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ENVIRONMENTAL ASSESSMENT

Flood Risk Assessment 5930

13 Elm Drive,
Bognor Regis,
PO22 6JE

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Prepared for: Julia Maynard

Reference: 5930

Site Location: 13 Elm Drive, Bognor Regis, PO22 6JE

Proposed Development: It is understood that the development is for the demolition of the existing residential dwelling on site, followed by the construction of a replacement dwelling with a larger built footprint.

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1. Summary

- 1.1 Ambiental Environmental Assessment has been appointed by Julia Maynard to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at 13 Elm Drive, Bognor Regis, PO22 6JE.
- 1.2 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling with a slightly greater built footprint. Plans of the proposed development are in Appendix 1.
- 1.3 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3 (high risk of flooding from fluvial and tidal sources). The English Channel is approximately 185m south of the site (based on the Mean High-Tide Water Level) and Elmer Rife, an EA Main River, is approximately 345m east of the site.
- 1.4 The existing residential dwelling is considered “More Vulnerable” under Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance and the principles of the National Planning Policy Framework (NPPF). There will be no change in flood risk vulnerability of the site post-development.
- 1.5 Ambiental have received modelled flood information from the Environment Agency, including flood levels, depths and outlines for the proposed site.
- 1.6 Information provided by the EA indicates that there are flood defences located near the site in the form of a sea wall, breakwaters and a sand and shingle beach. The sea wall has a crest height of 5.50mAOD and provides a standard of protection of 1 in 100. This indicates that the existing sea wall should provide protection to the site in the 1 in 100-year flood event.
- 1.7 The EA provided site-specific modelled flood information for both undefended and defended scenarios. The model used was the River Arun to East Head Coastal Modelling, completed in 2016 by JBA Consulting.
- 1.8 Using the EA flood data for the site, it is demonstrated that the site benefits from flood defences in the 1 in 200-year and 1 in 1,000-year present-day tidal flood events. Based on the 2016 model, the site should also be defended in the 1 in 200-year (2115 epoch) flood event. This does not take account of the EA’s latest climate change allowances.
- 1.9 It should be noted that the Elmer coastal defences scheme was completed in June 2020 and included the improvement of existing rock revetments and addition of shingle across existing defences. These defences should provide enhanced protection to the site from coastal flooding.
- 1.10 From a review of the plans, it is understood that the built footprint on site will increase by approximately 102m² as a result of the development. The site is in a coastal floodplain, so flood compensatory storage is not required.
- 1.11 The site is positively drained as existing. Given that the proposal is for the replacement of the existing dwelling on site, with an increase in built footprint of approximately 102m², it is recommended that the surface runoff is discharged via the existing drainage infrastructure. The additional surface water runoff generated as a result of the increased footprint should be attenuated by temporarily storing in a rainwater harvesting system, such as water butts or rain planters. Water butts can provide non-potable water uses on site and rain planters can provide additional ecological benefits to the site.
- 1.12 The following mitigation measures are recommended for the proposed replacement dwelling:

- Residents should sign up to the EA Flood Warning service if they have not done so already. In the event of an EA Flood Warning, the site shall be evacuated for the duration of the warning.
- All sleeping will be located on the first floor and above, set at 6.85m AOD, approximately 1.48m above the undefended 1:200 year plus climate change flood level (5.37m AOD).
- The proposed replacement dwelling should incorporate flood resilience measures in line with current best practice for construction within an area at risk of flooding in line with CLG 2007 'Improving the Flood Performance of New Buildings. These are outlined in Section 7 of the report.
- Additional SuDS devices could be implemented to provide some additional betterment.

Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Development Description	Existing	Proposed
Development Type:	Existing residential dwelling	Demolition of existing dwelling and construction of a replacement two-storey dwelling, with a larger built footprint.
Number of Bedrooms:	N/A	4no. bedrooms
EA Vulnerability Classification:	More vulnerable	More vulnerable
Ground Floor Level:	Existing ground levels are circa 3.60mAOD, according to the topographic survey.	
Level of Sleeping Accommodation:	N/A	First floor
Impermeable Surface Area:	Existing built footprint is approx. 81m ²	Proposed built footprint is approx. 183m ²
Surface Water Drainage:	Existing building is positively drained	Recommended that the proposed replacement dwelling is drained via the existing drainage infrastructure. Additional SuDS devices could be implemented to provide additional betterment.
Site Size:	582m ²	Same as existing
Risk to Development	Summary	Comment
EA Flood Zone:	Flood Zone 3	
Flood Source:	Tidal	
1:200 Year Flood Level	Site is defended	
1:200 Year Flood Level & Climate Change	Site is defended	The Environment Agency has provided modelled flood information for the site. The data demonstrates that the site is defended in the 1:200-year and 1:1000-year tidal events; and the 1:200-year event in the 2070 and 2115 epochs, based on old climate change allowances.
1:1000 Year Flood Level	Site is defended	
Recorded Flood Events in Area:	Yes	1997 flood event in Climping, according to EA flood records.
Recorded Flood Events at Site:	No	EA flood records
SFRA Available:	Yes	Arun District Council SFRA (2016)
Management Measures	Summary	Comment
Ground floor level above extreme flood levels:	Yes	Site is defended against 1:1000-year tidal event, so floors will be above extreme flood levels.
Safe Access/Egress Route:	Yes	See Section 7
Flood Resilient Design:	Yes	See Section 7
Site Drainage Plan:	Yes	Recommended that the proposed replacement dwelling is drained via the existing drainage infrastructure. Additional SuDS devices could be implemented to provide additional betterment.
Flood Warning & Evacuation Plan:	Yes	EA Flood Alert/Warning Service Area
Offsite Impacts	Summary	Comment
Displacement of floodwater:	No	Site is in a tidally dominated floodplain, so flood compensation storage is not required.
Increase in surface run-off generation:	No	The development will result in an increase in built footprint, so any increase in surface water run-off will be discharged via the existing drainage infrastructure for the site or via small-scale SuDS devices.
Impact on hydraulic performance of channels:	None	Development should not affect any watercourses.

Table 1 Summary of flood risks, impacts and proposed flood mitigation measures.

N/A¹ not required for this assessment; N/A² data not available.

2. Development Description and Site Area

Proposed Development and Location

- 2.1 The proposed development is located at 13 Elm Drive, Bognor Regis, PO22 6JE (Figure 1).
- 2.2 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling, with a slightly greater built footprint. Plans of the proposed development are in Appendix 1.
- 2.3 Existing ground levels are between 3.60m AOD and 3.70m AOD, according to the topographic survey provided by the client (see Appendix 1). The site topography is generally flat.



Figure 1 Location Map, identifying the location of the proposed development (Source: OS)

Vulnerability Classification

- 2.4 The EA Flood Map for Planning (Figure 2) demonstrates that the proposed development lies within Tidal Flood Zone 3 with a high probability of greater than 1 in 200 (0.5%) of flooding from seas or tidal estuaries in any year.
- 2.5 Under Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance and the principles of the National Planning Policy Framework (NPPF), the existing site is classified as 'More Vulnerable', due to its residential usage. The proposal is for the demolition of the existing dwelling and construction of a replacement dwelling. As such, post-development, the NPPF flood risk vulnerability will be unchanged compared to the existing situation.

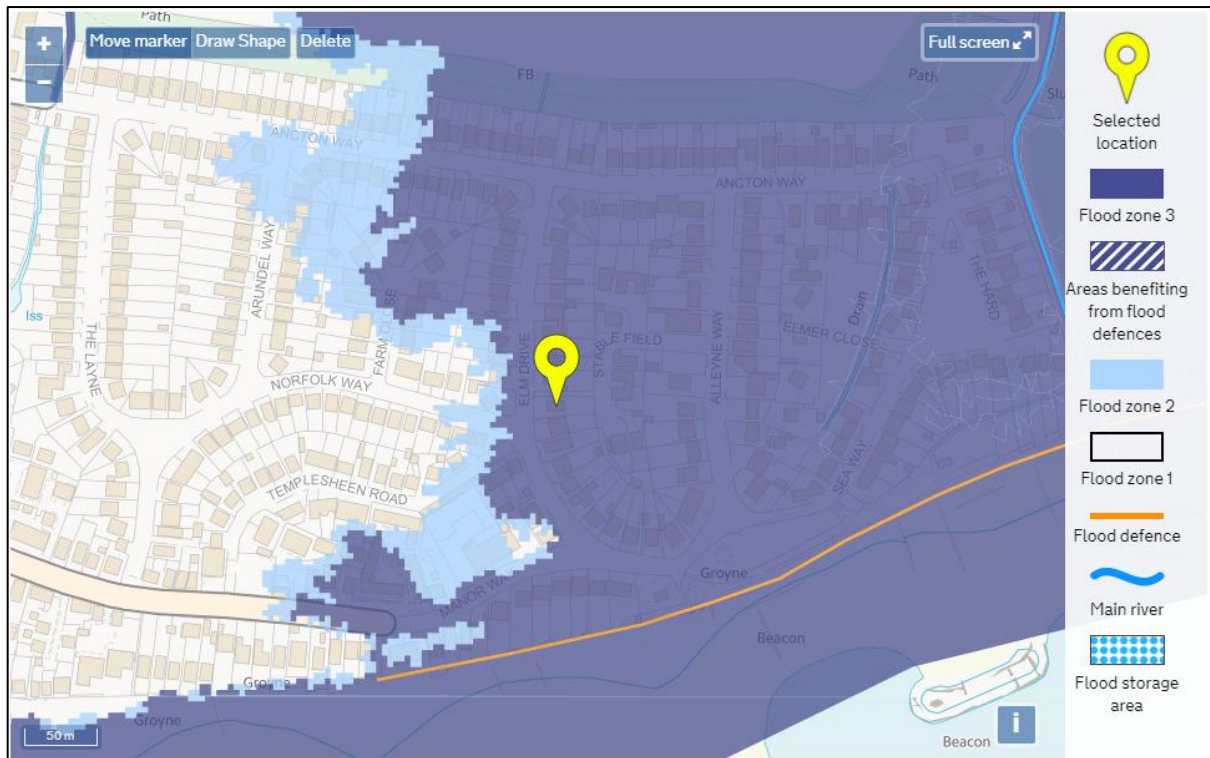


Figure 2 EA Flood Map for Planning (Source: EA)

Geology

- 2.6 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (undifferentiated), which predominantly comprises of chalk. (Source: BGS). This formation is considered to be a Principal aquifer (Source: EA; Magic Map online resource. See Figure 3). A Principal aquifer is highly permeable, supporting water supply and/or river base flow on a strategic scale.
- 2.7 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the superficial deposits underlying the site are Raised Beach Deposits, 1, comprising of sand and gravel (Source: BGS). This formation is a Secondary 'A' aquifer (Source: EA; Magic Map online resource. See Figure 4). A Secondary 'A' aquifer is permeable, supporting water supplies at a local scale and may contribute to base flow of rivers.
- 2.8 The site is not within an area identified as an EA groundwater Source Protection Zone, according to the online Magic Maps. This is shown in Figure 5.

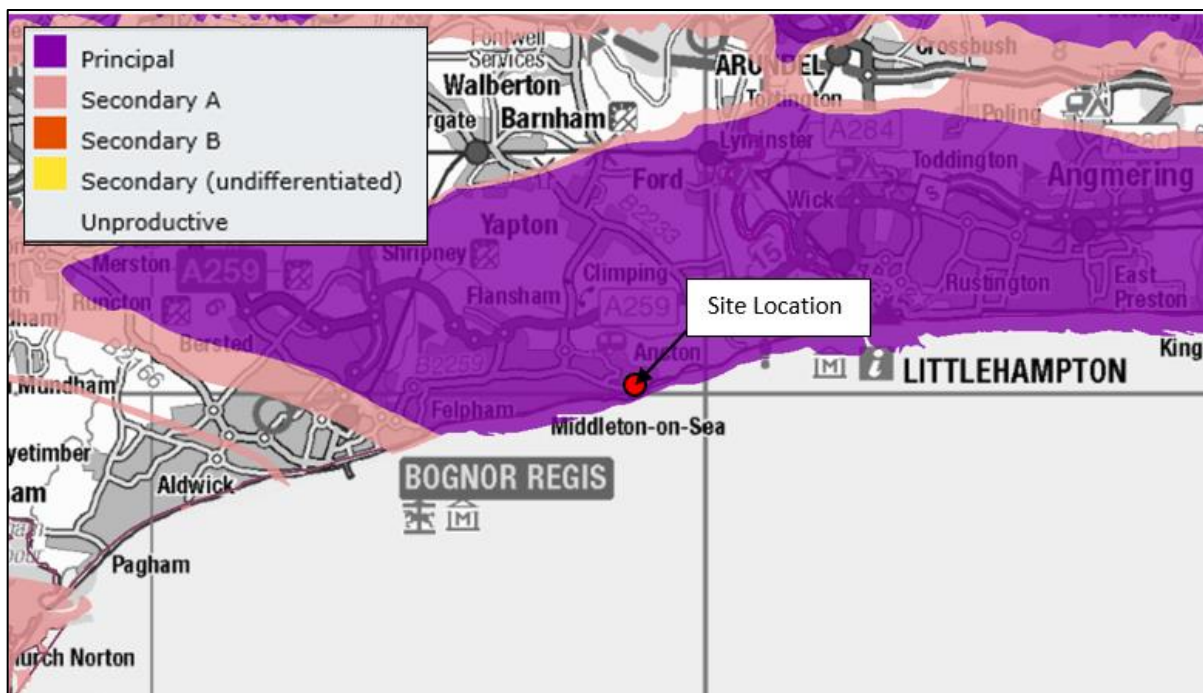


Figure 3 Aquifer Designation of Bedrock Geology, indicating location of site (Source: MagicMap online)

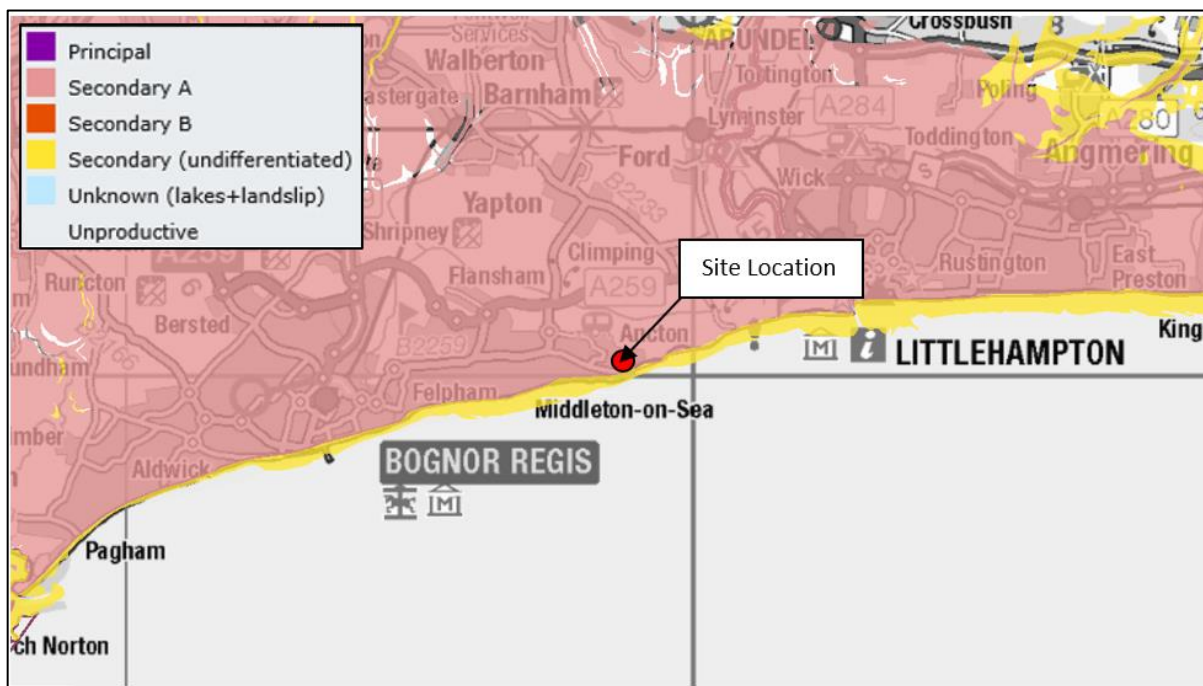


Figure 4 Aquifer Designation of Superficial Deposits, indicating location of site (Source: MagicMap online)

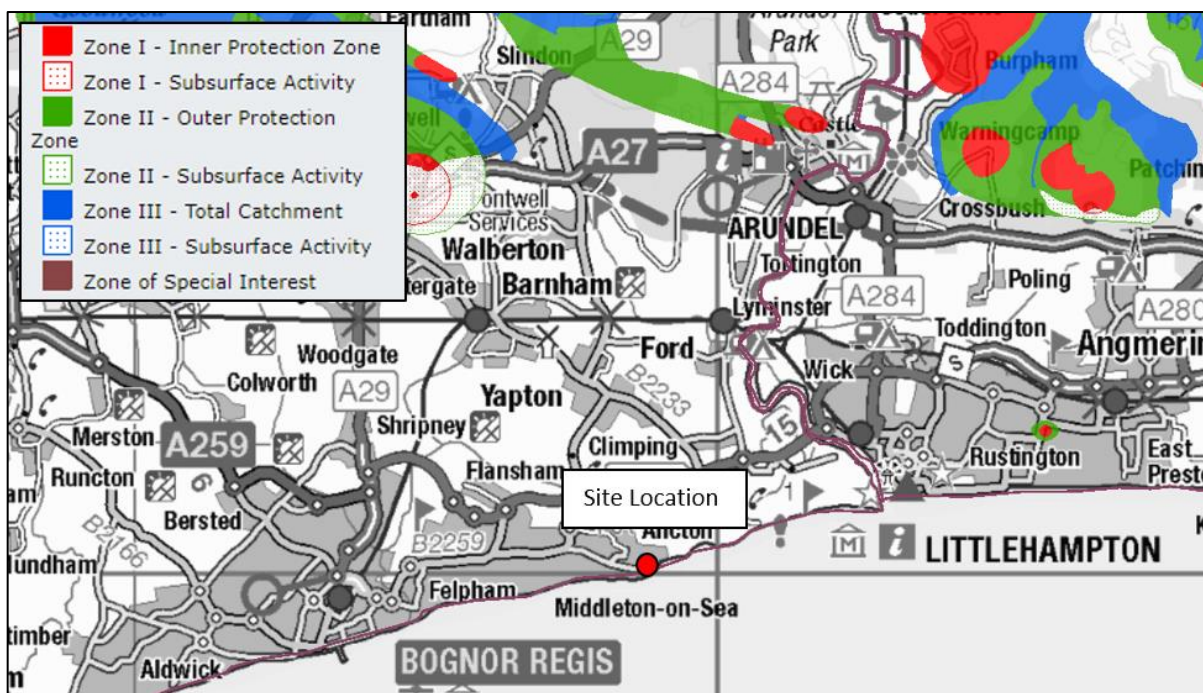


Figure 5 EA Groundwater Source Protection Zones, indicating location of site (Source: Magic Map online)

3. Sequential Test/Exception Test

- 3.1 Under the NPPF, all new planning applications should undergo a *Sequential Test*. This test should be implemented by local planning authorities with a view to locating particularly vulnerable new developments (e.g. residential, hospitals, mobile homes etc.) outside of the floodplain.
- 3.2 The Flood Risk and Coastal Change Planning Practice Guidance (PPG) *Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table* is reproduced below;

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
	Zone 3b <i>Functional Floodplain</i>	Exception Test Required	✓	✗	✗	✗

Table 2 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF.
 Please note: ✓ means development is appropriate; ✗ means the development should not be permitted.

- 3.3 The proposal is considered as a 'More Vulnerable' development, under the NPPF guidance. The site is located in an area of Flood Zone 3. As indicated in Table 2 above, 'More Vulnerable' developments located in Flood Zone 3 are required to be submitted alongside an Exception Test. In accordance with this, the proposed development is required to have an Exception Test.
- 3.4 Paragraph 160 of the Flood Risk and Coastal Change Planning Practice Guidance states, for the Exception Test to be passed, it should be demonstrated that:
- The development would provide wider sustainability benefits to the community that outweigh the flood risk; and
 - The development would be safe for its lifetime without increasing flood risk elsewhere and, where possible, will reduce flood risk overall.
- 3.5 All developments in Flood Zones 2 and 3 require a site-specific flood risk assessment to be submitted alongside the planning application.
- 3.6 Therefore, the proposed development is required to have a flood risk assessment, which demonstrates that the development will be safe for its lifetime without increasing flood risk elsewhere.

4. Site Flood Hazards

Sources of Flooding

- 4.1 The proposed development is located within Flood Zone 3 (high risk of flooding) and is considered to be 'More Vulnerable' according to the Flood Risk and Coastal Change Planning Practice Guidance (PPG). Table 3 summarises the potential sources of flooding to the site:

Source	Description
Tidal	Flood Zone 3
Fluvial	Elmer Rife
Surface	Very Low risk at site; High risk on Elm Drive
Groundwater	'Potential for groundwater flooding to occur at surface'
Sewer	Local area has been affected by sewer flooding in the past

Table 3 Summary of flood sources.

Tidal

- 4.2 With reference to the EA Flood Map for Planning (Figure 2), the site is shown to be located within Flood Zone 3 (high risk of flooding).
- 4.3 The Mean High-Tide Water Level for the English Channel is approximately 185m south of the site.
- 4.4 Existing ground levels of the site are between 3.60mAOD and 3.70mAOD, according to the topographic survey provided by the client (see Appendix 1). The site topography is generally flat.
- 4.5 Ambiental have received modelled flood information from the Environment Agency for the site.
- 4.6 Information provided by the EA indicates that there are flood defences located near the site in the form of a sea wall, breakwaters and a sand and shingle beach. The sea wall has a crest height of 5.50mAOD and provides a standard of protection of 1 in 100. This indicates that the existing sea wall should provide protection to the site in the 1 in 100-year flood event.
- 4.7 The EA provided site-specific modelled flood information for both undefended and defended scenarios. The model used was the River Arun to East Head Coastal Modelling, completed in 2016 by JBA Consulting.
- 4.8 The EA have also confirmed that they do not hold any records of previous flood events affecting the site.

Undefended

- 4.9 The undefended scenario represents the potential flooding which could occur if there were no flood defences benefitting the site. Thus, this represents a worst-case scenario.
- 4.10 The modelled flood level extracted from the site during the 1 in 200-year tidal flood event (undefended) is 3.88mAOD. When this is compared with the existing ground levels of the site (between 3.60mAOD and 3.70mAOD), it is demonstrated that the site could be affected by flood depths of between 0.18m and 0.28m in this event.

- 4.11 During the 1 in 1,000-year tidal flood event (undefended), the site could be affected by a flood level of 4.09mAOD. This could result in flood depths between approximately 0.39m and 0.49m on site.
- 4.12 Figure 6 shows the modelled flood outlines provided by the EA for the following return periods, in the undefended tidal scenarios (See Appendix 2 for EA data):
- 0.5% AEP (1 in 200-year);
 - 0.5% AEP (1 in 200-year) in 2070 epoch;
 - 0.5% AEP (1 in 200-year) in 2115 epoch;
 - 0.1% AEP (1 in 1,000-year).

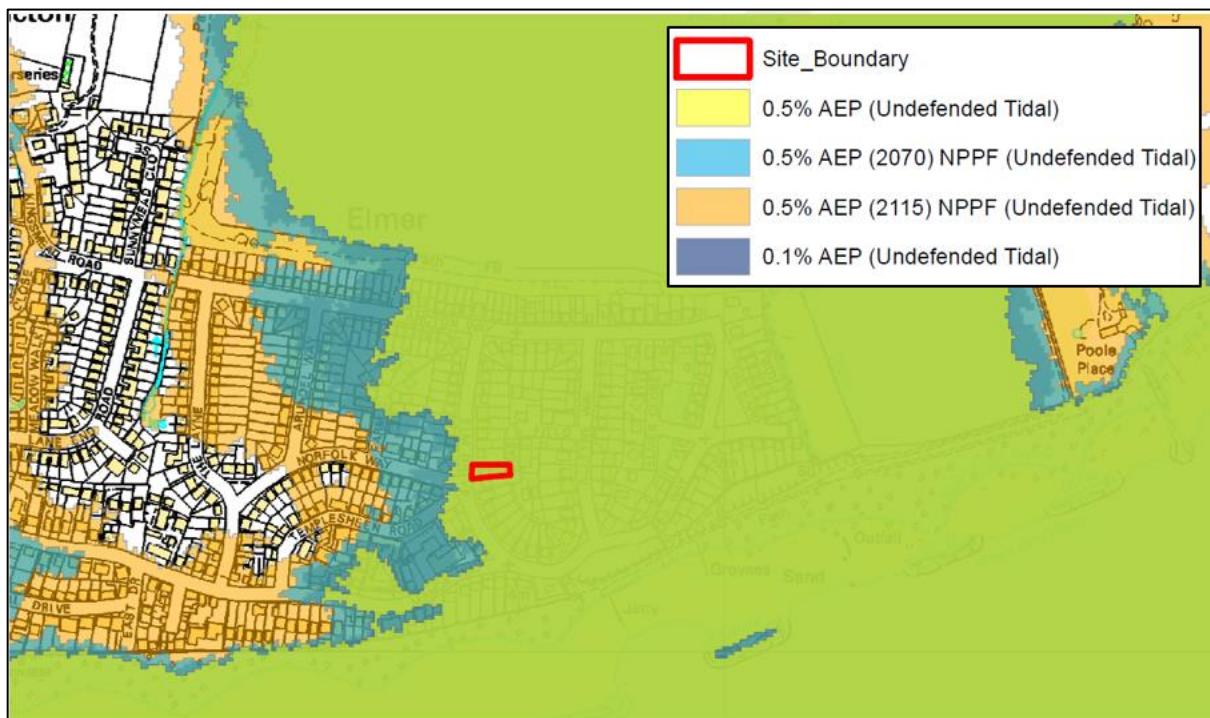


Figure 6 Modelled flood outlines in undefended scenarios, showing location of site as redline boundary (Source: EA)

Defended

- 4.13 The flood data provided by the EA demonstrates that the site should remain unaffected by flooding in the modelled 1 in 200-year and 1 in 1,000-year flood events, in the present-day defended scenario. As such, this indicates that the site is defended up to the 1 in 1,000-year tidal event.
- 4.14 Figure 7 shows the modelled flood outlines provided by the EA for the following return periods, in the defended tidal scenarios (See Appendix 2 for EA data):
- 0.5% AEP (1 in 200-year);
 - 0.5% AEP (1 in 200-year) in 2070 epoch;
 - 0.5% AEP (1 in 200-year) in 2115 epoch;
 - 0.1% AEP (1 in 1,000-year).
- 4.15 It should be noted that the Elmer coastal defences scheme was completed in June 2020 and included the improvement of existing rock revetments and addition of shingle across existing defences. Given the

proximity of the site to the coastal defences, it is considered that the flood defence scheme will provide better protection to the proposed site.

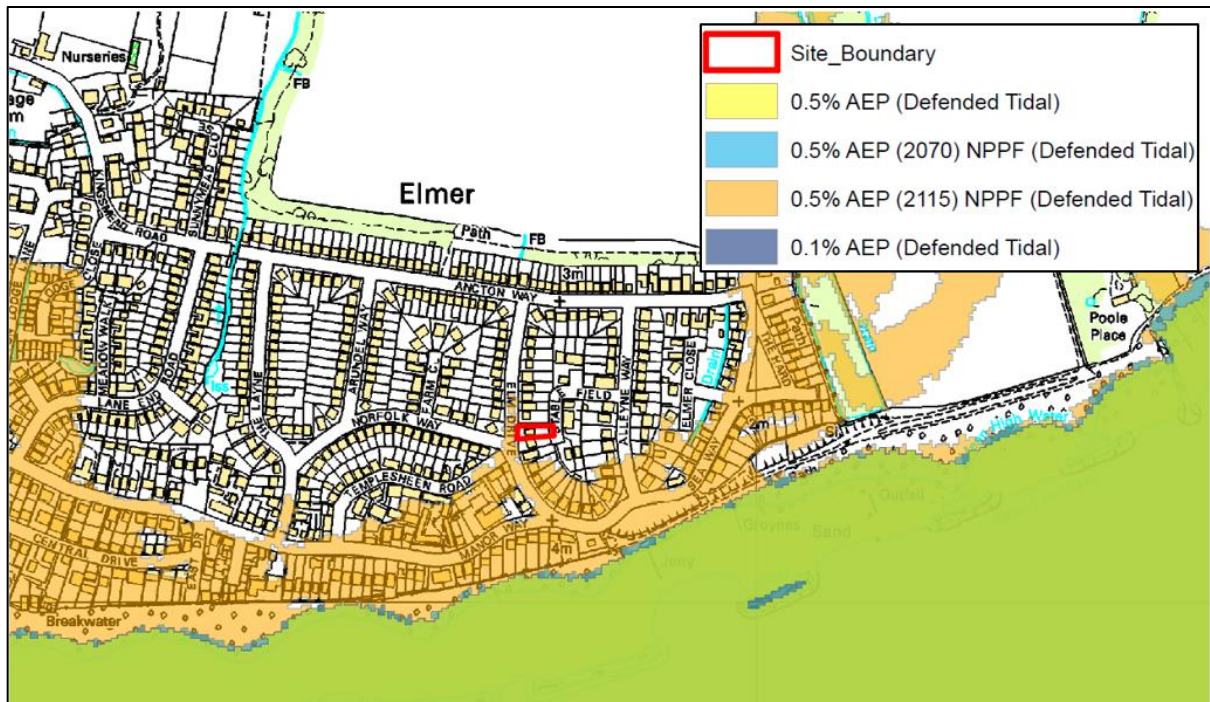


Figure 7 Modelled flood outlines in defended scenarios, showing location of site as redline boundary (Source: EA)

Fluvial

4.16 Elmer Rifer, an EA Main River, is located approximately 345m east of the site. This is a tributary of Ryebank Rife, which is further north of the site.

Surface Water (Pluvial)

4.17 The Environment Agency Flood Risk from Surface Water map (Figure 8) shows the site to be within an area of 'Very Low' risk of flooding from surface water. The road to the west of the site, Elm Drive, which provides the main access route, is shown to have areas of 'High' risk of flooding from surface water.

4.18 The following definitions of the annual surface water flood risk labels are given by the EA:

- 'High Risk'; >3.3% AEP (more often than 1 in 30)
- 'Medium Risk'; 3.3% to 1.1% AEP (between 1 in 30 and 1 in 100)
- 'Low Risk'; 1% to 0.1% AEP (between 1 in 100 and 1 in 1000)
- 'Very Low Risk'; <0.1% AEP (less often than 1 in 1000)

4.19 Ambiental have assessed the Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset on our internal GIS software. The 1 in 30-year, 1 in 100-year and 1 in 1,000-year flood extents and depths have been reviewed, which are indicative of the 'High', 'Medium' and 'Low' risk extents on the Environment Agency Flood Risk from Surface Water map. Ambiental have used the plans provided by the client to draw the existing and proposed built footprint of the development, and the site boundary.

4.20 Following this assessment, it has been confirmed that the site is located wholly outside the modelled flood extents for the 1 in 30-year, 1 in 100-year and 1 in 1,000-year surface water events, as shown in Figures 9, 10 and 11 respectively.

- 4.21 Elm Drive, the main access road to the site, is shown to be affected by flooding in all modelled surface water flood events. In both the 1 in 30-year event (Figure 9) and the 1 in 100-year event (Figure 10), parts of Elm Drive to the north of the site could be affected by flood depths of 150mm to 300mm, and 300mm to 600mm in some areas. The part of the road in front of the site is shown to remain unaffected by flooding in the 1 in 30-year and 1 in 100-year events, so access/egress is achievable.
- 4.22 As shown in Figure 11, Elm Drive directly in front of the site could be affected by flood depths of below 150mm and between 150mm and 300mm. Parts of Elm Drive to the north of the site could be affected by flood depths of 150mm to 300mm, and 300mm to 600mm in some areas.
- 4.23 Access and egress routes are discussed in Section 7 of the report.



Figure 8 EA Surface Water Flood Risk Map. (Source: EA)

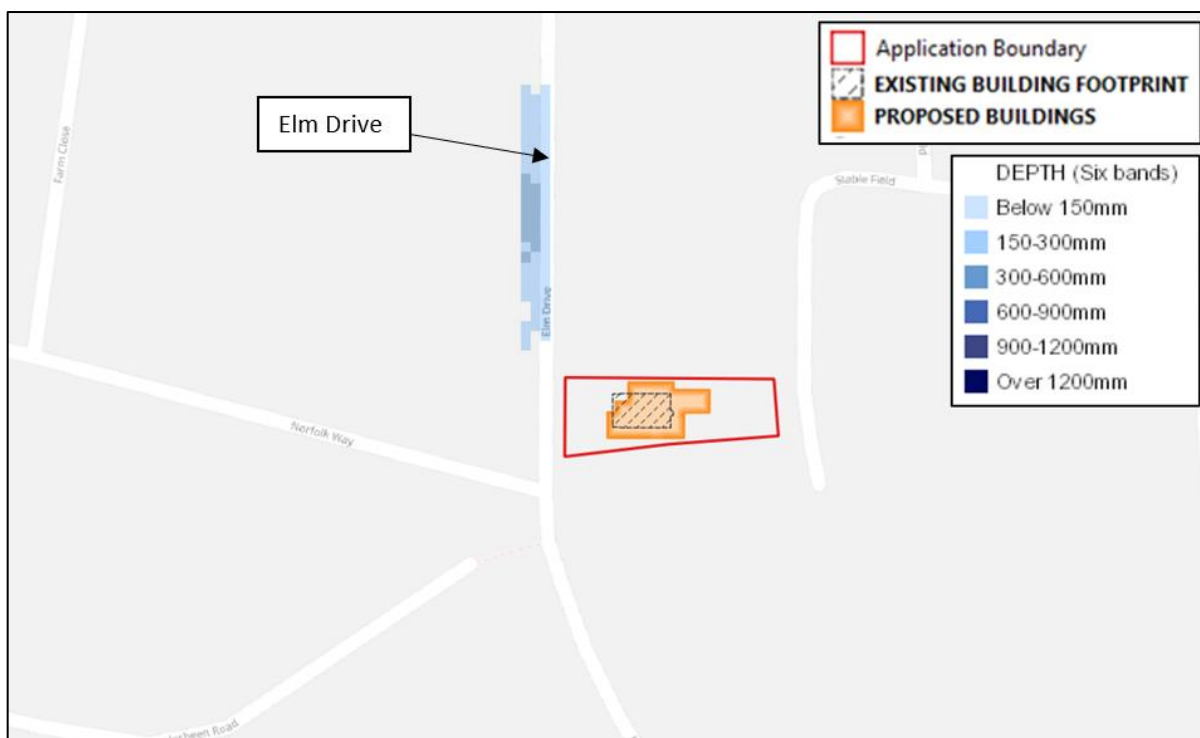


Figure 9 EA RoFSW modelled 1 in 30-year surface water flood depths (Source: EA)

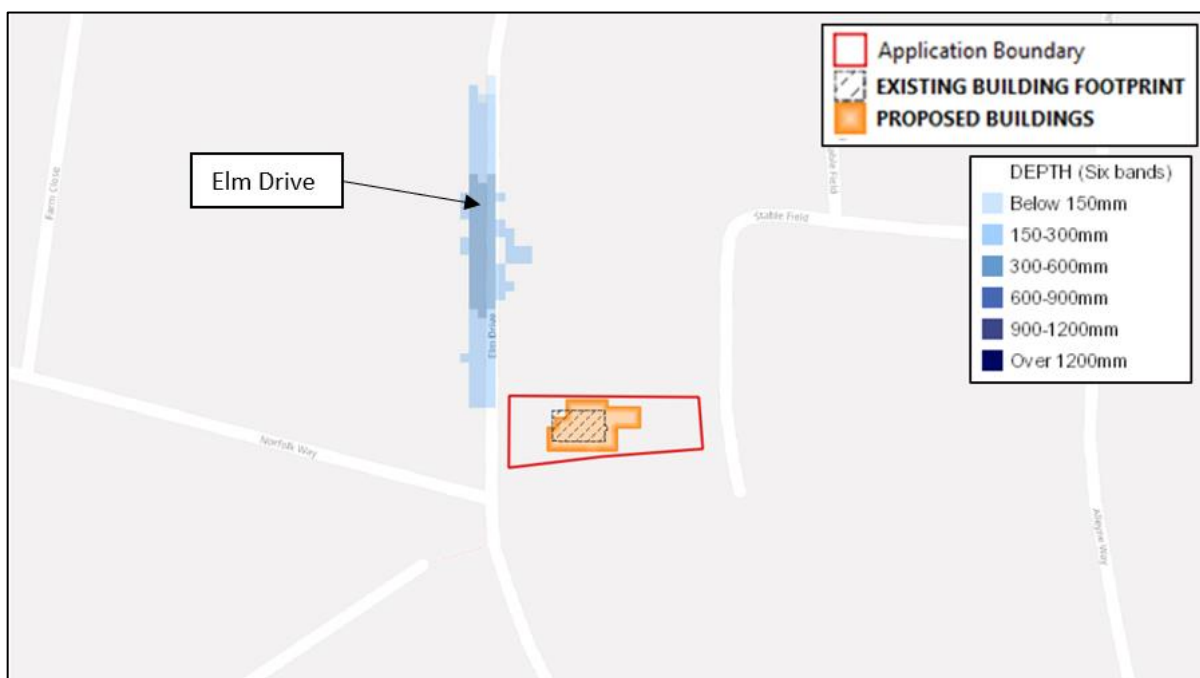


Figure 10 EA RoFSW modelled 1 in 100-year surface water flood depths (Source: EA)

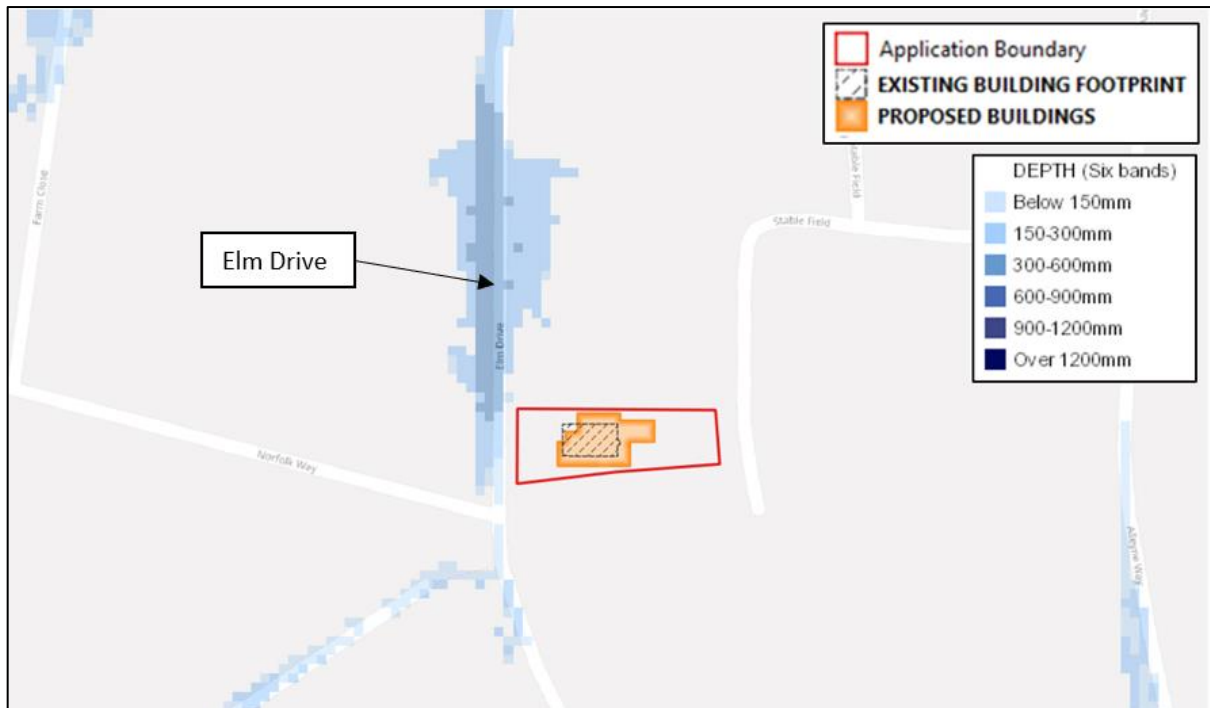


Figure 11 EA RoFSW modelled 1 in 1,000-year surface water flood depths (Source: EA)

Groundwater

- 4.24 Ambiental have used the British Geological Society's (BGS) Susceptibility to Groundwater Emergence mapping to discern whether there is any potential risk of flooding from groundwater at the proposed site.
- 4.25 As shown in Figure 12, the footprint of the proposed building is shown to be within an area identified as 'Potential for groundwater flooding to occur at surface'. This is considered as the highest risk category with regards to groundwater flooding.
- 4.26 As such, mitigation measures have been discussed in Section 7 of the report.

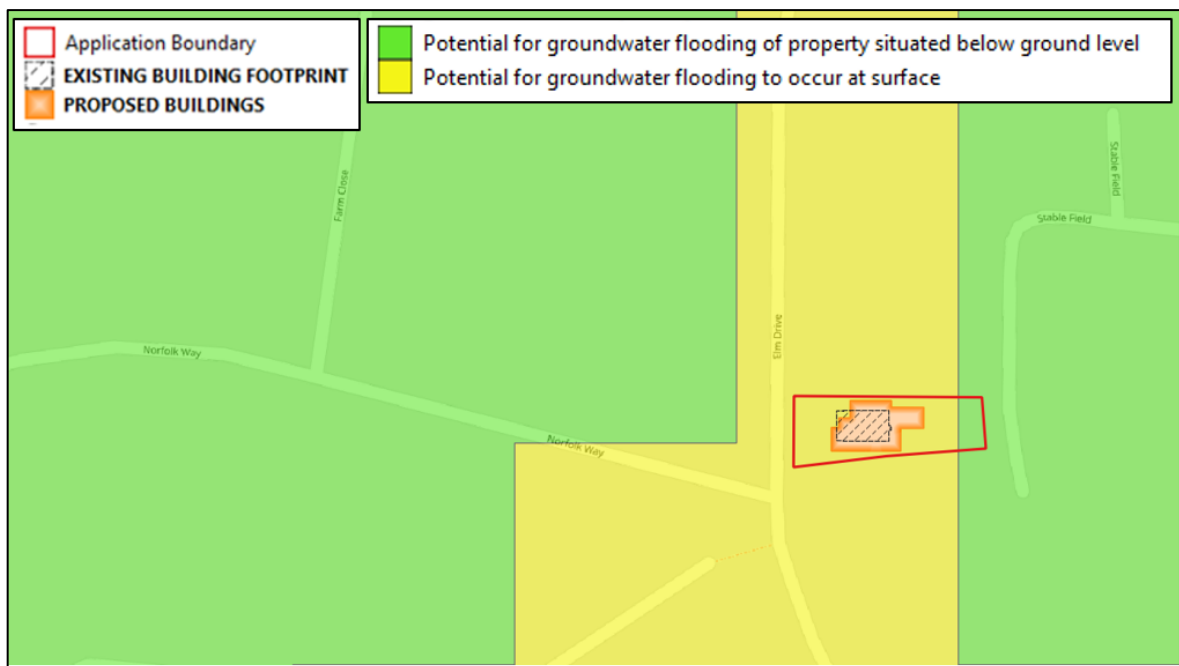


Figure 12 BGS Susceptibility to Groundwater Emergence mapping and location of proposed development

Sewer

- 4.27 Sewer Incident Report Form (SIRF) data was provided by Southern Water and included within the Arun District Council SFRA (2016). This data showed that there have been a total of 315 recorded flood incidents in the district, at the time at which the SFRA was written. There are 27 recorded incidences of sewer flooding within postcode area PO22 6, where the site is located. Due to the nature of this information, it is not known whether the existing property on site has been affected by sewer flooding in the past.
- 4.28 Any new sewer connection created as part of the development proposals should be first agreed with the local sewer provider and fitted with non-return valves to mitigate the risk of sewer flooding.

Surface Water Drainage Strategy

- 4.29 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling with a slightly greater built footprint.
- 4.30 In order to mitigate flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water runoff is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.
- 4.31 The runoff generated will need to be managed in accordance with the National Planning Policy Framework (NPPF 2019) policy which requires the use of Sustainable Drainage Systems (SuDS). The design guidelines for the SuDS should follow the recommendations set out in Local guidance for the South East of England, provided within the 'Water. People. Places. A guide to master planning sustainable drainage into developments' document.
- 4.32 The management of surface water has been considered in respect to the SuDS hierarchy (Table 4 below) (as detailed in Building Regulations Part H and within the CIRIA 753 'The SUDS Manual', Section 3.2.3):

SuDS Drainage Hierarchy				
			Suitability	Comment
	1.	Infiltration	x	Poor levels of infiltration could be achieved at the site, due to naturally wet soil in this area (according to Soilscales online)
	2.	Discharge to Surface Water	x	There are no open surface water features neighbouring the site, therefore a direct connection cannot be achieved.
	3.	Discharge to Surface Water Sewer, Highway Drain or another Drainage System	✓	The site currently benefits from positive drainage.
	4.	Discharge to Combined Sewer	-	

Table 4: SuDS Hierarchy

- 4.33 To achieve the reduction in site run off rates, the use of various SuDS has been considered for the development as follows:

Suitability of SuDS Components

SuDS Component	Description	Constraints and Opportunities	Suitability
Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils.	Site is located over chalk, with superficial deposits comprising of sand and gravel. The soils underlying the site are ' <i>Loamy soils with naturally high groundwater</i> ', with naturally wet soil (Source: Soilscape online). As such, poor levels of infiltration could be achieved at this site.	x
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	Permeable paving should be provided within suitable hardstanding areas.	✓
Green / Blue Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	Green/blue roofs may not be suitable for this site, as the proposed replacement dwelling has a pitched roof structure.	x
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable areas, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	This could be a suitable method for this development.	✓
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design.	There is limited space on the proposed site for large SuDS devices to be implemented, such as these.	x
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance. They also provide effectiveness in pre-treatment removal of silts.		x
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution using engineer soils and vegetation. They are particularly effective in delivering interception but can also be an attractive landscape feature whilst providing habitat and biodiversity.		x
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.		x
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as a neighbourhood.		x
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	If necessary, these could be provided to complement the other SuDS solutions.	✓

Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS.	If necessary, these could be provided to complement the other SuDS solutions.	x
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	These may be used to provide interception drainage for overland flows from offsite.	x

Table 5 Suitability of SuDS Components

4.34 Ambiental have used the site plans provided by the client to measure the areas of the approximate built footprint of the existing and proposed dwellings, as well as the site boundary. The measurements are as follows:

- The site has an area of approximately 582m².
- The existing residential dwelling has a built footprint of approximately 81m².
- The footprint of the proposed replacement dwelling is approximately 183m².
- There will be an increase in built footprint on site of approximately 102m².

4.35 Greenfield runoff rates have been calculated using the HR Wallingford Tool. The calculations are shown in Table 6 below and included in Appendix 3. The site area is associated with a greenfield runoff rate (QBAR) of 0.289 l/s.

4.36 Ambiental have completed initial attenuation storage calculations using the online HR Wallingford Tool. By restricting runoff flow rates to 1 l/s, the calculations demonstrate that the attenuation storage volume required for managing runoff from the site, taking account of the entire footprint of the proposed replacement dwelling (0.018ha), would be approximately 4m³. The calculations have been included in Appendix 3.

SURFACE WATER DISCHARGE RATES SUMMARY					
	Area (ha)	Discharge Rates (l/s)			
		1 year	2 year/Q _{BAR}	30 year	100 year
Greenfield runoff	1	4.1	4.82	11.1	15.39
Greenfield runoff site	0.06	-	0.289	-	-
Existing dwelling	0.01	-	0.048	-	-
Proposed dwelling	0.018	-	0.096	-	-

Table 6: Surface water discharge rates summary

4.37 The site is positively drained as existing. Given that the proposal is for the replacement of the existing dwelling on site, with an increase in built footprint of approximately 102m², it is recommended that the surface runoff is discharged via the existing drainage infrastructure. The additional surface water runoff generated as a result of the increased footprint should be attenuated by being temporarily stored in a rainwater harvesting system, such as water butts or rain planters. Water butts can provide non-potable water uses on site and rain planters can provide additional ecological benefits to the site.

Records of Historical Flooding

4.38 The Arun District Council SFRA (2016) includes mapping of historic flood events. As indicated in Figure 13 below, the site is located in an area which has been affected by surface water flood events. It is not known whether the site has been affected by flooding in the past.

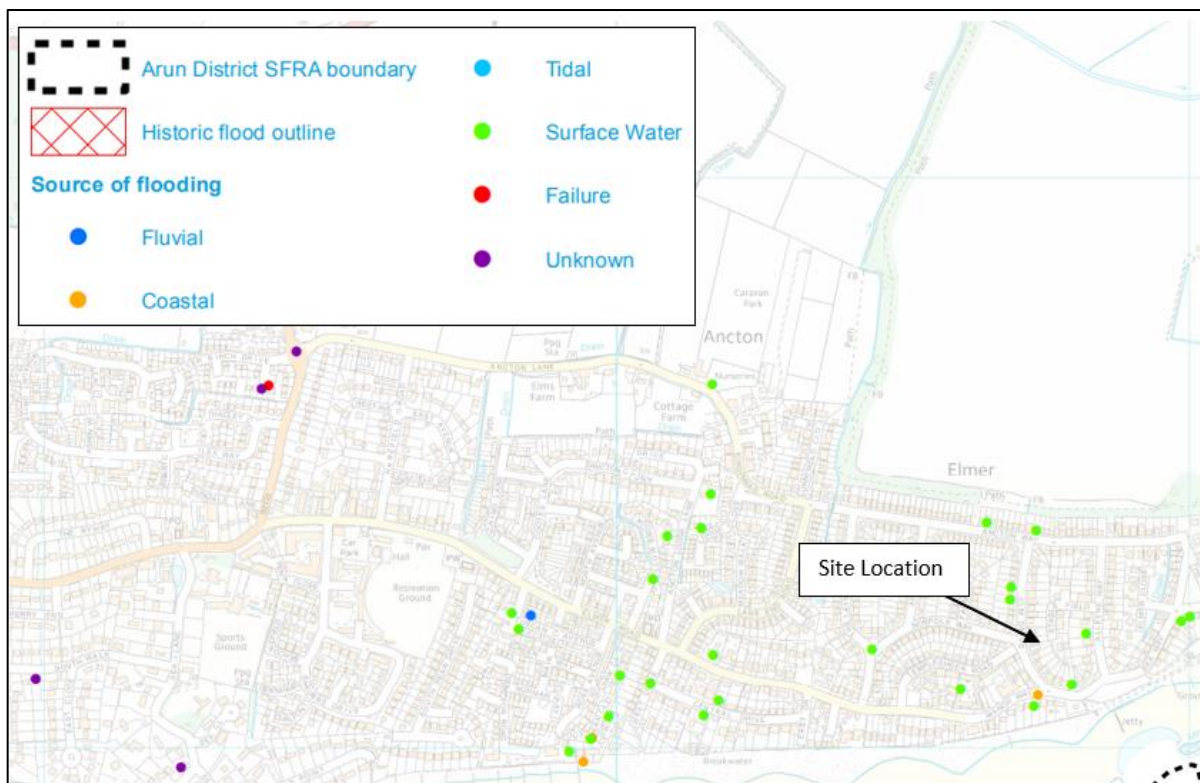


Figure 13 Extract from historic map in Arun DC SFRA (2016), indicating approximate location of site

5. Probability of Flooding

Flood Zones

- 5.1 According to the EA Flood Map for Planning, the site is located within Flood Zone 3 (high risk of flooding).
- 5.2 The EA Flood Map for Planning has been produced in part using a relatively coarse, national scale flood modelling strategy, and in part by detailed modelling. It is important to note that only the potential floodplain is modelled; **the mitigating effects of any flood defences currently in place are not considered.** For reference, the definition of the NPPF flood risk zones is included below (Table 7).

Zone	Description
1	Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium Probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
3a	High Probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
3b	The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. SFRA's should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).

Table 7 Definition of the NPPF Flood Zones. (Source: EA)

Climate Change on Site

- 5.3 Climate change is likely to increase the flow in rivers, raise sea levels and increase storm intensity. The range of allowances in *Table 8* is based on percentiles. A percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flows fall below it and half fall above it.
- 5.4 The:
- central allowance is based on the 50th percentile
 - higher central is based on the 70th percentile
 - upper end is based on the 90th percentile
- 5.5 So, if the central allowance is 30%, scientific evidence suggests that it is just as likely that the increase in peak river flow will be more than 30% as less than 30%.
- 5.6 At the higher central allowance, 70% of the possible scenarios fall below this value. So, if the higher allowance is 40%, then current scientific evidence suggests that there is a 70% chance that peak flows will increase by less than this value, but there remains a 30% chance that peak flows will increase by more (Source: EA).

- 5.7 The risk of flooding to the site would, therefore, be expected to increase following the effects of climate change. The likely increases in peak rainfall intensity would also lead to an increased risk of surface water flooding.

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Central	Central	Central	Central	None
2	Upper End	Higher Central and Upper End	Higher Central and Upper End	Central and Higher Central	Central
3a	Upper End	Development should not be permitted	Higher Central and Upper End	Central and Higher Central	Central
3b	Upper End	Development should not be permitted	Development should not be permitted	Development should not be permitted	Central

Table 8: Allowance and Flood Zone Table (Source EA)

- 5.8 The proposed development is 'More Vulnerable' (residential) and is in Flood Zone 3.
- 5.9 With reference to Table 7, 'More Vulnerable' developments in Flood Zones 2 and 3a should consider the 'Higher Central' and 'Upper End' allowances.
- 5.10 Ambiental have received modelled flood information from the Environment Agency for the site. This includes modelled flood levels in the climate change scenarios, extracted from the River Arun to East Head Coastal Modelling Study, completed in 2016 by JBA Consulting.
- 5.11 The flood data demonstrates that the site should benefit from flood defences in the modelled 1 in 200-year tidal events in both the 2070 and 2115 epochs.
- 5.12 Environment Agency climate change allowances were updated in December 2019 for tidal and coastal flooding. Given that the model used here was completed in 2016, it does not take account of the updated allowances. The EA's latest climate change allowances for tidal and coastal flooding have been applied to the present-day flood level experienced on site in the 1 in 200-year event.
- 5.13 After applying the climate change allowances, which are dependent on the year the model was completed (2016 and the region of the UK (south-east)), it has been demonstrated that the cumulative sea-level rise could be approximately 1.11m in the 'Higher Central' scenario and 1.49m in the 'Upper End' scenario. When this is added to the present-day flood level extracted on site in the 1 in 200-year undefended event (3.88mAOD), the total sea level is calculated to be 4.99mAOD in the 'Higher Central' scenario and 5.37mAOD in the 'Upper End' scenario. This is shown in Table 9 below.
- 5.14 Ambiental have then used the existing ground levels of the site according to the topographic survey provided by the client, to assess the potential flood depths at the site as a result of sea level rise due to climate change. The existing ground levels are between 3.60mAOD and 3.70mAOD. During the 'Higher Central' scenario, maximum flood depths of 1.39m could be experienced on site. In the 'Upper End' scenario, the site could be affected by maximum flood depths of 1.77m. It should be noted that the undefended climate change scenarios represent the flooding which could occur in the future if there were no flood defences benefitting the site.

5.15 Furthermore, this is a crude analysis which does not take account of the protection provided by the recently completed Elmer coastal defences. Given that the Elmer coastal defences were completed in 2020, they should provide the proposed site with protection for years to come.

		Year					
Start Year		2020	2036	2066	2096		
End Year		2035	2065	2095	2125		
Length of time (years)		15	30	30	30		
Sea level rise per year (mm)	Higher Central	5.7	8.7	11.6	13.1		
	Upper End	6.9	11.3	15.8	18.2	Cumulative sea-level rise 2020 to 2125	Total flood level (sum of 1:200-yr flood level on site and cumulative sea-level rise)
	High++	6	12.5	24	33	(metres)	(mAOD)
Cumulative rise (mm)	Higher Central	86	261	348	393	1.11	4.99
	Upper End	104	339	474	546	1.49	5.37
	High++	90	375	720	990	2.20	6.08

Table 9: Cumulative sea-level rise from 2020 to 2125 in South East region and total sea level, based on EA extreme sea level (1 in 200-year)

6. Residual Risks

Identification of Residual Risks

6.1 Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;
- failure of a reservoir, or;
- a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.

Defence Breach

6.2 The EA Flood Map for Planning (Figure 2) does not indicate that the site is in an area which benefits from formal flood defences. It is understood that coastal defences have recently been completed south of the site.

6.3 The EA have not provided any defence breach modelling for the site.

Reservoir Failure

6.4 The online EA Risk from Reservoir Flooding Map (Figure 14) demonstrates that the site is outside flood extents in the event of reservoir flooding.



Figure 14 EA Risk from Reservoir Flooding Map, showing approximate location of site (Source: EA)

Drainage Exceedance

- 6.5 In the event of drainage failure/exceedance, overland flows would be dictated by site topography. External levels should be designed to fall away from ground floor thresholds to direct overland flow away from the property and provide some mitigation against drainage exceedance.

7. Flood Risk Management Measures

Flood Risks

- 7.1 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling, with a slightly greater built footprint. Plans of the proposed development are in Appendix 1.
- 7.2 The site is in an EA Flood Alert/Warning Service Area, so residents should sign up to this service if they have not done so already. In the event of an EA Flood Warning, the site shall be evacuated for the duration of the warning.
- 7.3 Analysis has shown that the site would remain unaffected by flooding during the defended scenarios. As such, there is no requirement to raise the FFL of the proposed replacement dwelling. Flood resilience measures will be incorporated into the ground floor.
- 7.4 The climate change undefended scenario has been used to present a worst-case scenario. This flood level has been calculated to be 5.37mAOD with maximum flood depths of 1.77m. All sleeping accommodation will be located on the first floor (circa. 6.85mAOD), which is approximately 1.48m above this flood level.
- 7.5 The proposed replacement dwelling should incorporate flood resilience measures in line with current best practice for construction within an area at risk of flooding in line with CLG 2007 'Improving the Flood Performance of New Buildings. These measures are detailed below:
- Damp proof membranes should be included within the design of the dwelling to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping. Effective methods of joining membrane sections are overlaps of 300mm, and also taping (mastic tape with an overlap of 50mm minimum). Care should be taken not to stretch the membrane in order to retain a waterproof layer.
 - Cavity insulation should preferably incorporate rigid closed cell materials as these retain integrity and have low moisture take-up. Other common types, such as mineral fibre, are not generally recommended as they can remain wet several months after exposure to flood water which slows down the wall drying process. Blown-in insulation can slump due to excessive moisture uptake, and some types can retain high levels of moisture for long periods of time (under natural drying conditions).
 - Avoid standard gypsum plasterboard as it tends to disintegrate when immersed in water.
 - Any new electrical sockets should be installed above flood level (0.3m) for ground floors to minimise damage to electrical services and allow speedy re-occupation.
 - Windows and patio doors are vulnerable to flood water and similar measures to those used for doors should be taken. Special care should be taken to ensure adequate sealing of any PVC window/door sills to the fabric of the house. Of concern would be excessive water pressure on the glazing of patio doors. Double glazing conforming to the relevant standards would, in principle, adequately resist the pressures generated by flood waters.

Flood Warning Service

- 7.6 It is recommended that residents are aware of the EA Flood Information service which identifies whether any flood warnings or alerts have been issued for a specific postcode or place in England or Wales: <https://flood-warning-information.service.gov.uk/>.

- 7.7 During periods of bad weather, site users should monitor local weather reports and sign up for the Met Office UK weather warnings. Warnings can be monitored through an Apple/Android app, Twitter or directly via emails. Further information can be found at <https://www.metoffice.gov.uk/>.
- 7.8 The EA operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. Further information can be found on www.environment-agency.gov.uk/floodline. Floodline Warnings Direct is a free service operated by the EA that provides flood warnings direct to occupants by telephone, mobile phone, fax or pager.
- 7.9 The proposed development site is located within an EA Flood Warning Service Area. As such, it is recommended that site users sign up to this service, if they have not done so already.
- 7.10 Upon receipt of a Flood Warning, site users are advised to evacuate the site to a designated place of safe refuge within Flood Zone 1.
- 7.11 If flood waters along the proposed evacuation route have exceed 25cm, site users are advised, if possible, to seek refuge at the upper floors on site.

What to do if you receive a Flood Alert

- 7.12 A flood alert means you need to prepare, flooding is possible. You should:

- check your flood risk - <https://flood-warning-information.service.gov.uk/long-term-flood-risk>
- sign up for flood warnings - <https://www.gov.uk/sign-up-for-flood-warnings>
- keep up to date with the latest situation - call Floodline on 0345 988 1188 or follow @EnvAgency and #floodaware on Twitter for the latest flood updates
- have a bag ready with vital items like insurance documents and medications in case you need to leave your home
- check you know how to turn off your gas, electricity and water mains supplies
- plan how you'll move family and pets to safety



What to do if you receive a Flood Warning

- 7.13 A flood warning means you need to act, flooding is expected. You should do all the actions for a flood alert but also:

- move vehicles to higher ground if it's safe to do so
- move family and pets to safety
- move important items upstairs or to a safe place in your property, starting with cherished items and valuables, then furniture and furnishings
- turn off gas, electricity and water supplies if it's safe to do so; never touch an electrical switch if you're standing in water
- if you have property protection products such as flood barriers, or air brick covers, use them now
- keep track of the latest situation - <https://flood-warning-information.service.gov.uk/warnings>



What to do if you receive a Severe Flood Warning

7.14 A severe flood warning means there is danger to life: you must act now:

- call 999 if you're in immediate danger
- follow advice from the emergency services and evacuate if you're told to do so
- make sure you have an emergency kit including a torch, spare batteries, mobile phone and charger, warm clothes, important numbers like your home insurance, water, food, first aid kit and any medicines and baby care items you may need
- alert neighbours and offer help if it's safe to do so
- avoid driving or walking through flood water: just 30cm (1 foot) of fast flowing water could move your car and even shallow moving water can knock you off your feet
- keep your family and pets away from floodwater – it may contain heavy debris, sharp objects, open manhole covers, sewage and chemicals
- wash your hands if you've been in contact with flood water which may contain toxic substances



Flood Evacuation Plan

- 7.15 The controlling residual flood risk mechanism on site is tidal. Tidal flooding is generally caused by low pressure weather systems creating storm-surges (or storm tides), chiefly via high speed winds. These winds (and to a certain extent, the low pressure) create a 'bulge' of water which, if it coincides with high tide, can generate very high water levels. This mechanism is well understood, so it is very likely that an early warning would be issued before a tidal flood event. Given the nature of the tidal cycle, flood waters on site would likely recede as in-channel water levels fall. It should be noted however that there may not be time to provide a Flood Warning in the event of the sudden and catastrophic failure of flood defences.
- 7.16 As with all Flood Evacuation Plans, in the first instance, all residents and occupants should always defer to, and cooperate with, the direction provided by "Blue Light Responders". This is especially true in areas which under normal circumstances would be protected by flood defences.
- 7.17 Upon receipt of a Flood Warning, site users are advised to evacuate the site to a designated place of safe refuge.
- 7.18 Based on the EA Flood Zone extents, a recommended evacuation route from the site to a place of safe refuge in Flood Zone 1 has been provided in Figure 15. Upon receipt of a Flood Warning, residents should leave the site, turn left along Elm Drive and then immediately right, to join Norfolk Way. After approximately 80m, evacuees will be in an area of Flood Zone 1 (low risk). It is recommended that evacuees continue along this road, turn left at the junction with the Layne and then at the end of this road, turn right onto Elmer Road. There are bus routes along Elmer Road, which could be used to travel to a place of safe refuge. It is advised that evacuees continue along Elmer Road until they reach either St Nicholas Church or Middleton Jubilee Hall.



Figure 15 Recommended evacuation route shown as green arrows, from site to safe refuge in Flood Zone 1 (Source: EA)

8. Off Site Impacts

Impact to Flood Risk Elsewhere

- 8.1 The proposed development is for the demolition of the existing dwelling on site, followed by the construction of a replacement building. Given that the site is in an area of Flood Zone 3 which is tidally dominated, it is considered that flood compensatory storage is not required.

Generation of Runoff

- 8.2 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling with a slightly greater built footprint. There will be an increase in built footprint on site of approximately 102m².
- 8.3 In order to mitigate flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water runoff is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.
- 8.4 The site is positively drained as existing. Given that the proposal is for the replacement of the existing dwelling on site, with an increase in built footprint of approximately 102m², it is recommended that the surface runoff is discharged via the existing drainage infrastructure. The additional surface water runoff generated as a result of the increased footprint should be attenuated by temporarily storing in a rainwater harvesting system, such as water butts or rain planters. Water butts can provide non-potable water uses on site and rain planters can provide additional ecological benefits to the site.

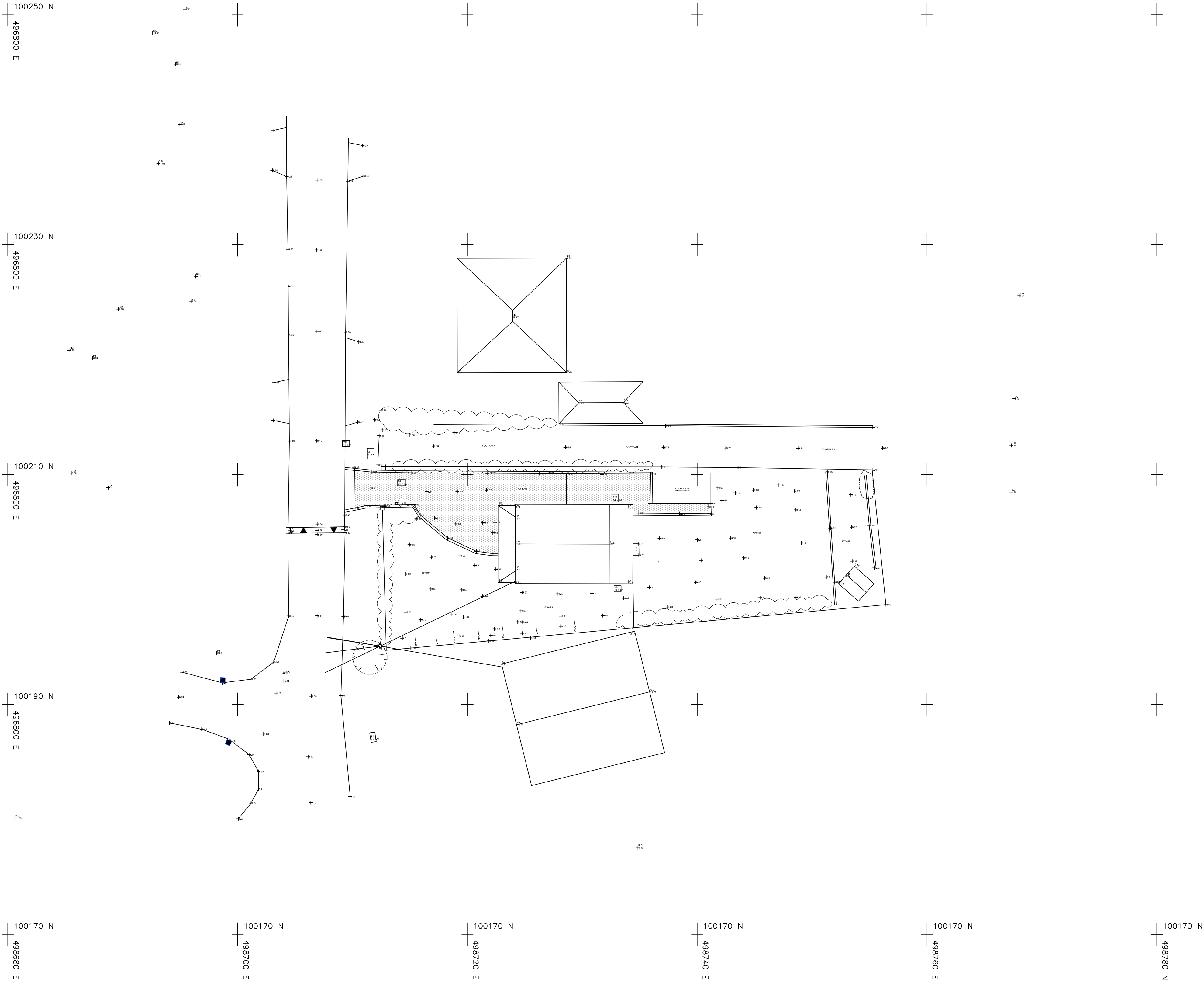
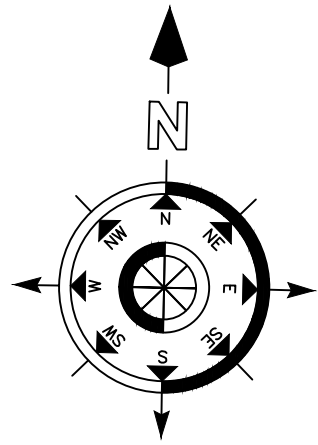
9. Conclusion

- 9.1 Ambiental Environmental Assessment has been appointed by Julia Maynard to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at 13 Elm Drive, Bognor Regis, PO22 6JE.
- 9.2 The site currently comprises of an existing residential dwelling. It is understood that the development is for the demolition of the existing dwelling, followed by the construction of a replacement dwelling with a slightly greater built footprint. Plans of the proposed development are in Appendix 1.
- 9.3 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is located within Flood Zone 3 (high risk of flooding from fluvial and tidal sources). The English Channel is approximately 185m south of the site (based on the Mean High-Tide Water Level) and Elmer Rife, an EA Main River, is approximately 345m east of the site.
- 9.4 The existing residential dwelling is considered “More Vulnerable” under Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance and the principles of the National Planning Policy Framework (NPPF). There will be no change in flood risk vulnerability of the site post-development.
- 9.5 Ambiental have received modelled flood information from the Environment Agency, including flood levels, depths and outlines for the proposed site.
- 9.6 Information provided by the EA indicates that there are flood defences located near the site, in the form of a sea wall, breakwaters and a sand and shingle beach. The sea wall has a crest height of 5.50mAOD and provides a standard of protection of 1 in 100. This indicates that the existing sea wall should provide protection to the site in the 1 in 100-year flood event.
- 9.7 The EA provided site-specific modelled flood information for both undefended and defended scenarios. The model used was the River Arun to East Head Coastal Modelling, completed in 2016 by JBA Consulting.
- 9.8 Using the EA flood data for the site, it is demonstrated that the site benefits from flood defences in the 1 in 200-year and 1 in 1,000-year present-day tidal flood events. Based on the 2016 model, the site should also be defended in the 1 in 200-year (2115 epoch) flood event. This does not take account of the EA’s latest climate change allowances.
- 9.9 It should be noted that the Elmer coastal defences scheme was completed in June 2020 and included the improvement of existing rock revetments and addition of shingle across existing defences. These defences should provide enhanced protection to the site from coastal flooding.
- 9.10 From a review of the plans, it is understood that the built footprint on site will increase by approximately 102m² as a result of the development. The site is in a coastal floodplain, so flood compensatory storage is not required.
- 9.11 The site is positively drained as existing. Given that the proposal is for the replacement of the existing dwelling on site, with an increase in built footprint of approximately 102m², it is recommended that the surface runoff is discharged via the existing drainage infrastructure. The additional surface water runoff generated as a result of the increased footprint should be attenuated by temporarily storing in a rainwater harvesting system, such as water butts or rain planters. Water butts can provide non-potable water uses on site and rain planters can provide additional ecological benefits to the site.
- 9.12 The following mitigation measures are recommended for the proposed replacement dwelling:

- Residents should sign up to the EA Flood Warning service if they have not done so already. In the event of an EA Flood Warning, the site shall be evacuated for the duration of the warning.
- All sleeping will be located on the first floor and above, set at 6.85m AOD, approximately 1.48m above the undefended 1:200 year plus climate change flood level (5.37m AOD).
- The proposed replacement dwelling should incorporate flood resilience measures in line with current best practice for construction within an area at risk of flooding in line with CLG 2007 'Improving the Flood Performance of New Buildings. These are outlined in Section 7 of the report.
- Additional SuDS devices could be implemented to provide some additional betterment.

Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Appendix I - Site Plans



NOTES

- DO NOT SCALE OFF THIS DRAWING EXCEPT FOR PLANNING PURPOSES
- CHECK ALL DIMENSIONS ON SITE BEFORE ANY WORK IS COMMENCED
- ALL GOODS MATERIALS AND WORKMANSHIP MUST CONFORM WITH CURRENT BUILDING REGULATIONS, BRITISH STANDARDS AND CODES OF PRACTICE
- COPYRIGHT OF THIS DRAWING IS RETAINED BY THE ARCHITECT AND IT MUST NOT BE REPRODUCED WITHOUT WRITTEN CONSENT

LEGEND

BANKING		SLOPING MASONRY	
BUSHES & HEDGES		FENCE	
MARSH		WALL	
TREES		BUILDING	
NOTE: SPOT HEIGHTS AND HEIGHTS ARE INDICATIVE ONLY		OPEN SIDED BUILDING	
GATES		GLASS ROOFED	
RETAINING WALL		CONTOURS	
		OVERHEAD WIRES	

ABBREVIATIONS (WHERE APPLICABLE)

AIR VALVE	AM	MANHOLE	MH
BED LEVEL	BL	MARKER	MKR
BEISHA BEACON	BB	NOTICE BOARD	NB
BOLLARD	B	NAME PLATE	NP
BRITISH TELECOM BOX	BTB	OVERHEAD WIRES	OW
BRITISH TELECOM MANHOLE	BTMH	PARKING METER	PM
BRIKWORK	BRWK	ROOF LEVEL	RID
BUS STOP	BS	ROAD SIGN	RS
CABLE TV	CATV	RODDING EYE	RE
COVER LEVEL	CL	RETAINING WALL	RTW
CABLE MARKER	CM	SLUCE VALVE	SV
CONCRETE POST	CP	STOP COCK	SC
DOWN PIPE	DP	SOFFIT LEVEL	SOF
DROP KERB	DK	SPOT LEVEL	SL
EAVES LEVEL	EA	STRUCTURAL SLAB LEVEL	SSL
ELECTRICITY CABLE PIT	ELCP	STATION	STN
ELECTRICITY CONTROL BOX	ECB	TREE STUMP	ST
ELECTRICITY POLE	EP	TELEGRAPH POLE	TP
EARTH ROD	ER	TELEPHONE CALL BOX	TCB
FIRE HYDRANT	FH	TURNSTILE	TS
FLOWER BED	FB	TRAFFIC LIGHT	TL
FLOOR LEVEL	FL	TOP OF WALL	TW
FLAG STAFF	FS	UNDERGROUND	UG
GAS VALVE	GV	UNABLE TO LIFT	UTL
GATE STOP	GS	UNABLE TO SURVEY	UTS
GULLY	G	VENT PIPE	VP
GULLY OUTLET	GO	WATER LEVEL	WL
INSPECTION COVER	IC	WATER METER	WM
INVERT LEVEL	IL	WASH OUT	WO
LAMP POST	LP	WASTE PIPE	WP
LETTER BOX	LB	WATER VALVE	WV

BUILDING

ACCESS HATCH	AH	WINDOW CILL LEVEL	WCL
ARCH HEAD HEIGHT	AHH	WINDOW HEAD LEVEL	WHL
ARCH HEAD LEVEL	AHL	SKYLIGHT	SL
ARCH SPRINGER HEIGHT	ASH	SOIL AND VENT PIPE	SVP
ARCH SPRINGER LEVEL	ASL	THRESHOLD LEVEL	TL
BEAM	BE	WASH BASIN	WB
BEAM HEIGHT	BH	WATER TANK	WT
BEAM HEAD LEVEL	BHL		
BEAM SOFFIT LEVEL	BSL		
COLUMN	CH		
CILL TO HEAD	C/H		
CEILING LEVEL	CL		
DOOR HEAD	DH		
DOOR HEAD LEVEL	DHL		
FIRE ALARM	FA		
FLOOR TO CILL	F/C		
FALSE CEILING	FLC		
FLOOR TO CEILING HEIGHT	F/CH		
FINISHED FLOOR LEVEL	FFL		
HIRE REEL	HR		
ROOF LEVEL	RL		
RADIATOR	RAD		
RAIN WATER PIPE	RWP		

FENCES

BARRIED WIRE FENCE	BWF
CORRUGATED IRON FENCE	CIF
CLOSE BOARD FENCE	CBF
CHAIN LINK FENCE	CLF
CHESTNUT PALING FENCE	CPF
FENCE POST	FPO
INTERWOVEN FENCE	IWF
IRON RAILING FENCE	IRF
LARCH LAP FENCE	LLF
MISCELLANEOUS FENCING	Misc.F
PALISADE FENCE	PF
POST AND CHAIN FENCE	PCF
POST AND RAIL FENCE	PRF
POST AND WIRE	PWF
TUBULAR STEEL RAIL	TSRF
WIRE MESH FENCE	WMF

(Concrete Post/Steel Post/Timber Post) (CPS/SPS/TPS)

REV	DATE	BY	AMENDMENT

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CLIENT

Mrs. J. Maynard & Mr S. Reddick

JOB TITLE

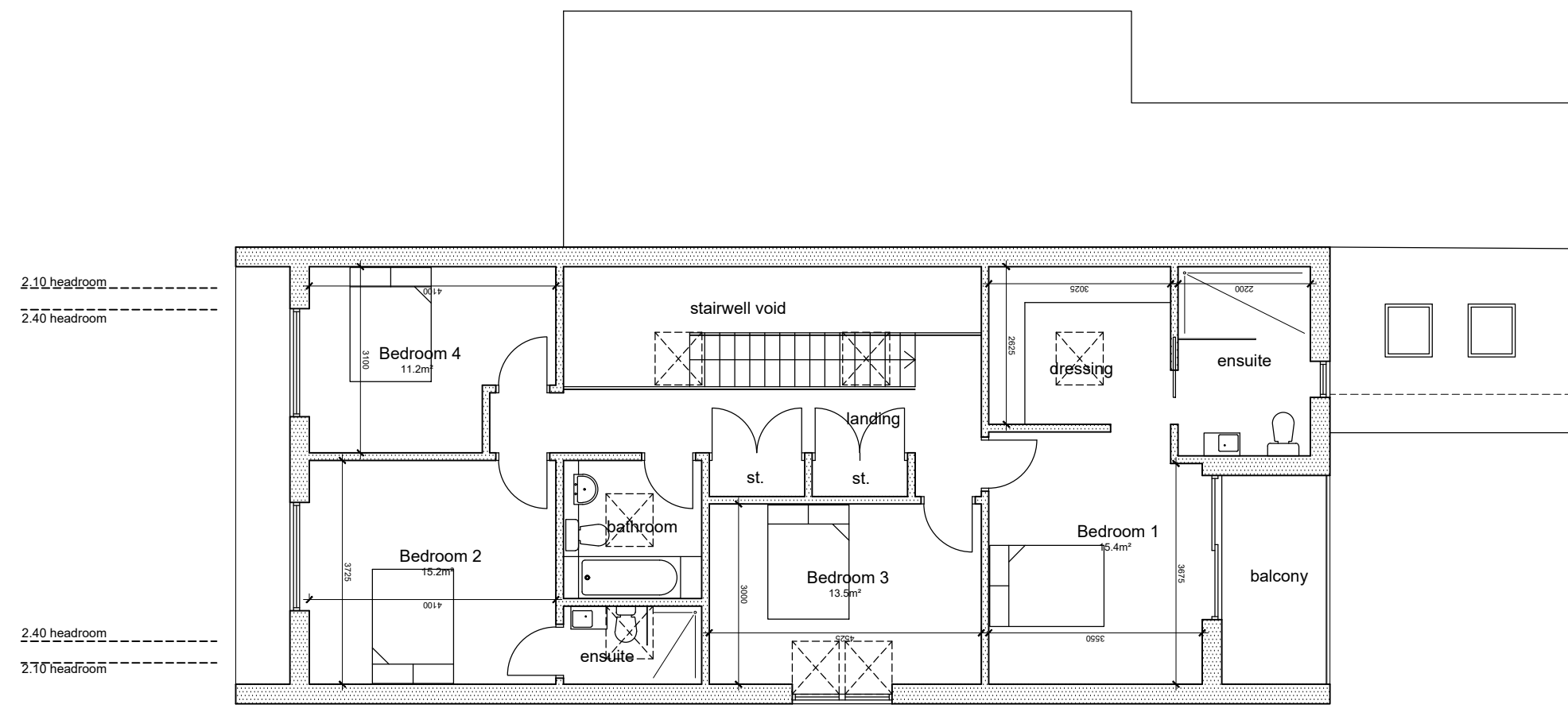
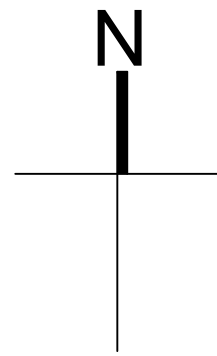
Replacement Dwelling
13 Elm Drive
Bognor Regis
West Sussex
PO22 6JE

DRAWING TITLE

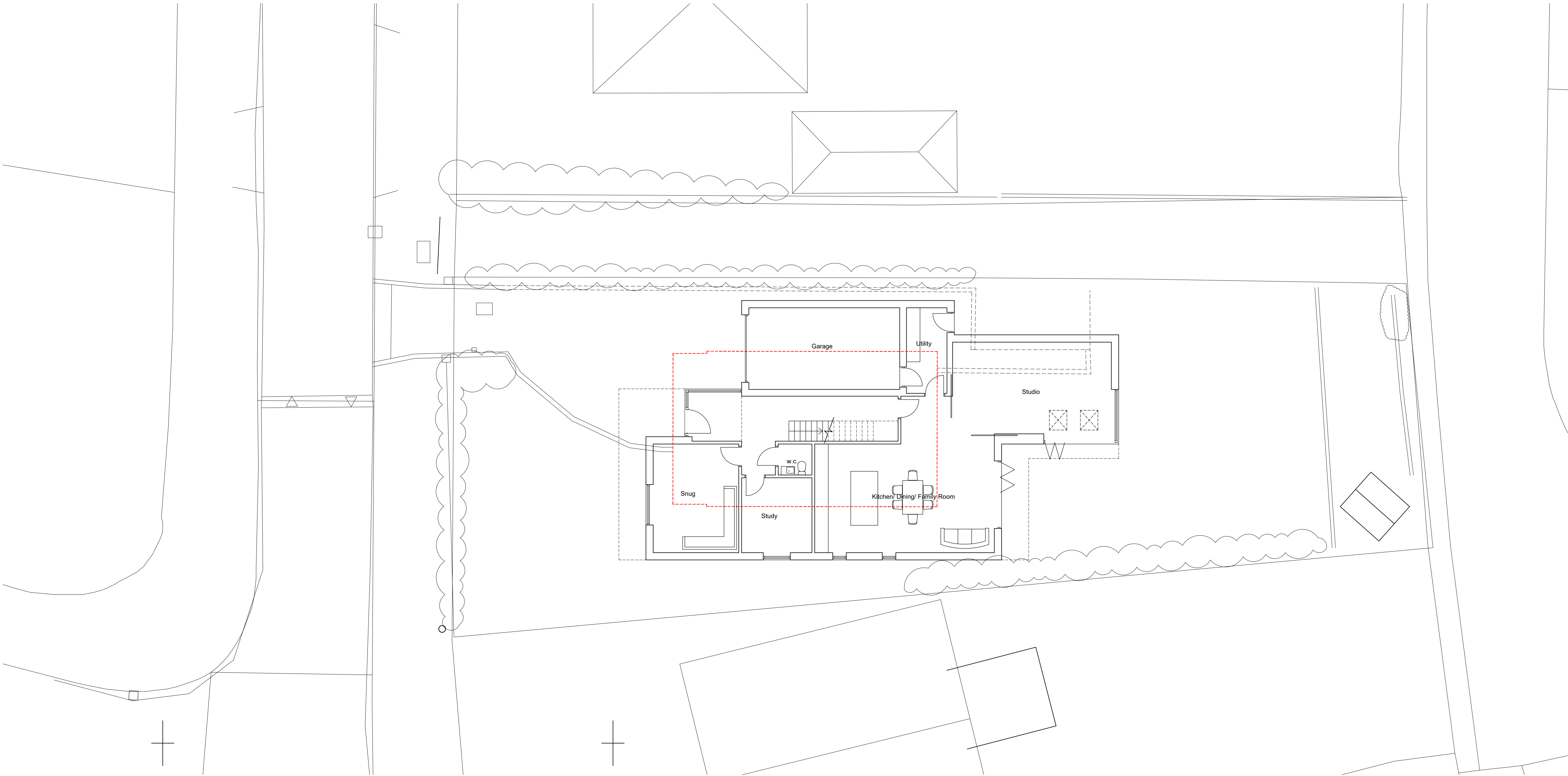
Topographical Survey

DATE	SCALE	DRAWN BY
24/5/2020	1:200 @ A1	LM
		CHECKED BY DT

JOB NO.	DRAWING NO.	REVISION
20030	1.01	



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REV	DATE	BY	AMENDMENT
A	30.07.2020	ec	gen updates

**folkes architects**

L 01903 888029
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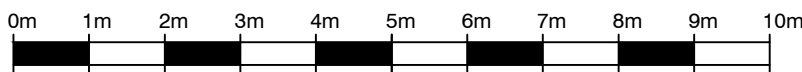
CLIENT
Julia Maynard

JOB TITLE
**13 Elm Drive
Bognor Regis
West Sussex
PO22 6JE**

DRAWING TITLE
Proposed Floor Plans

PRELIMINARY ISSUE

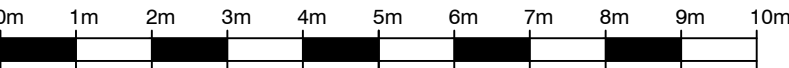
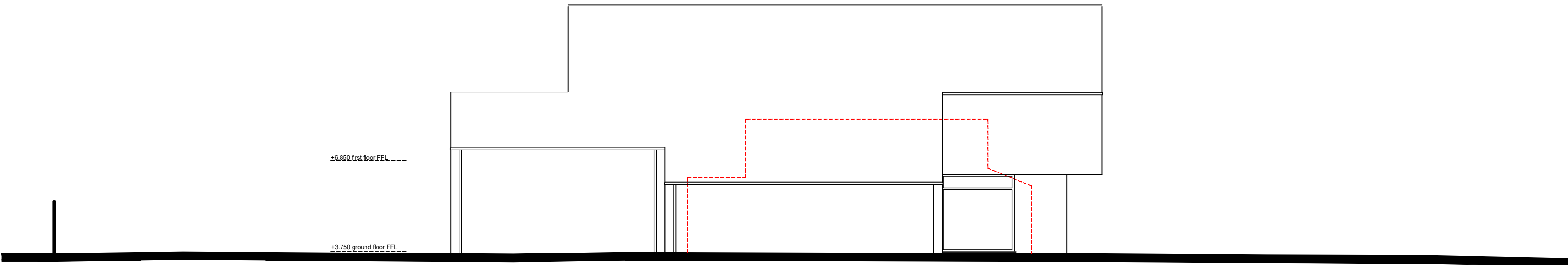
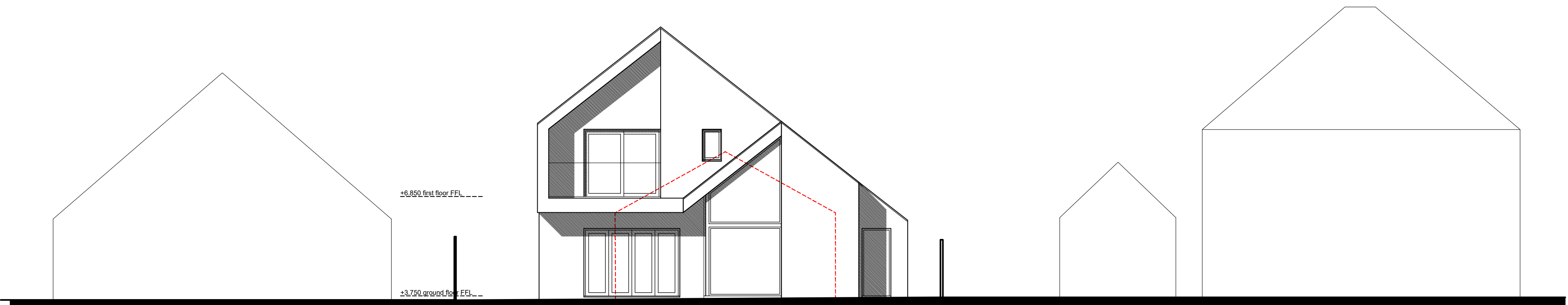
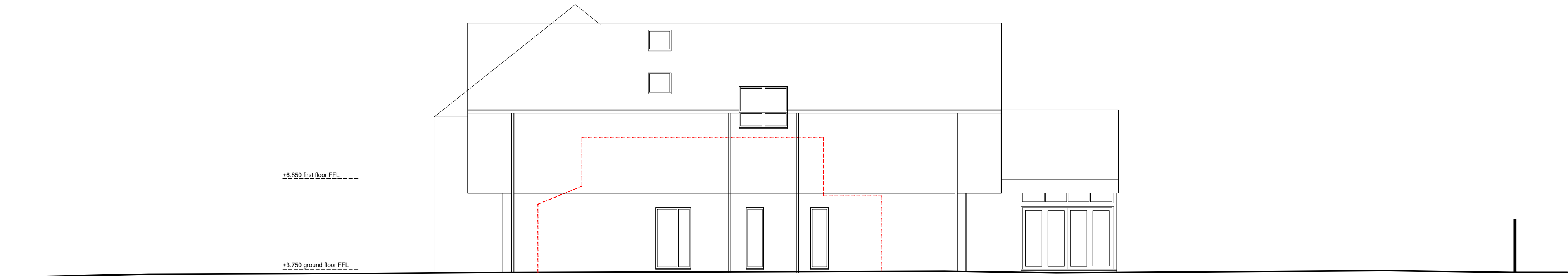
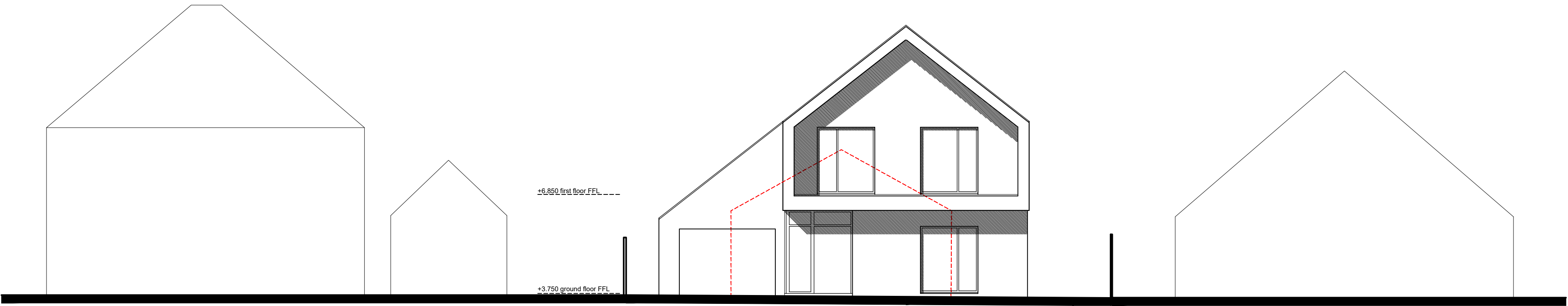
DATE July 2020	SCALE 1:100 @ A1	DRAWN BY EC
JOB NO. 20030	DRAWING NO. 2.02	CHECKED BY MF
		REVISION A



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NOTES

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A	30.07.2020	ec	gen updates
REV	DATE	BY	AMENDMENT

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DRAWING TITLE

Proposed Elevations

PRELIMINARY ISSUE

DATE	SCALE	DRAWN BY	EC
July 2020	1:100 @ A1	CHECKED BY	MF
JOB NO.	DRAWING NO.	REVISION	
20030	2.03	A	

Appendix II - EA Data

Flood Map for Planning (Rivers and Sea). Centred PO22 6JE. Created 18/12/2020.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

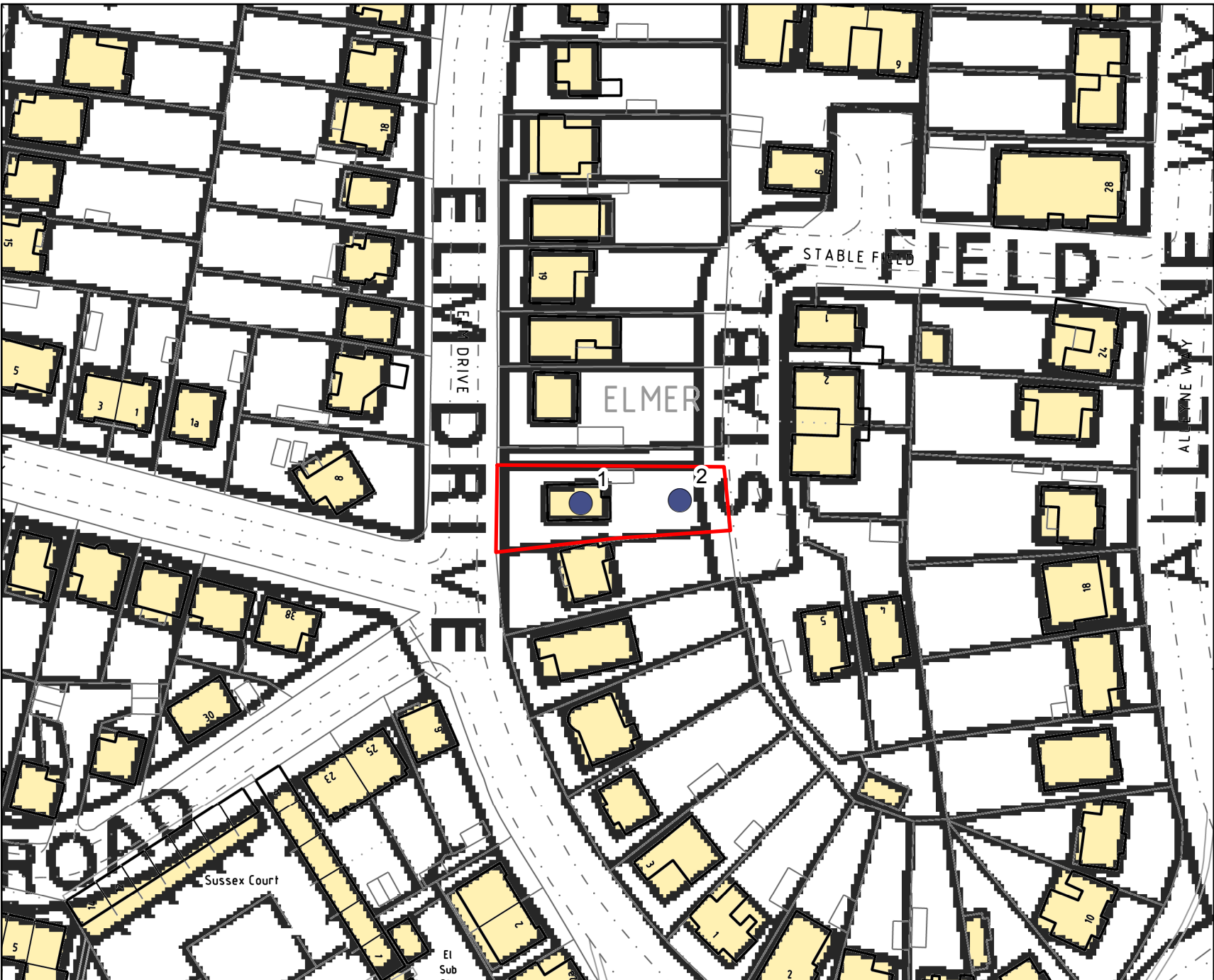
- - - Defences
- - - Flood Storage Areas
- ▨ Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

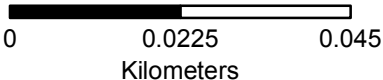
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.



Legend

- Site_Nodes
- Site_Boundary

Scale: 1:1,000



Product 4 Flood Risk Data Requested by: Ambiental
Site: 13 Elm Drive, Elmer, PO22 6JE

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	498729	100204	3.88	4.40	5.00	4.09
2	498747	100204	3.88	4.40	5.00	4.09

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	498729	100204	-	-	-	-
2	498747	100204	-	-	-	-

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	498729	100204	0.30	0.82	1.43	0.52
2	498747	100204	0.30	0.82	1.43	0.52

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	498729	100204	-	-	-	-
2	498747	100204	-	-	-	-

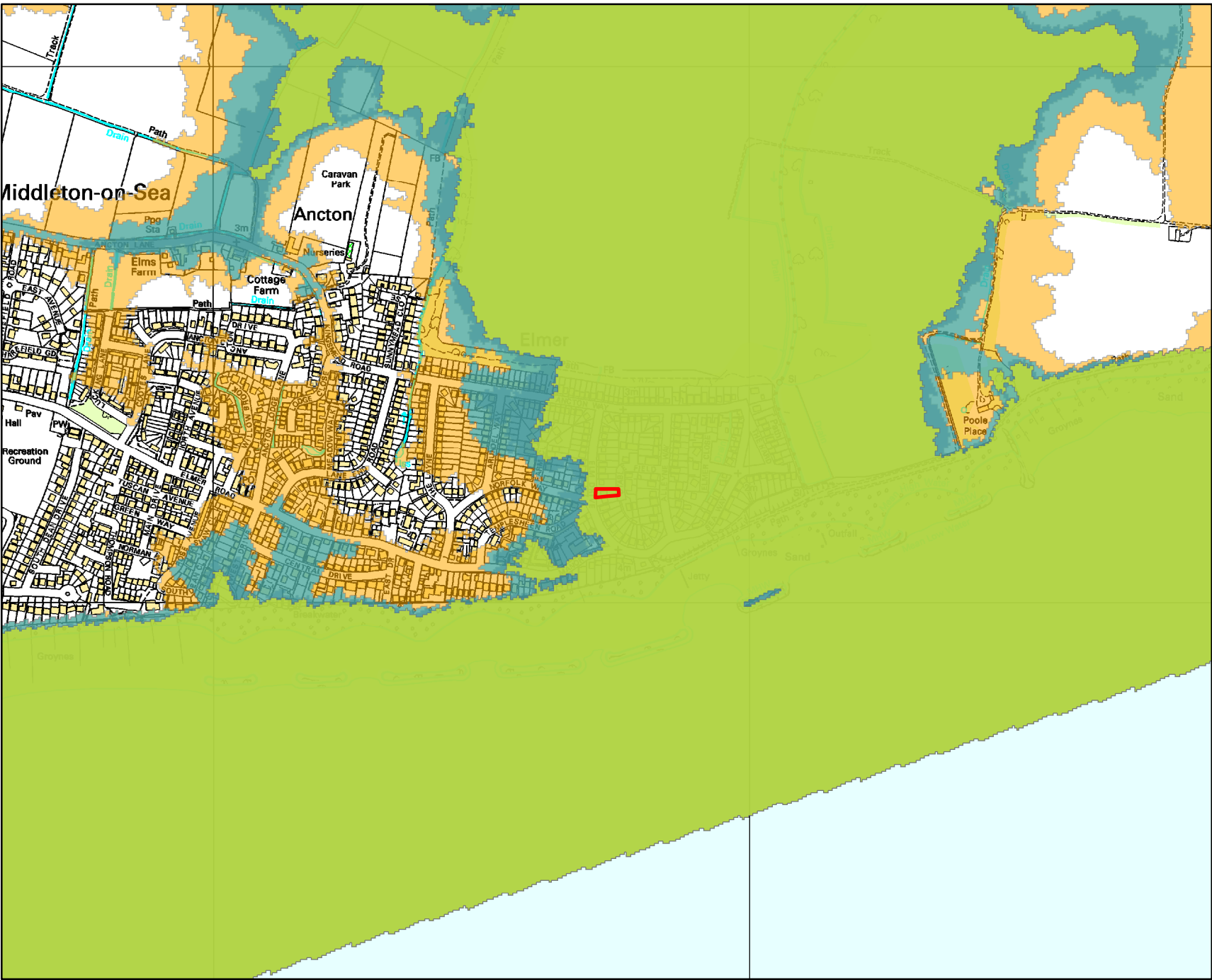
All levels taken from: River Arun to East Head Coastal Modelling (2016)

Produced on: 18/12/2020

*** The flood risk data provided is based on existing EA hydraulic models for existing 0.5% annual probability events with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 17 December 2019.**

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.

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

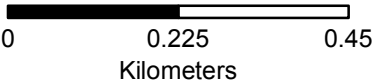


Legend

-  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





Environment
Agency



Legend



Site_Boundary



0.5% AEP (Defended Tidal)



0.5% AEP (2070) NPPF (Defended Tidal)



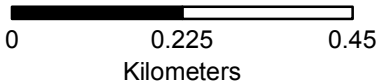
0.5% AEP (2115) NPPF (Defended Tidal)



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.

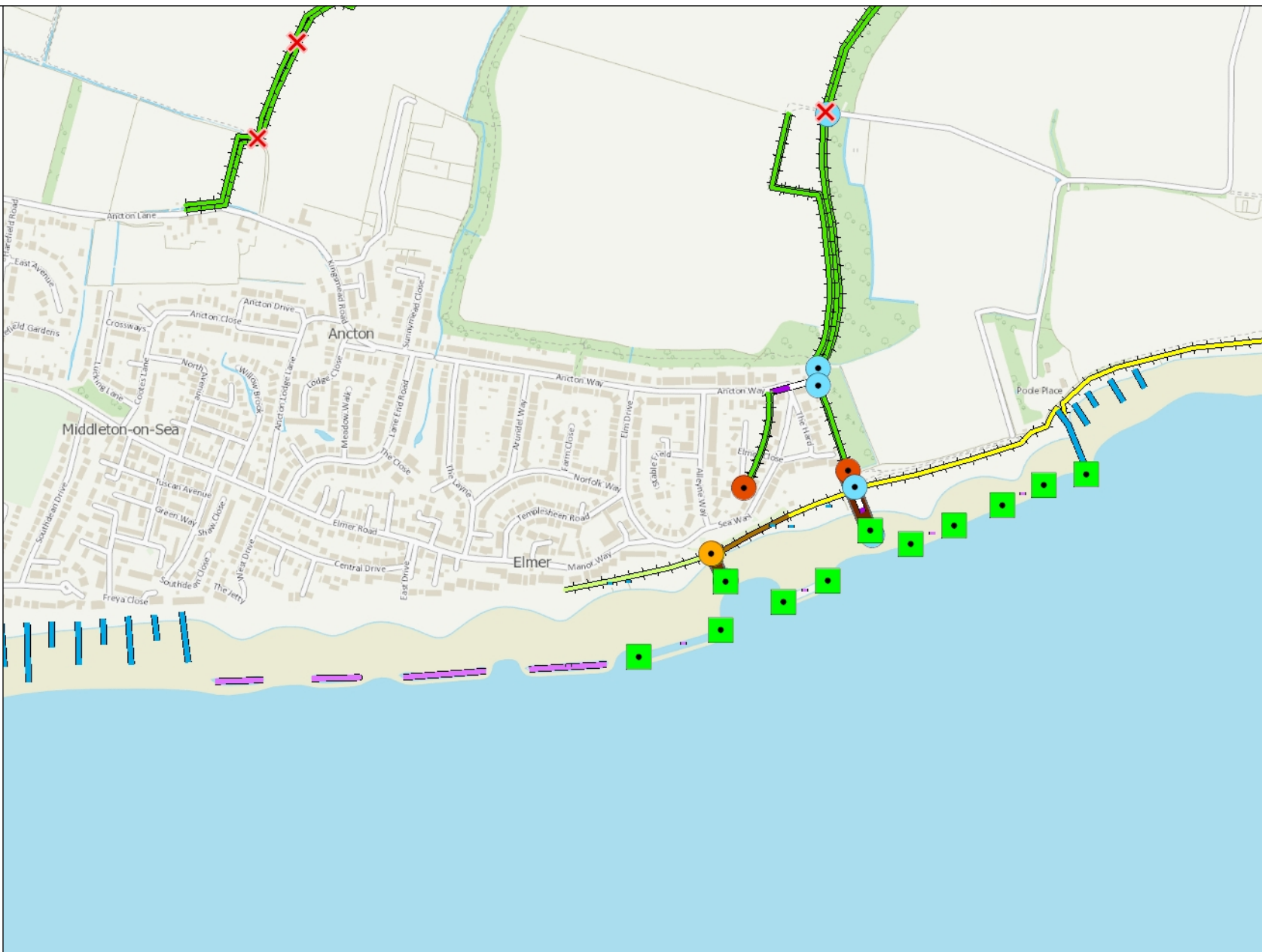
Scale: 1:10,000



Asset Locations. Centred PO22 6JE. Created 18/12/2020.

Legend

Please see page 2 for asset
symbology



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Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
- 
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

-  Open channel
-  Simple culvert
-  Complex culvert

Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier