

Flood Risk Assessment and outline SuDS strategy

For the proposed replacement dwelling at
Pemba, 18 Old Point, Middleton on
Sea, PO22 7RY

Prepared by
Dr Robin Saunders CEng
Innervision Design Ltd

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1 Executive Summary

- A. Part of the site's curtilment falls within Flood Zone 2/3a. This area, while falling within the overall curtilment of the proposal is not developed land and is not intended to be developed land;
- B. The developed area of the site lies wholly within Flood Zone 1.
- C. There is no documented evidence of flood risk from any other sources and the re-development does not impact on flood risk elsewhere.
- D. Safe access and egress is immediately available.
- E. The proposed development consisting of a single dwelling house located within Flood Zone 1 is considered acceptable.

2 Introduction

2.1 Site location

The development site is Pemba, 18 Old Point, Middleton on Sea, PO22 7RY (see Figure 1). The site is located immediately adjacent to the Coastline of the English Channel.

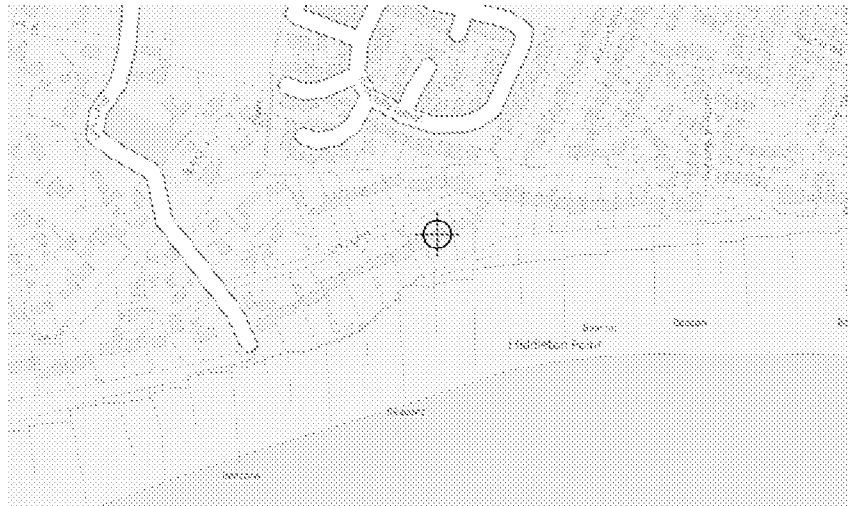


Figure 1: Site location plan, as indicated (source: EA flood mapping).

2.2 Development description

The proposal is for a replacement dwelling together with associated landscaping, Appendix A.

2.3 Site geology

Geological mapping data from within the vicinity indicate River Terrace Deposits (undifferentiated) - Sand, Silt And Clay.

2.3.1 Infiltration rates

Subject to testing on site, given the local geology and proximity to the sea, infiltration rates are expected to be high enough support infiltration devices.

Part I

Flood risk

3 Policies

In preparation for this Flood Risk Assessment (FRA), National Planning Policy Framework^[4] and British Standards on Assessing and Managing Flood Risk^[2] were reviewed, and their related policies were referred to in this report.

Furthermore, the Environment Agency was consulted in order to establish the flood zone of the proposed site. In addition, planning policies from the local Council were also reviewed including its Strategic Flood Risk Assessment.

Some of key planning policies are summarised as below.

3.1 National Planning Policy Framework (NPPF)

A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

3.1.1 Paragraph 158 - Sequential test

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

3.1.2 Paragraph 163

When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in

areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location;
- the development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

3.2 Sequential test

While the proposed location of the site lies wholly in flood zone 2 the curtailment of the donor site is within the same flood risk zone and already in domestic use. The sequential test is therefore deemed to be passed.

4 Flood risk analysis

4.1 Sources of potential flooding

Flood risk from various sources at the site is analysed in this section. It is concluded that the only source of flood risk at the site is tidal.

4.1.1 Flood risk from sea and rivers

Flooding can also take place from flows that are not contained within the channel due to high levels of rainfall in the catchment.

The site is not shown to be at risk from fluvial flooding.

Flooding can occur from the sea due to a particularly high tide or surge, or combination of both.

Part of the site is shown to be at risk from tidal flooding with part of the site classed as Flood Zone 3 (greater than 1 in 200yr) and part of the site in Flood Zone 2 (between a 1 in 200yr and 1 in 1000yr annual probability in any one year).

4.1.2 Area within curtailment of site classed as Flood zone 2/3

With reference to the EA flood maps, Figures 2, 3 and Appendix C, it is noted that part of the site's curtailment falls within Flood Zone 2/3. This is an area within the curtailment of the site adjacent to coastline.

Note: This area in flood zone 2/3, while falling within the overall curtailment of the proposal is not developed land, is not intended to be developed land and does not impact on any access or egress.



Figure 2: Site location plan, relative to flood zone 3



Figure 3: Site location plan, relative to flood zones 2

4.1.3 Area of site in Flood zone 1

The remainder of the site, including the location of the proposed dwelling is located within flood zone 1 (less than 1 in 1000yr annual probability of flooding in any one year).

Flood defences

The EA provided data indicated the site is offered some protection in the form of a beach erosion control, details at Appendix C.

4.1.4 Flood risk from groundwater

Groundwater flooding occurs when water levels in the ground rise above surface levels. It is most common in low-lying areas underlain by permeable rock (aquifers), usually due to extended periods of wet weather.

This is considered a Low risk to the site due to the proximity of the sea.

4.1.5 Flood risk from sewer and highway drains

Flooding occurs when combined, foul or surface water sewers and highway drains are temporarily over-loaded due to excessive rainfall or due to blockage.

With reference to the council's SFRA there is no documented evidence of flood risk from highway drainage networks at the proposed site.

Hence, the risk of sewer and highway flooding to the proposed site can be considered to be Low.

4.1.6 Flooding risk from surface water

Flooding occurs when rainfall fall on a surface (on or off the site) which acts as run off which has not infiltrated into the ground or entered into a drainage system.

The site is not shown to be at risk from surface water flooding, Figure 4.



Figure 4: Area at risk from surface water flooding relative to proposed development. (Source: EA online data)

4.1.7 Flood risk from infrastructure failure

Flooding occurs because of canals, reservoirs, industrial processes, burst water mains or failed pumping stations.

There is no documented evidence of flooding risk, to the site, arising from other infrastructure.

4.2 Flood risk vulnerability and flood zone “compatibility”

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
 × Development should not be permitted.

Figure 5: Flood risk vulnerability and flood zone compatibility^[3]

With reference to Figure 5, the proposed development is classified as “More Vulnerable” and has been shown to lie in Flood Zone 1 (refer to Section 4.1.3). This is considered to be appropriate development.

5 Levels

5.1 Flood level data

Predicted Flood level data as provided by the EA are given in Appendix C for two nodes on the site.

These do not however allow for revised climate change allowances.

5.1.1 Applying revised climate change figures

For this domestic site, part being in Zone 2/3 in the South East the Higher Central and Upper End Allowances are considered appropriate.

The Extreme Sea Level (taken at Feature ID 3595 from the EA coastal design sea levels data) for the design period 1 in 200yr event is 3.84m AOD (with 3.79 & 4.11 the upper and lower confidence limits).

The base year is 2017

Years to 2035 = 18yrs

For the years 2017 to 2035 the Higher Central allowance = +5.7mm per yr = total 102.6mm and the Upper End allowance = +6.9mm per yr = total 124.2mm

For the years 2036 to 2065 the Higher Central allowance = +261mm and the Upper End allowance = +339mm

For the years 2066 to 2095 the Higher Central allowance = +348mm and the Upper End allowance = +474mm

Based on a 100yr design life this takes the design to year 2120

Years 2096 to 2120 = 24

For the years 2096 to 2120 the Higher Central allowance = +13.1mm per yr = total 314.4mm and the Upper End allowance = +18.2mm per yr = total 436.8mm

Total allowances 2017 to 2120:

Higher Central = +1.026m

Upper End = +1.374m

For design purposes, Extreme + Higher central +10% wind/wave = $1.1 \times (3.84 + 1.026)$ = 5.35m AOD

For design sensitivity, Extreme + Upper End +10% wind/wave = $1.1 \times (3.84 + 1.374)$ = 5.74m AOD

5.1.2 Site levels

Site levels, Appendix B, indicate that existing the site is generally higher than 6.1m AOD (6.34 at the front door).

5.1.3 Minimum FFL required

All floor levels to be no less than $5.35 + 0.3 = \underline{5.65\text{m AOD}}$

When a further 150mm is added for Building Regulation compliance the required minimum over site levels a FFL of 5.65m AOD can be readily achieved.

5.1.4 Design FFL

The design FFL is confirmed as 6.49m AOD

5.1.5 Freeboard

Freeboard to be provided = 1.14m

5.1.6 Sensitivity checking

A FFL of 6.49m AOD offers a freeboard of 750mm over the 1 in 200yr + Upper End allowance CC event

6 Residual Risk

6.1 Flood resistance and resilience measures

Because the site is shown to in close proximity to the area at risk of flooding, the proposed development should consider flood risk mitigation measures where possible and practicable.

Table 1 provides guidance on which materials are most suitable, suitable and unsuitable, when considering construction work involved in this project. This report recommends the use of materials from the “most suitable” column were this is at all possible on site, however they are not mandatory requirements.

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood.	Untreated timber, Chipboard
Floor Covering	Clay tiles, Rubber sheet floors, Vinyl sheet floors	Vinyl tiles, Ceramic tiles	
External Walls - to max flood level	Engineering brick, Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives, Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal Partitions	Brick with waterproof mortar, Lime based plasters	Common bricks	Chipboard, Fibreboard panels, Plasterboard, Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

Table 1: Summary of Material Suitability for Building Components^[1]

6.2 Warning schemes

Since it has been established that the seaward frontage of the site and the immediately adjacent area within the curtailment of the site is identified as being at risk of flooding, the development should sign up to the E.A. "Flood Warnings Direct" which is a free service providing flood warnings by phone, text or email. See <https://fwd.environment-agency.gov.uk/app/olr/home>, or call the E.A. on 0845 988 1188 for full information. In doing so any residual risk can be safely managed.

6.3 Access and Egress

The NPPF stipulates that, where required, safe access and escape routes should be available to/from new developments in flood risk areas. Access routes should be such that occupants can safely access and exit buildings in design flood conditions. The proposed dwelling does not impact on existing access and egress routes from the site. All areas way from the site are directly out of the coastal flood risk zone.

6.4 Flood Plan

The site owners are already well prepared in terms of a flood management plan for the site. However to enhance this where possible, the project team will also provide the

owners of the building with a proforma Flood Plan (See Appendix D for an example). The plan will provide guidance on emergency response procedures in the event of flooding to the site. This will:

- Provide details of who to contact and how;
- Provide details of how to turn off gas, electricity and water mains supplies;
- Provide details of designated safe egress routes out of the building and out of the local area at risk;
- Provide details of E.A. Flood warning codes;
- Provide details of local radio stations
- Provide a check list of essential items.

Part II

Surface water disposal strategy (outline)

Given the site has immediate and direct access to the coastal water part of the surface water arising can be managed on site with a direct outfall to the sea. Hence, only a limited amount of SuDS are considered necessary on this site however and in line with the SuDS management train the following will be considered.

6.5 Source control

- Soakaways. These rely on infiltration to attenuate flows.
- Rain water harvesting / water butts. The collection and re-use of water can reduce run off volumes arising from roofs. The collected water being used for the flushing of toilets or local irrigation.
- Bio-retention planting, rain gardens. Typically these systems use the natural gradients in a beneficial manner and provide surface water retention volumes.
- Permeable paving, porous asphalt. These provide both infiltration and short term storage volumes thus reducing overall un-mitigated runoff volumes.

6.6 General SW drainage proposal

6.6.1 Roof areas

Given the direct access to the sea, all surface water arising from the roof area can be disposed of directly into this tidal water via silt trap gullies at the base of all rainwater pipes (for the removal of gross solids and sediments). Back flow valves will be required on final outfall chambers.

Water butts will be installed however to help reduce potable water demand.

6.6.2 Hard surfaces

Any new areas of hard standing on the site will be constructed using a permeable medium on a DOT/MOT 3 sub-base of no less than 200mm depth.

The perimeter of these areas will be considered for expansive planting to accommodate any exceedence flows. Residual exceedence will be surface channelled onwards towards the the site's surface water drains which can drain directly drain to coastal waters.

For a check on the capacity of the permeable paving to function an infiltration rate of 5mm.hr^{-1} has been used below. A nominal 100m^2 is checked here but the results can be scaled pro rata.

Over 100m^2 plan area, 5mm.hr^{-1} equates to a total outflow rate of 0.138ls^{-1}

Designed to accomodate all surface water arising from a design drained area of 100m^2 requires a minimum attenuation volume of 5 m^3 . This can be achieved using an overall storage volume of 35.0 m^3 formed within a $100\text{m}^2 \times 0.35\text{m}$ deep 30% void ratio sub-base. See Table 2.

Drained area	100m ²	
Urban Creep	1	
Designed drained area	100m ²	
Return periods considered	1yr, 30yr, 100yr	
Storm profiles used	50% Summer	75% Winter
Storm coeffs	a = 0.1, b = 0.815	a = 0.06, b = 1.026
Storm range, storm increments	From 5 minutes duration in further 2 min. intervals until critical storm reached	
M5-60	17mm	
r	0.4	
Rainfall model	FSR	
Critical design storm	223 mins, Summer	
Climate change	1.4	
Storm mean intensity	13.1mm.hr ⁻¹	
Design mean intensity	18.4mm.hr ⁻¹	
Storm peak intensity	66.1mm.hr ⁻¹	
Design peak intensity	92.5mm.hr ⁻¹	
Design maximum head	0.25m	
Calculated maximum head	0.16m	
Minimum attenuation volume required	4.86m ³	
Void ratio	30%	
Design attenuation volume	8m ³	(0.3 x 100m ² x 0.25m)
Provided attenuation volume	11m ³	(0.3 x 100m ² x 0.35m)
Factor of Safety	1.40	
1 in 1yr maximum outfall rate	0.1ls ⁻¹	(See Figure 6.)
1 in 30yr maximum outfall rate	0.1ls ⁻¹	(See Figure 7.)
1 in 100yr maximum outfall rate	0.1ls ⁻¹	(See Figure 8.)
1 in 100yr Time to peak	208 mins	
1 in 100yr Max head: Time to drop to 50%	4.89 hrs	
Outfall control method	Nominal GF outflow	

Table 2: Storage volume design summary

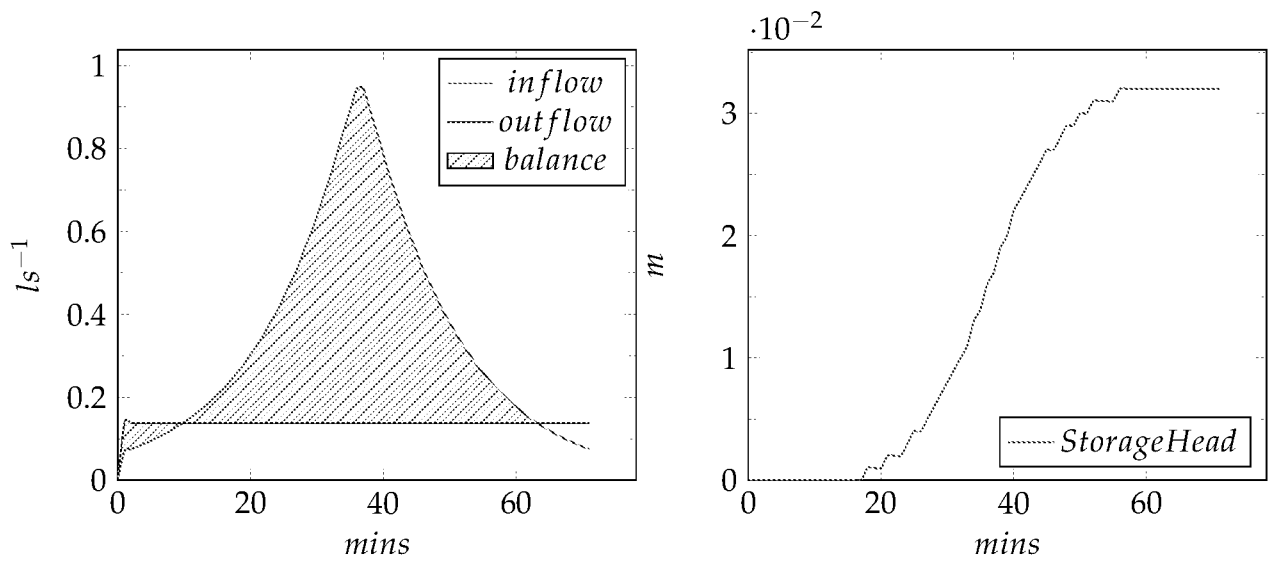


Figure 6: 1 in 1 year critical storm event

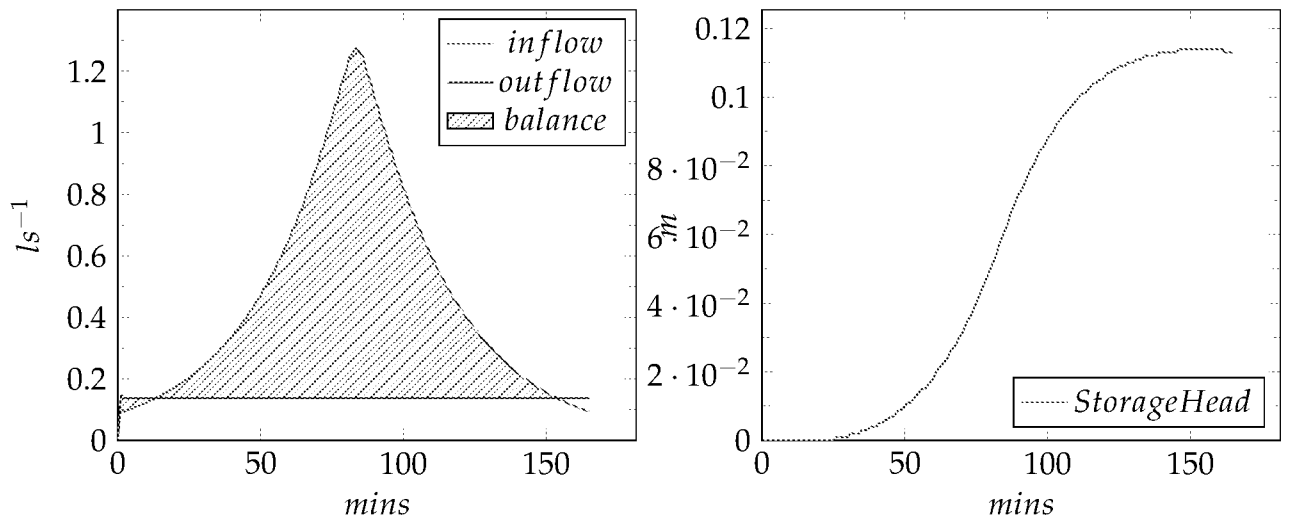


Figure 7: 1 in 30 year critical storm event

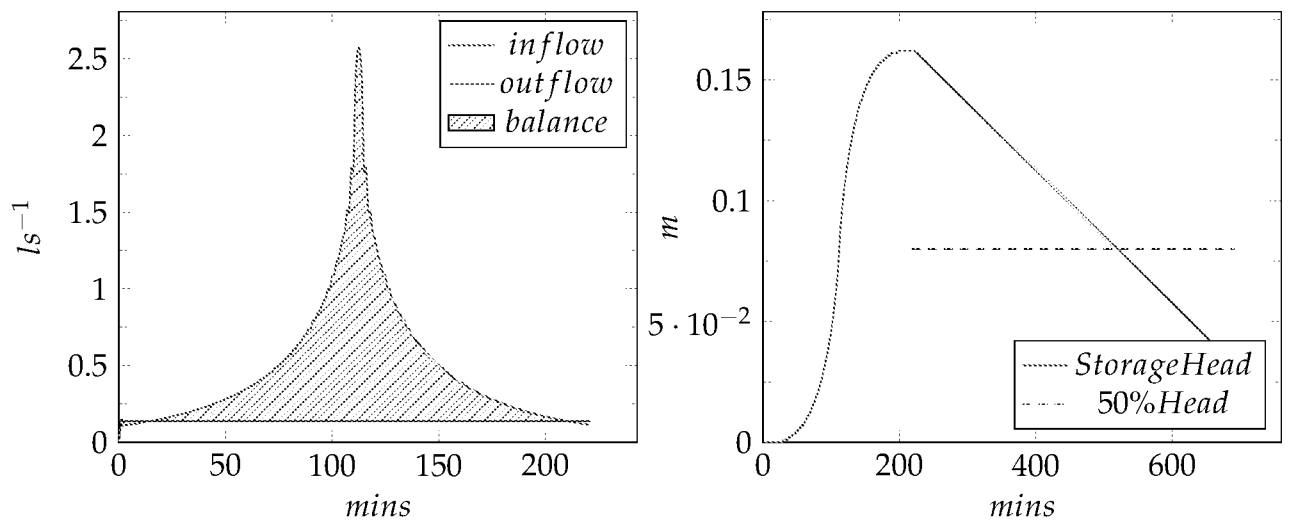


Figure 8: 1 in 100 year critical storm event

Simple index approach pollution removal indices: TSS 0.7, Metals 0.6, Hydrocarbons 0.7 = suitable for trafficked areas

6.7 Local Bylaws

Local bylaw consents to discharge into the sea may be required.

Part III

Conclusions

Given that:

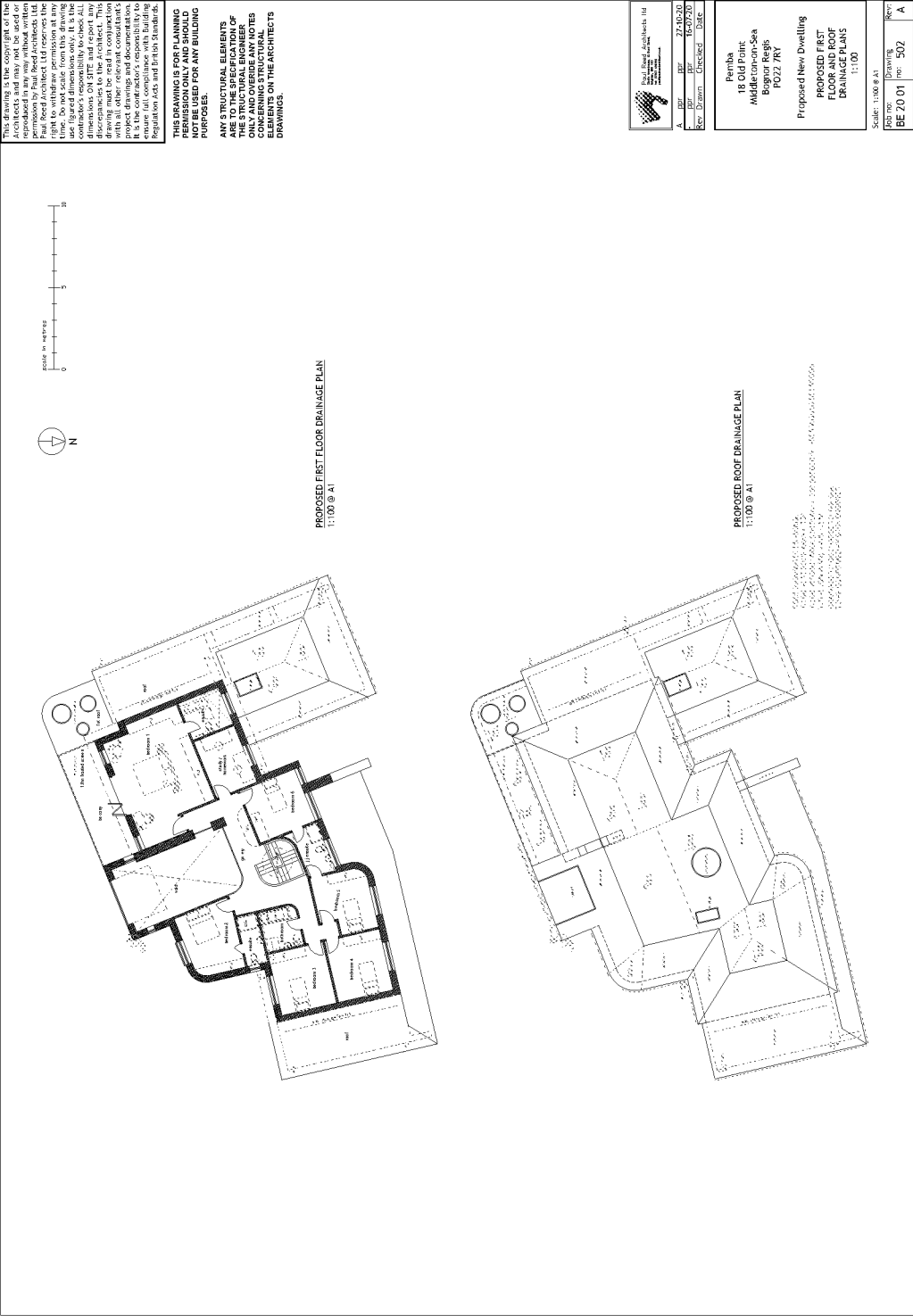
- Revised climate change allowances have been applied to the data;
- The developed area of the site lies wholly within Flood Zone 1;
- The undeveloped part of the site lies in tidal flood zones 2 & 3;
- There is no documented evidence of flood risk from any other sources;
- Greater than 300mm freeboard is provided over design period 1 in 200yr + Upper End CC flood levels
- Safe access and egress is immediately available;
- Surface water arising is to be managed on site via SuDS where required, otherwise via direct outfall to the sea;
- The development does not impact on flood risk elsewhere;

and assuming the mitigation, warning and evacuation procedures can be maintained over the lifetime of the development the proposed re-development consisting of a single dwelling house located within Flood Zone 1 is considered acceptable.

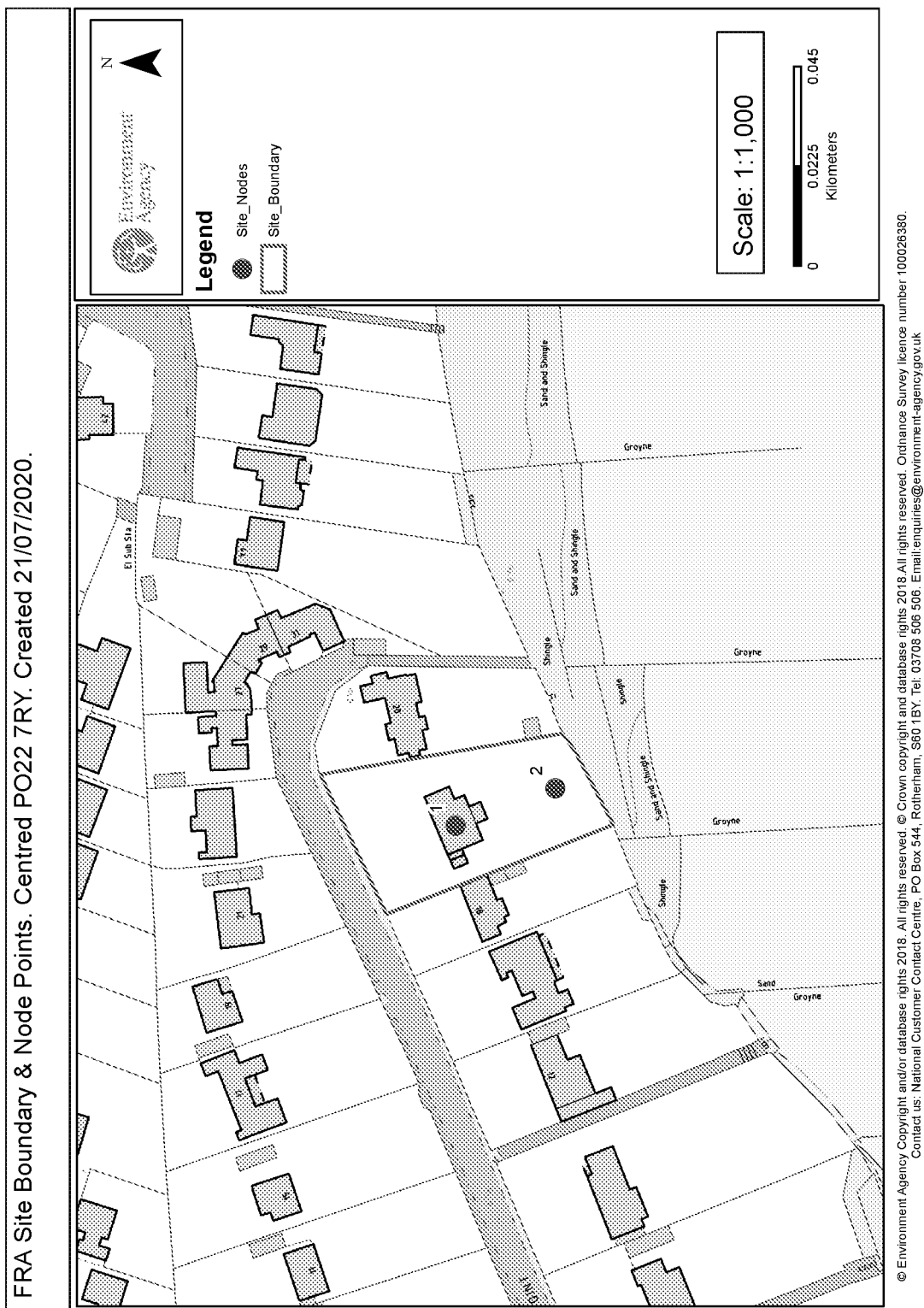
References

- [1] J Wingfield; M Bell; P Bowker. Improving the flood resilience of buildings through improved material, methods and details. Technical Report WP2c, CIRA, 2005.
- [2] BSI. BS 8533:2011. Technical report, 2011.
- [3] Department for Communities and Local Government. Technical guidance to the national planning policy framework. 2018.
- [4] Ministry of Housing, Communities and Local Government. National planning policy framework. 2019.

A Proposal plans



C Flood Maps



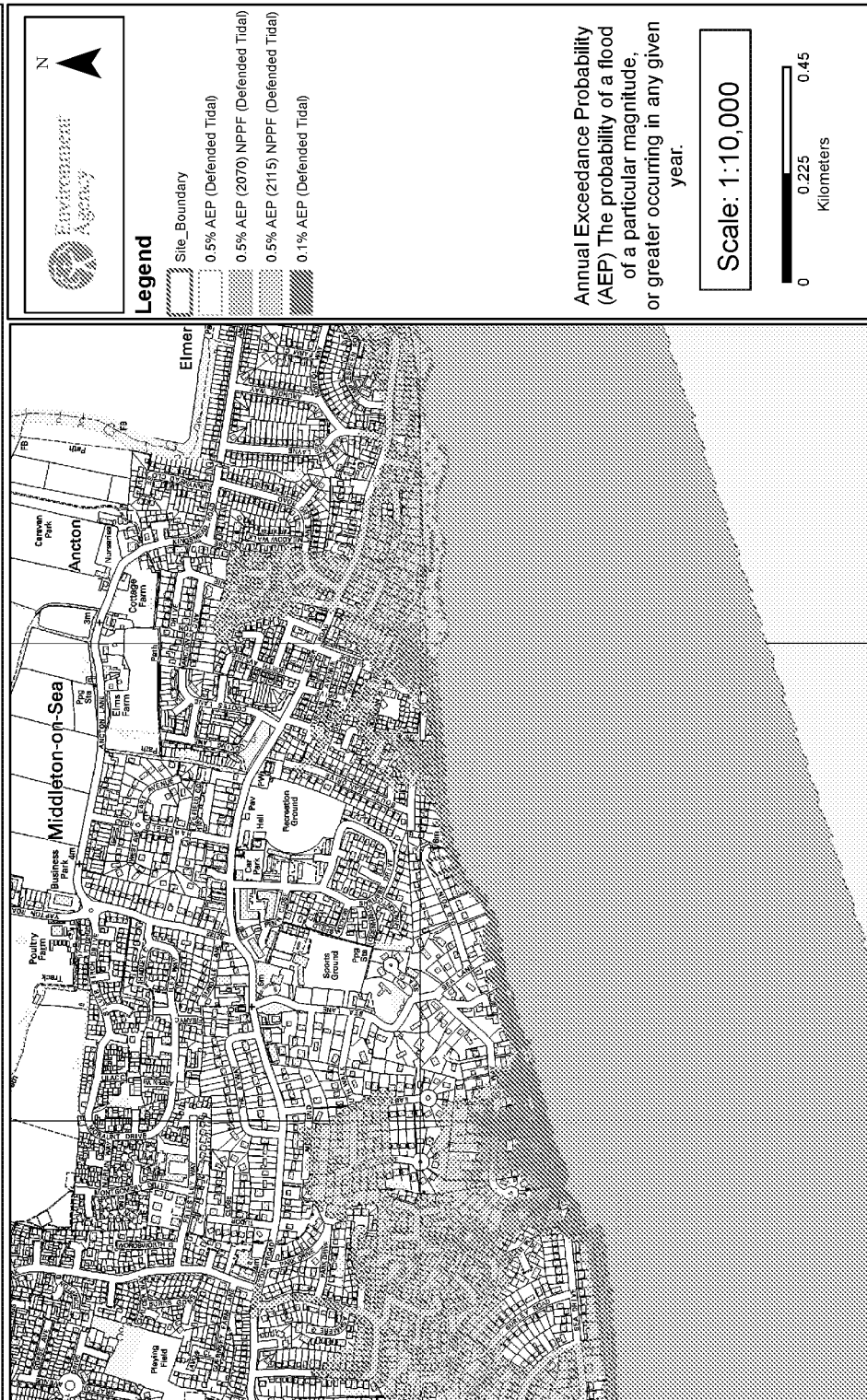
All levels taken from: River Arun to East Head Coastal Modelling (2D) (2016)

Produced on: 21/07/2020

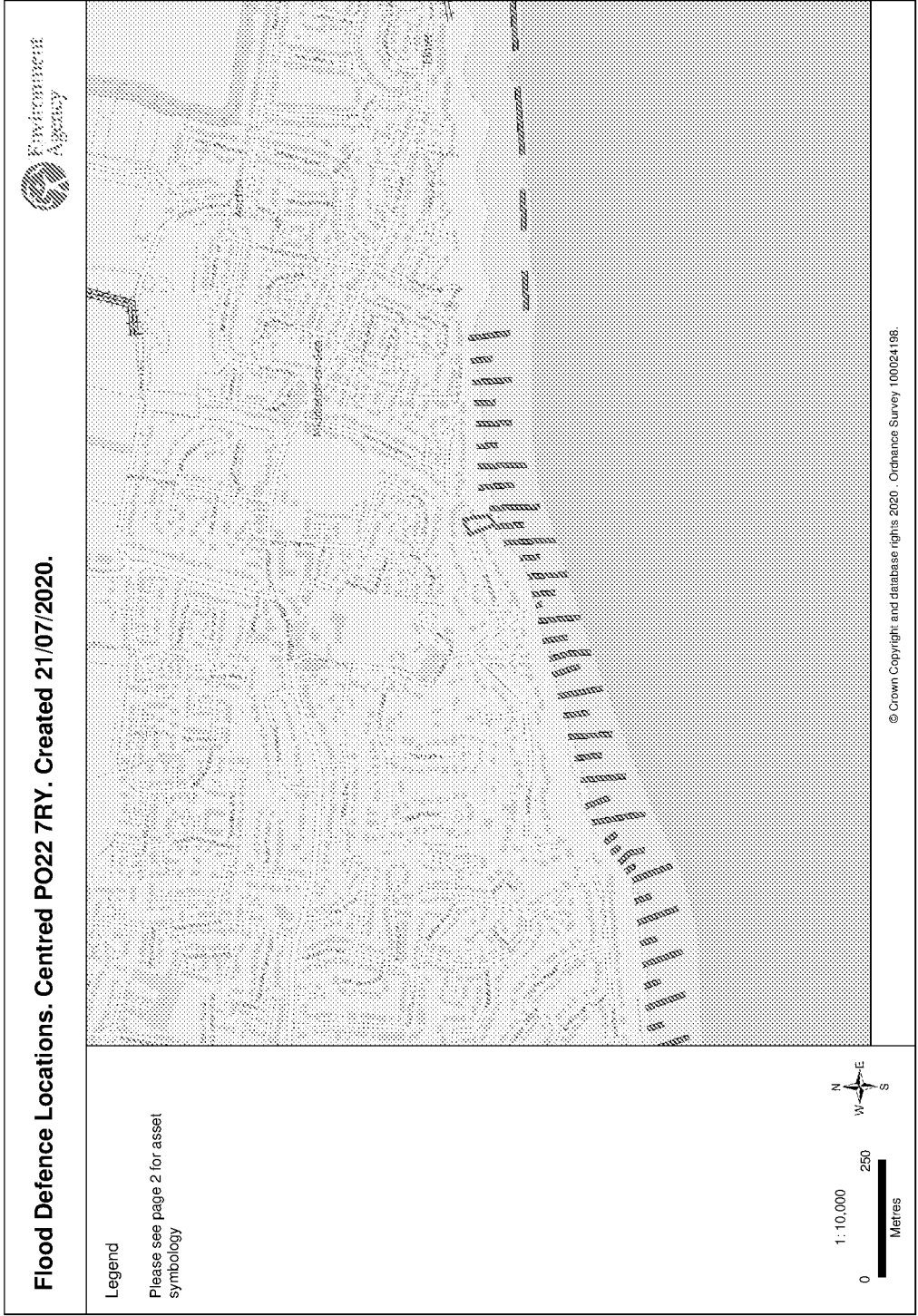
There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

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

Modelled Flood Outlines (Defended Tidal). Centred PO22 7RY. Created 21/07/2020.



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



Structures	Instruments	Defences	Land
Control Gate	Active Monitoring	Embankment	Audflats
Draw Off Tower	Passive Monitoring	Wall	Saltmarsh
Fish Pass	Channel Crossings	Flood Gate	Washland
Hydrobrake	Bridge	Demountable defence	Sites
In Channel Stoplogs	Utility Services	Bridge abutment	Amenity
Inspection Chamber	Aids to Navigation	High Ground	Control Structure
Jetty	Beacon	Beach	Erosion Protection
Outfall	Buoy	Barrier Beach	General
Screen	Dolphin	Promenade	Harbour
Spillway	Signage	Quay	Monitoring
Silling Basin	Signal	Cliff	Navigation Lock
Weir	Building Assets	Dunes	Pumping Station
Beach Structures	Pump House	Channels	Reservoir
Breakwater	Major Civils	Open channel	Tidal Barrier
Ramp	Abutment	Simple culvert	
Slipway	Central Pier	Complex culvert	
Steps			
Groyne			

D Emergency flood plan (example)

Personal flood plan

Are you signed up to receive flood warnings?
 If not call Floodline on 0345 988 1188 to see if you area receives free flood warnings.



Environment Agency

Name

Let us know when you've completed your flood plan by calling Floodline on 0345 988 1188.
 This will help us learn more about how people are preparing for flooding.

General contact list	Company name	Contact name	Telephone
Floodline	Environment Agency		0345 988 1188
Electricity provider			
Gas provider			
Water company			
Telephone provider			
Insurance company and policy number			
Local council			
Local radio station			
Travel/weather info			

Key locations

Address	Description of location
Electricity	
Gas	
Water	

Who can help/who can you help?

Relationship	Name	How can they/you help?
Relative		
Friend or neighbour		

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?



☐ Put important documents out of flood risk and protect in polythene
☐ Check your insurance covers you for flooding

☐ Look at the best way of stopping floodwater entering your property
☐ Make a flood plan and prepare a flood kit

☐ Find out where you can get sandbags
☐ Identify who can help you/who you can help

☐ Identify what you would need to take with you if you had to leave your home
☐ Understand the flood warning codes

What can you do if a flood is expected in your area?

Actions	Location
Home • Move furniture and electrical items to safety • Put flood boards, polythene and sandbags in place • Make a list now of what you can move away from the risk • Turn off electricity, water and gas supplies • Roll up carpets and rugs • Unless you have time to remove them hang curtains over rods • Move sentimental items to safety • Put important documents in polythene bags and move to safety	
Garden and outside • Move your car out of the flood risk area • Move any large or loose items or weigh them down	
Business • Move important documents, computers and stock • Alert staff and request their help • Farmers move animals and livestock to safety	
Evacuation - Prepare a flood kit in advance • Inform your family or friends that you may need to leave your home • Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons	

There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the **National Flood Forum** at www.bluespages.org.uk

Be prepared for flooding. Act now

GDH00709BQU-E-E