environment Agency Product 4

Adrian Quigley
Glanville
Cornerstone House,
62 Foxhall Road,
Didcot,
Oxfordshire,
OX11 7AD

Our ref: SSD228191
Date: 23/08/2021

Dear Adrian Quigley,

Enquiry Regarding Product 4 for Flood Risk Assessment for 12 East Front Road, Pagham, PO21 4SU.

Thank you for your enquiry which was received on 25 July 2021.

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. This is maintained by the Local Authority.

Model Information

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

Flood History

We hold no record of previous flooding events affecting this site.

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 12 East Front Road, Pagham, PO21 4SU.
Licence	Open Government Licence
Information Warnings	The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>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.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 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,

Edward Conway

Partnership & Strategic Overview - West Sussex

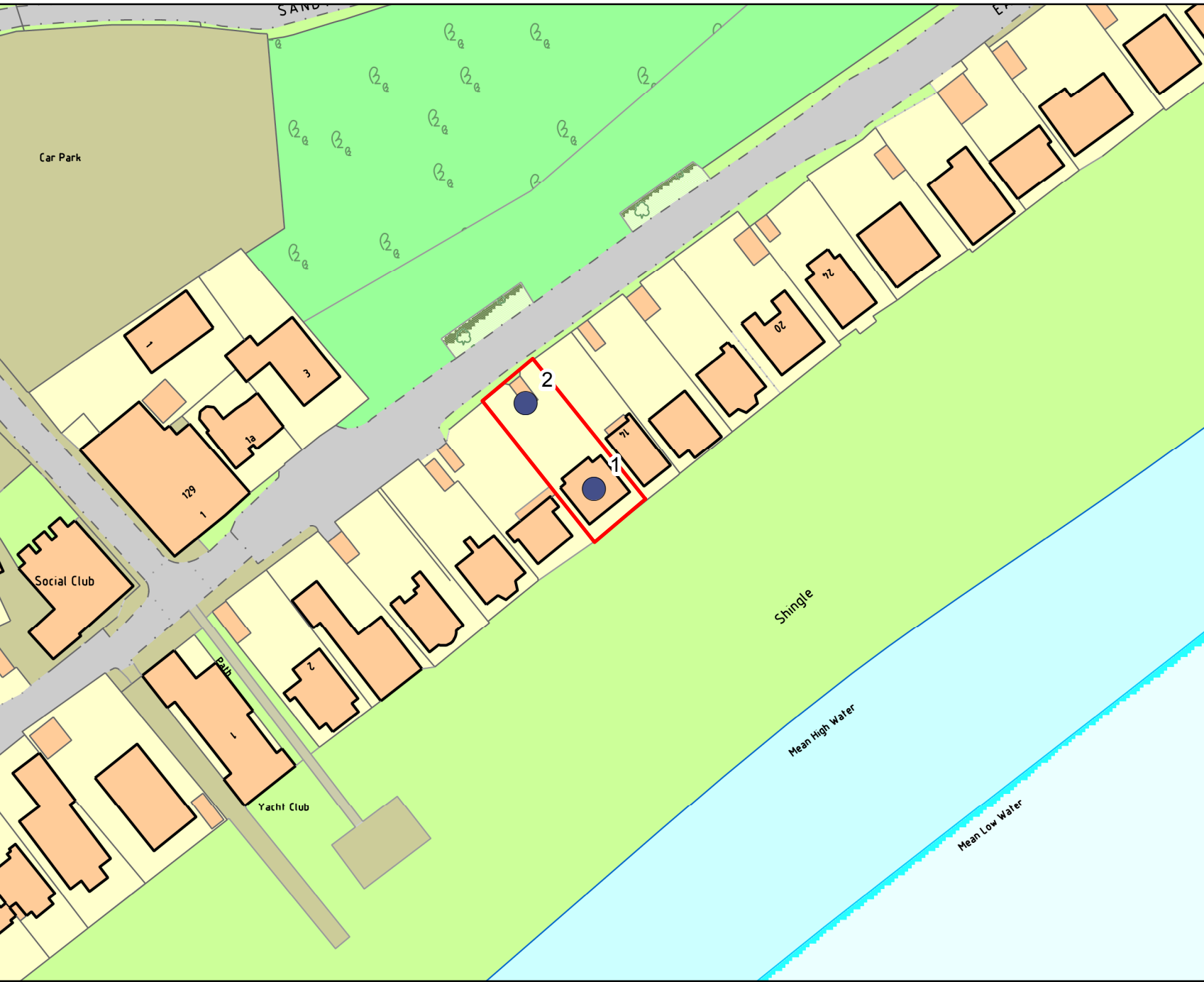
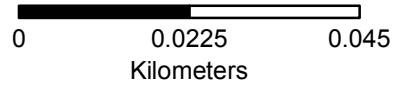
Environment Agency - Guildbourne House, Chatsworth Road, Worthing, BN11 1LD



Legend

- Site Nodes
- Site_Boundary

Scale: 1:1,000



Product 4 Flood Risk Data Requested by: Glanville

Site: 12 East Front Road, Pagham, PO21 4SU

Table 1: Water Levels: Tidal Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489190	97291	3.75	4.24	4.84	3.94
2	489178	97307	3.75	4.24	4.84	3.94

Table 2: Water Levels: Tidal Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Defended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489190	97291	-	-	5.20	-
2	489178	97307	-	-	4.27	-

Table 3: Water Depths: Tidal Undefended

Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489190	97291	1.58	2.07	2.68	1.77
2	489178	97307	0.94	1.43	2.03	1.13

Table 4: Water Depths: Tidal Defended

Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	489190	97291	-	-	0.10	-
2	489178	97307	-	-	0.85	-

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

Produced on: 23/08/2021

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

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



Environment
Agency

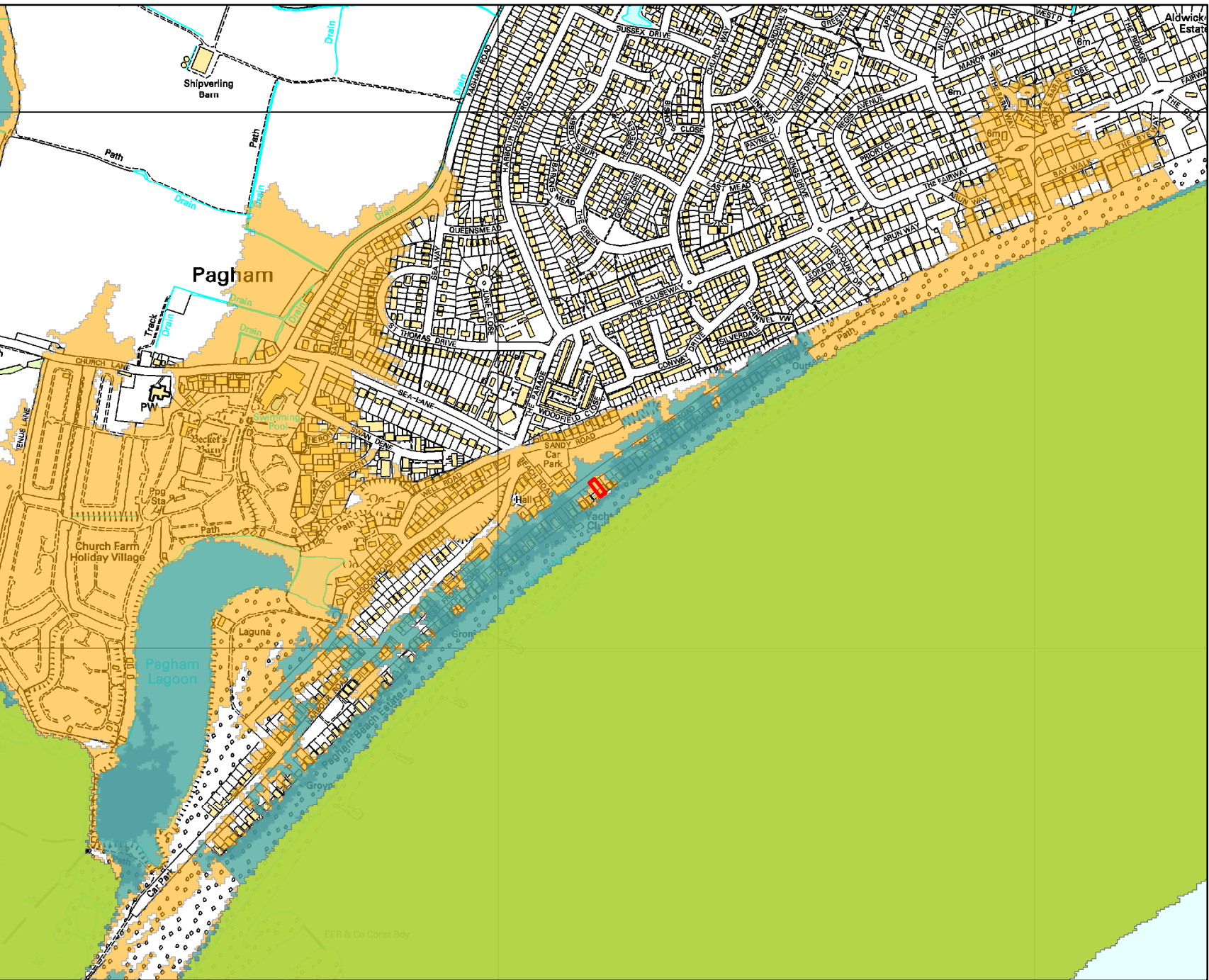
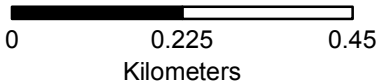


Legend

- Site_Boundary
- 0.5% AEP (Defended Tidal)
- 0.5% AEP (2070) NPPF (Defended Tidal)
- 0.5% AEP (2115) NPPF (Defended Tidal)
- 0.1% AEP (Defended Tidal)

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

Scale: 1:10,000





Environment
Agency



N

Legend

-  Site_Boundary
-  0.5% AEP (Un defended Tidal)
-  0.5% AEP (2070) NPPF (Un defended Tidal)
-  0.5% AEP (2115) NPPF (Un defended Tidal)
-  0.1% AEP (Un defended Tidal)

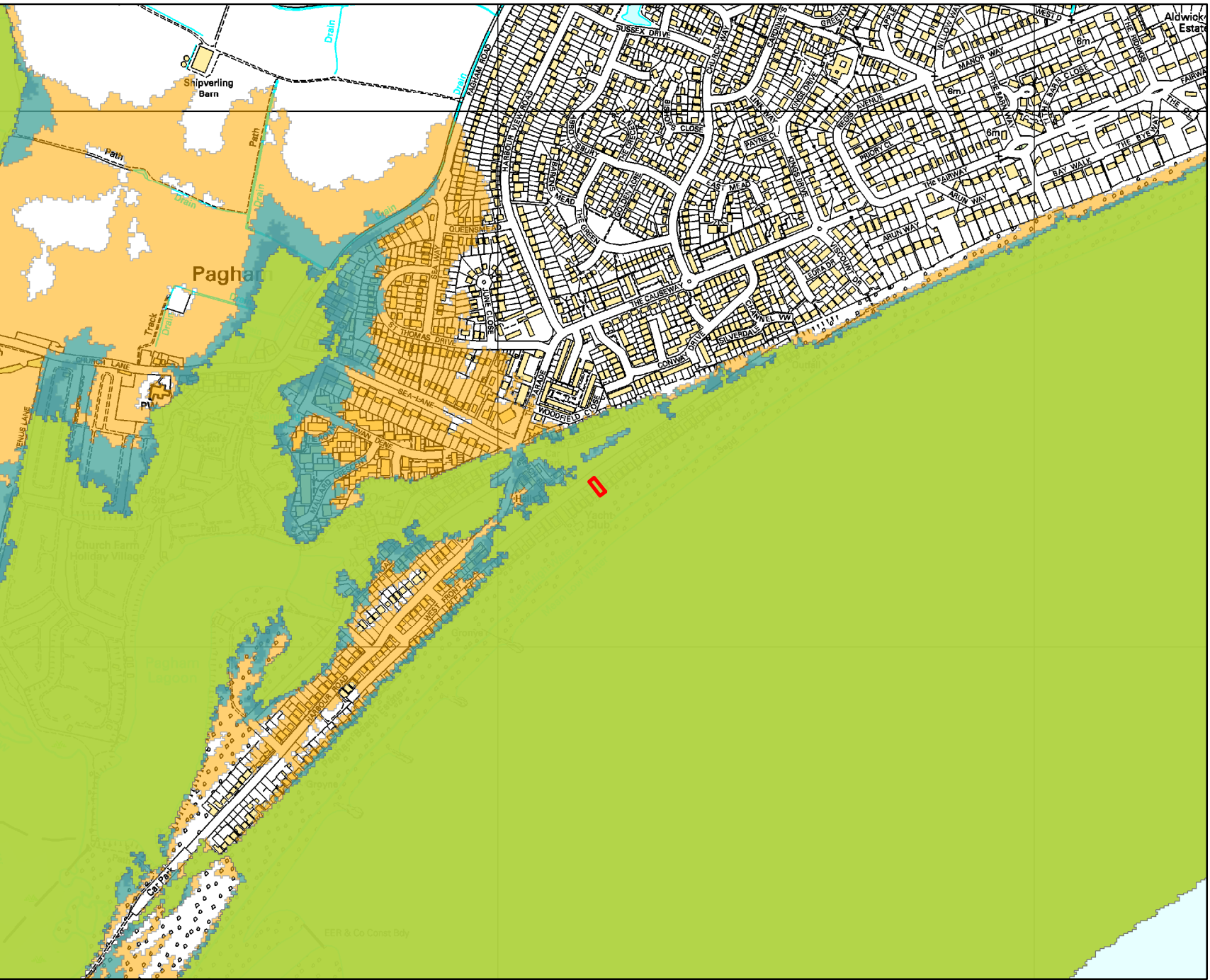
Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



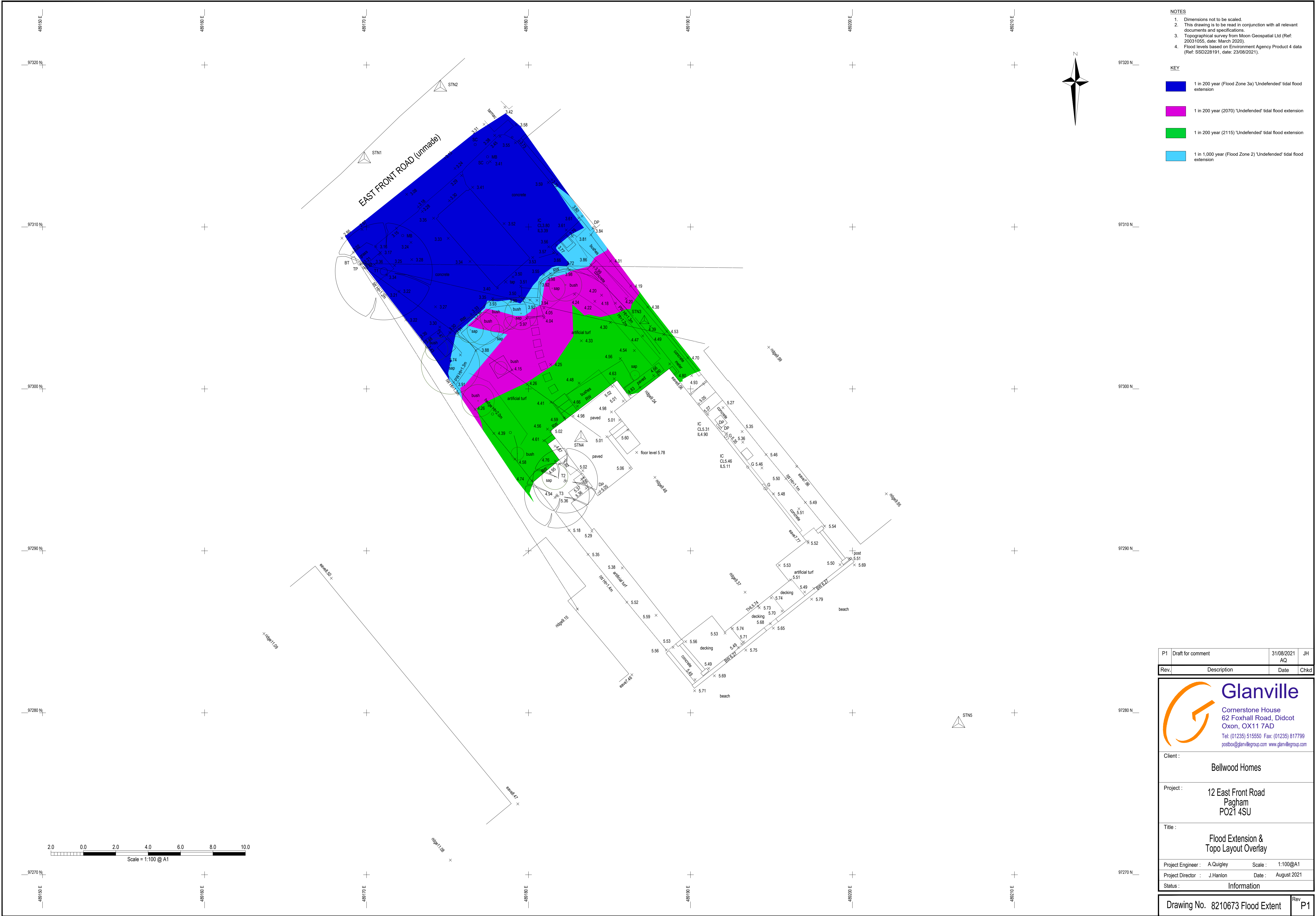
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Kilometers



Appendix D

Flood Extension and Topo Overlay



- NOTES
1. Dimensions not to be scaled.
 2. This drawing is to be read in conjunction with all relevant documents and specifications.
 3. Topographical survey from Moon Geospatial Ltd (Ref: 20031055, date: March 2020).
 4. Flood levels based on Environment Agency Product 4 data (Ref: SSD228191, date: 23/08/2021).

- KEY
- 1 in 200 year (Flood Zone 3a) 'Undefended' tidal flood extension
 - 1 in 200 year (2070) 'Undefended' tidal flood extension
 - 1 in 200 year (2115) 'Undefended' tidal flood extension
 - 1 in 1,000 year (Flood Zone 2) 'Undefended' tidal flood extension

P1	Draft for comment	31/08/2021	AQ	JH
Rev.	Description	Date	Chkd	
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Client :		Bellwood Homes		
Project :		12 East Front Road Pagham PO21 4SU		
Title :		Flood Extension & Topo Layout Overlay		
Project Engineer :		A.Quigley	Scale :	1:100@A1
Project Director :		J.Hanlon	Date :	August 2021
Status :		Information		
Drawing No. 8210673 Flood Extent				Rev P1