

1 SEA DRIVE, FERRING , WEST SUSSEX.
BN12 5HD

Proposed Residential Development

Flood Risk Assessment

Prepared on behalf of
Lucas Design and Construction Ltd

2016/D1223/FRA1.1
November 2016

DOCUMENT CONTROL

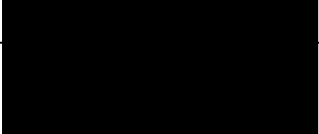
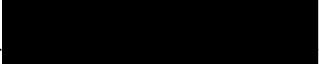
Project: 1 Sea Drive, Ferring, West Sussex. BN12 5HD
Proposed Residential Development

Document: Flood Risk Assessment

Client: Lucas Design and Construction Ltd

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1 INTRODUCTION

1.1 Background

1.1.1 RGP Design Ltd (RGP) is instructed by Lucas Design and Construction Ltd to prepare a Flood Risk Assessment (FRA) to support a planning application for a residential development at 1 Sea Drive, Ferring, West Sussex.

1.1.1 This FRA has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coastal Change (FRCC) and National Planning Policy Framework Section 10.

1.1.2 The proposed development will involve the construction of 8 residential units (1 block of apartments).

1.1.3 In preparing this report, RGP has made reference to the following documents and information:

- Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Drainage Records
- Topographical Survey
- LiDAR data
- British Geological Survey

1.1.4 This FRA has been prepared to assess if the proposed development is suitable for the site and confirms if mitigation is required to ensure that flood risk is not increased and that the proposed development remains safe during its design life.

1.1.5 This report has been prepared for the benefit of named Client only.

1.2 Site Location and Description

- 1.2.1 Site Location: The site is on the northern side of Sea Drive in Ferring, West Sussex. BN12 5HD. It is approximately 100m from the coast in a predominantly urban area. The Ferring Rife (main river) is located approximately 1km to the west. The coast is approximately 100m to the south.
- 1.2.2 Site Area: The overall site area is approximately 1200m² as shown on drawing 2016/D1223/SK200. The existing impermeable area is 460m².
- 1.2.3 Level of Site: The site lies between approximately 5.25m and 5.85m AOD.
- 1.2.4 Site Use: The site is occupied by a single dwelling with a driveway, outbuildings and gardens.
- 1.2.5 Environment Agency Flood Zone: The site is shown on the Flood Maps for Planning to be in zones 1, 2 and 3.

1.3 Ground Conditions

- 1.3.1 Intrusive geotechnical has not been undertaken but a review of the information provided on the British Geological Surveys website shows that the geology can be expected to be River terrace deposits (sand, silt and clay) over chalk at depth.
- 1.3.2 Historic boreholes approximately 100m north of the site record clay with flints and chalk with flints in the upper layers with chalk at around 7m below ground level. It is likely that the soil becomes more flinty/gravelly closer to the coast.
- 1.3.3 The site is not located in a groundwater source protection zone. The groundwater vulnerability zone is described as Major Aquifer, intermediate.
- 1.3.4 Full infiltration testing should be undertaken to determine exact figures for detailed design but It is anticipated that infiltration rates of 10⁻⁶ m/s will be measured.

1.4 Existing Drainage

- 1.4.1 The existing drainage systems have been identified by reviewing the topographic survey and from inspection on site.

1.4.2 Surface Water

- (i) The public sewer records show there are no public surface water sewers in close proximity to the site.
- (ii) Run off from the existing building and driveway appears to be disposed of by infiltration.
- (iii) Greenfield runoff has been calculated to be negligible due to the size of the site and the soil type.

1.4.3 Foul Water

- (i) The public sewer records show there is a 300mm diameter public foul sewer located within Sea Lane.
- (ii) It is likely that foul sewers exist in Sea Drive and whilst they are not shown on the public sewer map it is likely that they would have transferred to Southern Water.
- (iii) The existing building is understood to connect to mains foul drainage.

1.4.4 Highway Drainage

- (i) The run off from Sea Drive (private road) is understood to be disposed of by infiltration.
- (ii) The run off from the carriageway of Sea Lane (public highway) drains over the edge on to the adjacent verges.

2 PROBABILITY

2.1 Sources of Information

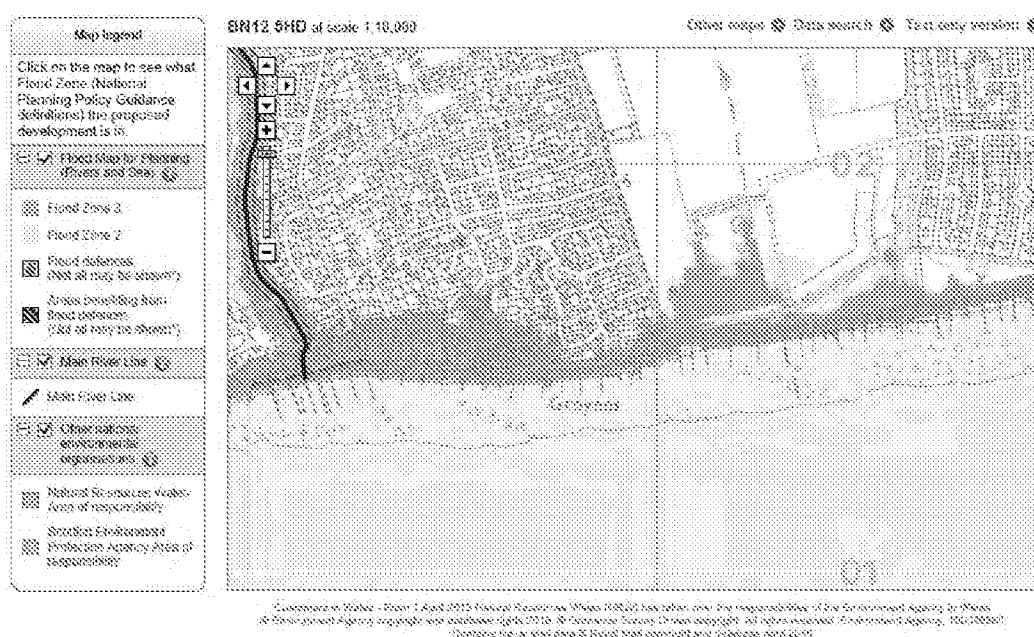
2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

2.1.2 The likelihood of the site flooding has been established by reviewing the following information:

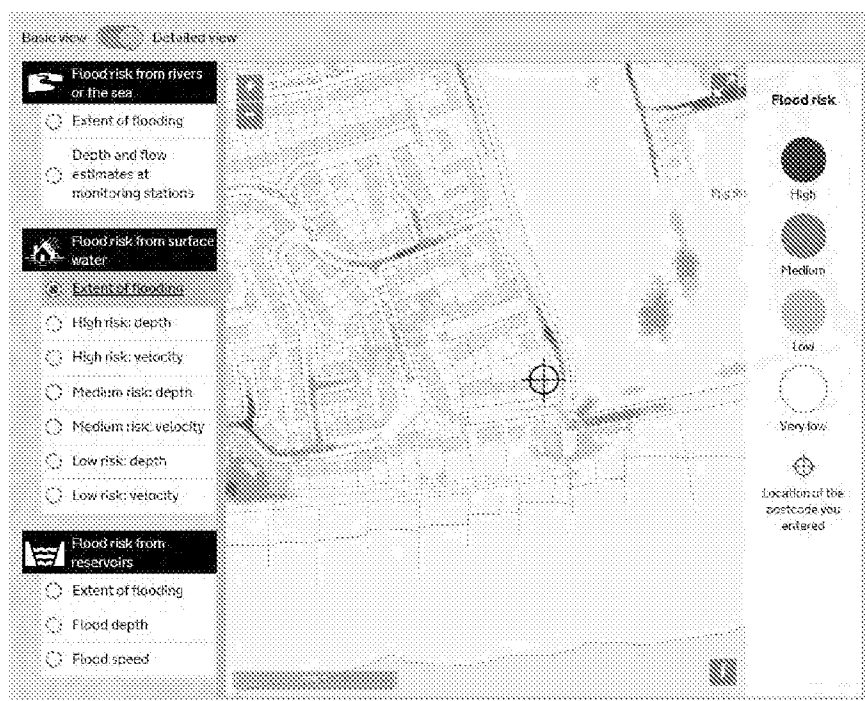
- Environment Agency Detailed Flood Data (Product 4)
- Surface Water Flood Risk Maps
- Reservoir/Canal Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Consultation with Local Authority/Lead Local Flood Authority
- Topographic Survey
- LiDAR Data

2.2 Flood Maps and Modelling

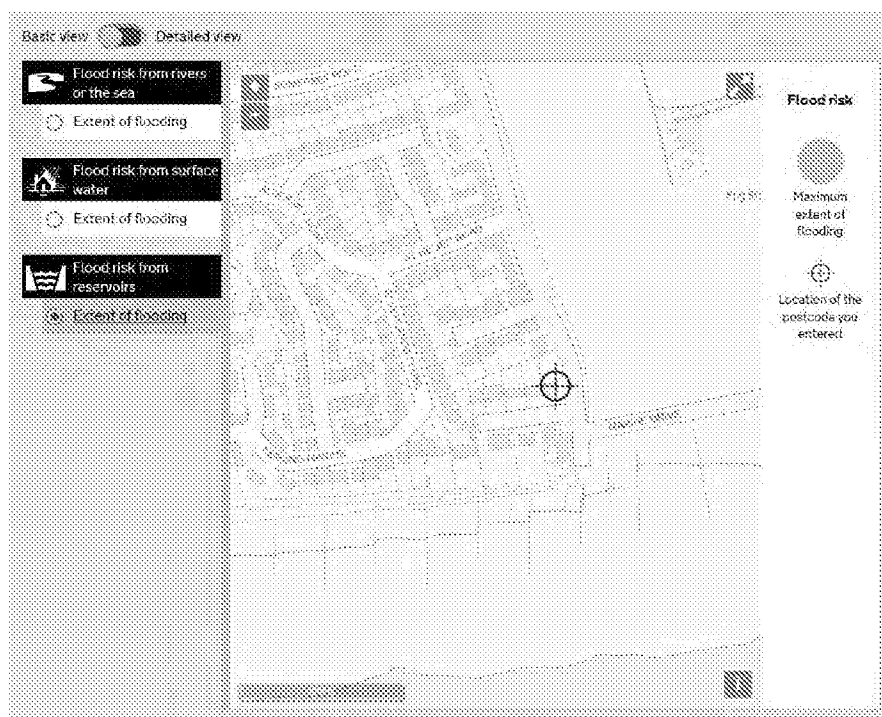
2.2.1 The Environment Agency's on-line Flood Maps for Planning (rivers and sea) show that the site is located in Zones 1, 2 and 3. The majority of the site lies within zone 1 with the remaining small area to the south in zones 2 and 3



- 2.2.2 The Environment Agency's detailed flood maps and modelling concur with the flood maps for planning and confirm that the defended flood level in 2115 including wave overtopping is 5.48m AOD with flood depths of up to 220mm on the site.
- 2.2.3 A comparison of the Environment Agency's modelled flood levels and the surveyed ground levels on the site (topographic survey) validates the flood zone extent shown on the Environment Agency plans.
- 2.2.4 The Flood Maps for Surface Water (gov.uk) show that the site is at very low risk of surface water flooding. The carriageway of Sea Drive is shown to be at low risk of surface water flooding and Sea Lane/Marine Drive is at low and medium risk of flooding.



- 2.2.5 The Flood Maps for Reservoirs (gov.uk) show that the site is not at risk from this source.



2.3 Strategic Flood Risk Assessment

- 2.3.1 A Strategic Flood Risk Assessment has been produced by JBA Consulting and is dated August 2016. It does not specifically reference the site.
- 2.3.2 The SFRA is generally consistent with the Environment Agency map, confirming that the site lies in Zones 1, 2 and 3 and is at low risk of flooding from surface water and sewers. It does however show that the site is at a $\geq 25\%$ to $< 50\%$ risk of flooding from groundwater.
- 2.3.3 The SFRA confirms that the coastal defences in the vicinity of the site comprise a wall maintained by the Environment Agency to the east of Sea Lane and shingle beach maintained by Arun District Council to the west of Sea Lane. The defences are described as being in good to fair condition and provide "a standard of protection from an event with an annual probability of 1 in 200".
- 2.3.4 The SFRA records some instances of historic flooding but they are not in close proximity to the site.

2.4 Historic Flooding

- 2.4.1 As above the SFRA does not record any instances of flooding either on or close to the site.

- 2.4.2 A consultation with the local authority concluded that there are no reported instances of flooding on the site.

2.5 Summary of Flood Risk

Source of Flooding	Level of Risk
Rivers and Water courses	Very low
The Sea	Residual risk of overtopping
Surface water	Very low
Groundwater	Low
Sewers	Very low
Artificial Sources	None

3 PROPOSED DEVELOPMENT

3.1 Description of Development

3.1.1 The development comprises the demolition of an existing dwelling and the construction of an apartment block (8 dwellings) with car parking and outbuildings.

3.1.2 The type of development falls with the More Vulnerable classification (Flood Risk and Coastal Change Table 2) and is compatible with Flood Zones 1 and 2 (Flood Risk and Coastal Change Table 3).

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

3.1.3 The proposed development encompasses the whole site and has an impermeable area of approximately 750m².

3.1.4 The proposed site layout is shown on drawing 046/PL02 prepared by Lucas Design.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

- 4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The Hierarchy favours infiltration methods of disposal over others methods such as water course and sewers.

SUDS Technique	Suitable	Comments
Living Roof	Possibly	Client determined not suitable
Basins and Ponds - Constructed Wetlands - Balancing Ponds - Detention Basins - Retention Ponds	no no no no	There is insufficient space to accommodate these techniques.
Filter strips and swales	no	There are no significant areas of soft landscaping for these methods to be used in.
Infiltration Devices - Soak ways - Infiltration trenches and basins	yes no	Insufficient space
Permeable surfaces and filter drains - Gravelled areas - Solid paving blocks Porous pavings	yes yes yes	
Tanked systems Oversize d pipes Cellular tanks	no no	No outfall location

- 4.1.2 As discussed in section 1.3, the soil underlying the site is expected to have adequate infiltration potential; therefore, the surface water drainage strategy should include infiltration methods, giving consideration to the existing overland flow routes on to the site.

- 4.1.1 The proposed development results in an increase in the impermeable area on the site of approximately 290m² (post development impermeable area =750m²)
- 4.1.2 The proposed infiltration system will be designed to accommodate a 1 in 100 year critical storm including an allowance for climate change.

4.1.3 The strategy above will ensure that there is no increase in the amount of run-off leaving the site, therefore no increase in the risk of flooding from this source.

4.1.4 The drainage strategy is shown on drawing 2016/D1223/SK300.

4.2 Foul Water Drainage

4.2.1 It is proposed to connect the proposed dwellings to the foul water sewer in the same location as the connection from the existing building.

4.2.2 The wastewater flow leaving the site, calculated in accordance with Sewers for Adoption will be 0.37l/s.

4.2.3 The proposed foul drainage layout is shown on drawing 2016/D1223/SK300.

4.3 Climate Change

4.3.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.

4.3.2 The Environment Agency flood maps and the SFRA suggest that the effects of climate change will not affect the flood zone in which the site lies (up to 2115).

4.3.3 In accordance with NPPF 'climate change allowances' update 12th April 2016, an increase of 20% should be applied for this development and a review should be undertaken to determine the impact of an increase of 40%.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

5.1.1 There is a residual risk of flooding as a result of waves overtopping the coastal defence.

5.1.2 There is a residual risk of flooding from groundwater.

5.2 Mitigation

5.2.1 The proposed building partially lies within the defended 2115 1:200 year flood zone (5.48m AOD, wave overtopping). The ground floor level of the proposed building will be raised above this level by 300mm to 5.8m AOD. The levels around the building will be raised to 5.65m AOD.

5.2.2 The vehicular access and parking bays 7 to 10 are in zones 2 and 3 but no specific mitigation is proposed in relation to this.

5.2.3 The SFRA suggests that the site has a low risk of flooding from groundwater, although there have been no recorded instances of flooding from this source either on or near the site, or in the general area. Should groundwater emergence occur, the proposed building is protected from flooding due to its raised floor level. The risk from this source will remain low.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

6.1.1 It is for the Planning Authority to decide if a proposed development passes the Sequential Test, largely based on information provided within the Strategic Flood Risk Assessment.

6.1.2 The commentary below provides additional information considered to be key in making that decision.

6.1.1 The objective of the sequential test is to promote development in areas that are at lowest risk of flooding.

6.1.2 The site lies within current Flood Zones 1, 2 and 3. The existing coastal defences provide a level of protection equivalent to a 1 in 200 year event.

6.1.3 The site has been laid out taking a sequential approach placing more vulnerable uses in the areas that are at the lowest risk of flooding.

6.1.4 Mitigation measures are proposed to ensure that the proposed dwellings are protected from flooding.

6.1.5 Safe access and egress is discussed in section 5.

6.1.6 It is considered that the sequential test should be passed.

6.2 Exception Test

6.2.1 Table 3 within Paragraph 067 of Flood Risk and Coastal Change confirms that developments classified as "More Vulnerable" are suitable for Zones 1 & 2. The proposed building is in Zone 1 and therefore an exception test is not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 The proposed building falls within Flood Zone 1 and the southern part of the site is in zones 2 and 3.
- 7.1.2 An assessment of the modelled flood data (2115) and topographic survey shows flood depths in the southern parking area will be up to approximately 100mm
- 7.1.3 During a flood event, dry access and egress will be available using the northern access on to Sea Lane (in zone 1).

7.2 Flood Warning

- 7.2.1 It is recommended that the occupiers of the proposed dwellings subscribe to the Environment Agency's flood warning scheme.
- 7.2.2 There is no requirement for a Flood Plan or site specific warning system to be implemented.

7.3 Maintenance

- 7.3.1 Maintenance plays an important part in the long term performance of a surface water drainage system and will be required to ensure that it remains fully operational.
- 7.3.2 The traditional parts (inspection chambers, pipes, gullies etc.) of the proposed surface water drainage system will need a minimal amount of maintenance similar to other traditional systems.
- 7.3.3 The SUDS devices will require slightly more maintenance focusing on reducing the amount of silt that is allowed to enter the system. For the cellular storage tanks this will involve ensuring that upstream catchpits and gully sumps are regularly emptied of silt.
- 7.3.4 It is important to ensure that the porous paved areas are properly maintained as recommended by the manufacturer which is likely to comprise:

- (i) Periodic surface sweeping to reduce silt and debris accumulation. The porous surfaces should be swept at least twice a year. Additional sweeps in the autumn may be required to clear fallen leaves.
- (ii) Periodic silt removal from porous surface as described by manufacturer. If any small areas are showing signs of ponding they shall be dealt with by fully raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive silting resulting in slow drainage over the whole area the blocks shall be uplifted and replacement of the bedding layer and geotextile shall take place.
- (iii) Redressing the joints on the block paved surface as required.

8 OFFSITE IMPACTS

- 8.1.1 The proposed development will not have an impact on flooding issues off-site.
- 8.1.1 There will be no increase in the rate and volume of run-off leaving the site because all runoff will be disposed of within the boundary of the site.
- 8.1.2 There will be no adverse impact on overland flood flow routes because the proposals will follow the existing general topography (falls from north to south).
- 8.1.3 The effects of climate change should be considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

9 SUMMARY

- 9.1.1 This site specific flood risk assessment is based on Flood Maps, the Local Authority's Strategic Flood Risk Assessment, and Topographical Survey data. LiDAR, Sewer Records.
- 9.1.2 The site is currently in residential use and is in an area that is already predominantly residential.
- 9.1.3 The site is approximately 1200m² in size and lies at approximately 5.25 to 5.85m AOD, sloping to the south. The impermeable area is 460m² and will increase because of the development.
- 9.1.4 The site lies mostly within flood zone 1 and partially in zones 2 and 3. There is no change in flood risk as a result of climate change.
- 9.1.5 The surface water run-off from the existing site is drained by infiltration.
- 9.1.6 The waste water from the proposed development will drain to the public foul sewers located close to the boundary of the site.
- 9.1.7 The proposed drainage system will be designed to cater for the effects of climate change by including a 20% increase in peak rainfall intensity and assessing the impact for a 40% increase.
- 9.1.8 There will be an increase in the rate and volume of run-off generated by the site which will be disposed of by SUDS techniques within the boundary of the site ensuring that there is no impact offsite.
- 9.1.9 Following completion of the development the flood risk both on and off the site will remain unchanged.
- 9.1.10 The residual 'low' risk of wave overtopping and ground water flooding will be mitigated by ensuring the ground floor levels of the proposed dwellings is raised above existing ground level and the predicted 2115 flood level.
- 9.1.11 It is considered that the site will pass the Sequential Test and Exception Testing is not required.
- 9.1.12 A maintenance regime should be established to ensure the long term effectiveness of the surface water drainage system.

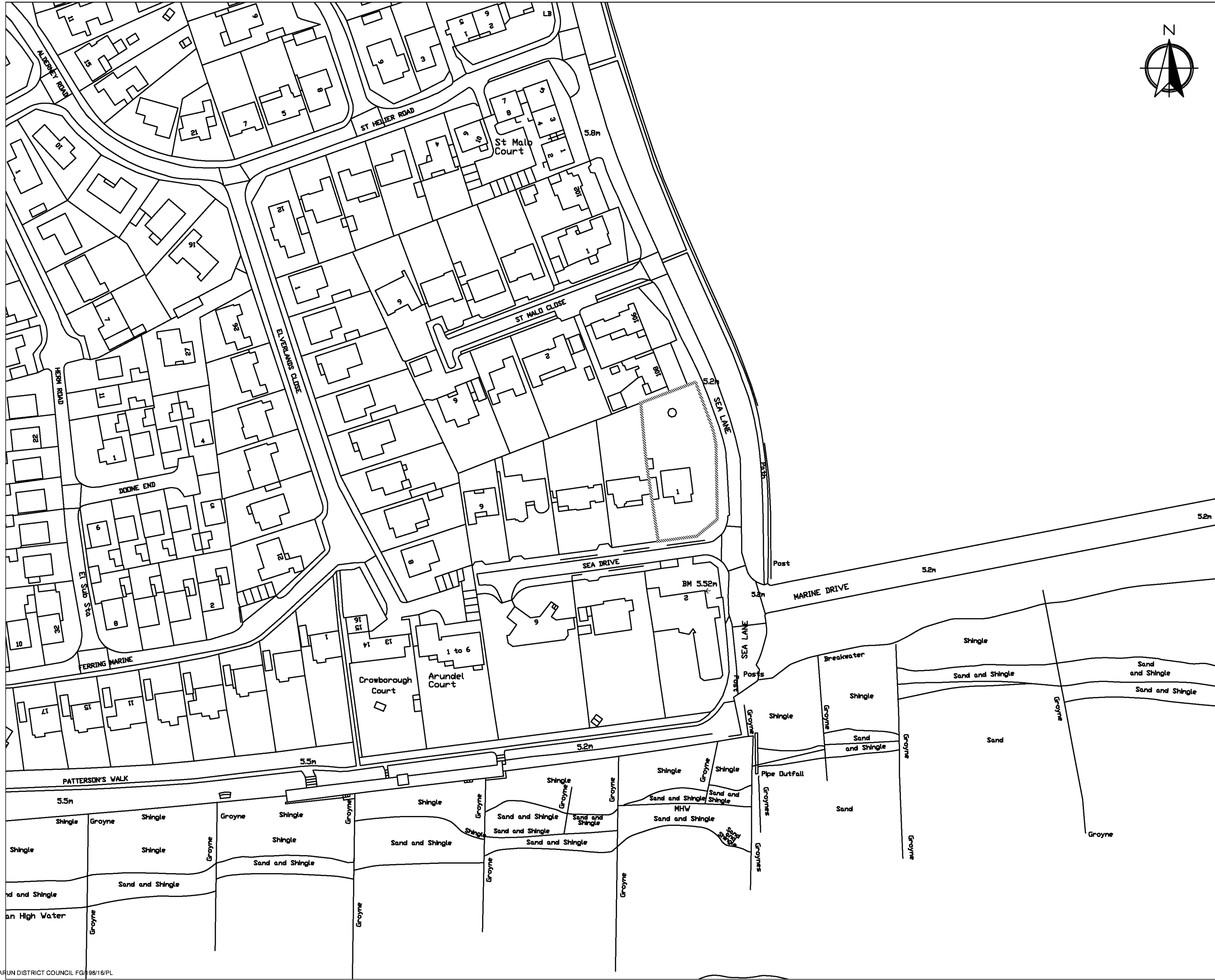
9.1.13 In conclusion, from a flood risk point of view the proposed development is suitable.

Plans and Drawings

SK100 Site Location Plan

SK200 Impermeable Area Comparison

SK300 Drainage Strategy



NOTES

A3

1

This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.

2

RGP accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.

3

Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.

4

Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

Rev.	26/07/2016	Original Issue	RAA
Date		Amendments	Drawn

rgp

Design

Transport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex, PO19 1BE

Tel: 01243 410418 Fax: 01483 861682

www.rgp.co.uk

Client

Lucas Design

Project

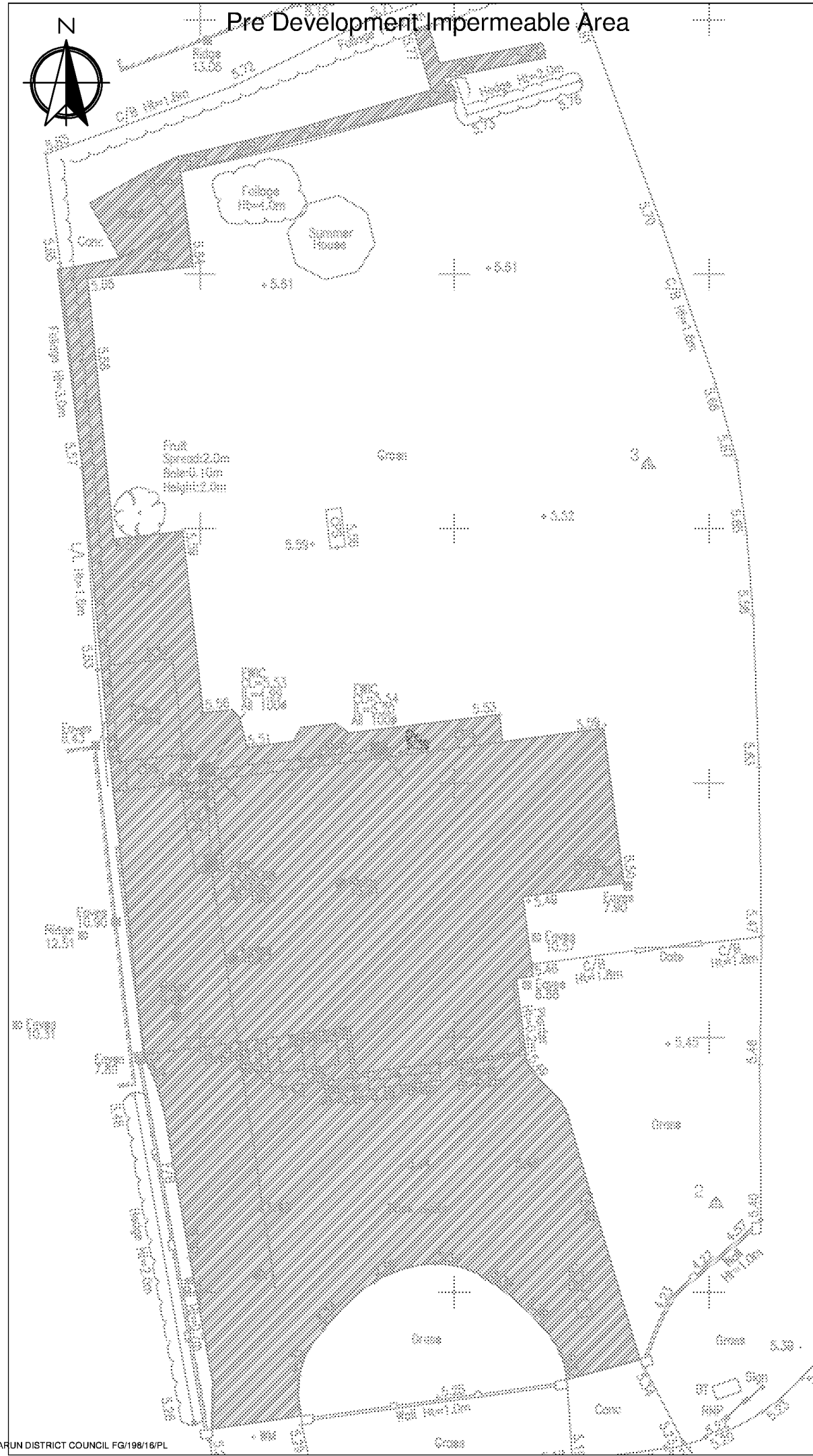
1 Sea Drive, Ferring, Worthing, BN12 5HD

Drawing Title

Site Location Plan

Scale	1:1250	Drawn By	IDF	Checked By	-	Approved By	-
Date	October 2016	Drawing No.	2016-D1223-100	Rev.	-		

ARUN DISTRICT COUNCIL FG/198/16/PL



NOTES

A3

1

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rgp

Design

Transport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex, PO19 1DE

Tel: 01243 410418 Fax: 01483 861682

www.rgp.co.uk

Client

Lucas Design

Project

1 Sea Drive, Ferring, Worthing, BN12 5HD

Drawing Title

Impermeable Area Comparison

Scale

1:200

Drawn By

IDF

Checked By

-

Approved By

-

Date

October 2016

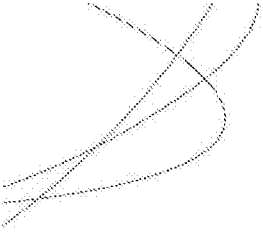
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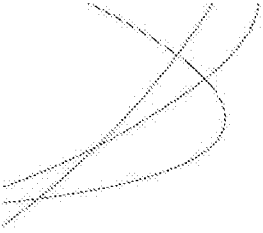
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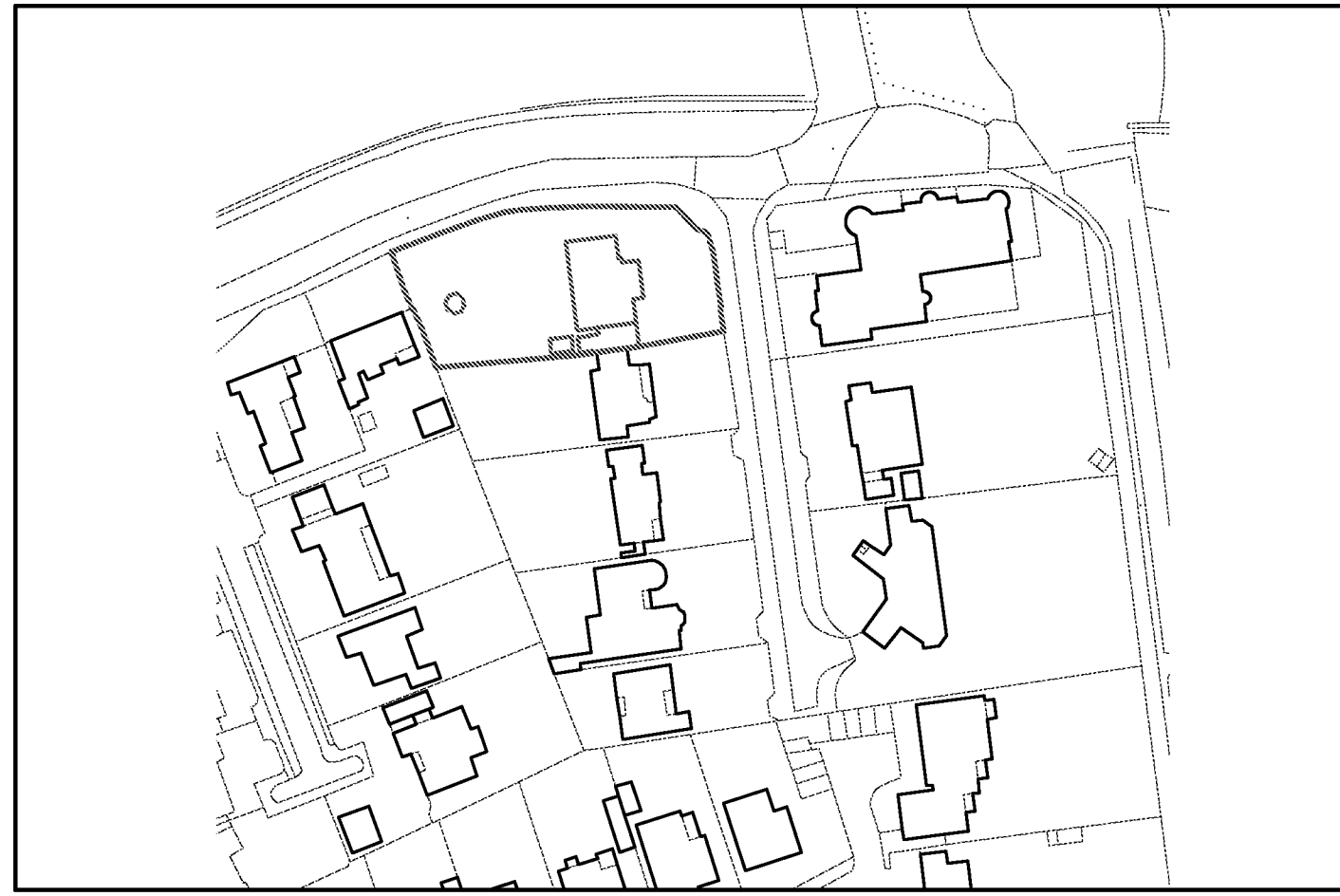
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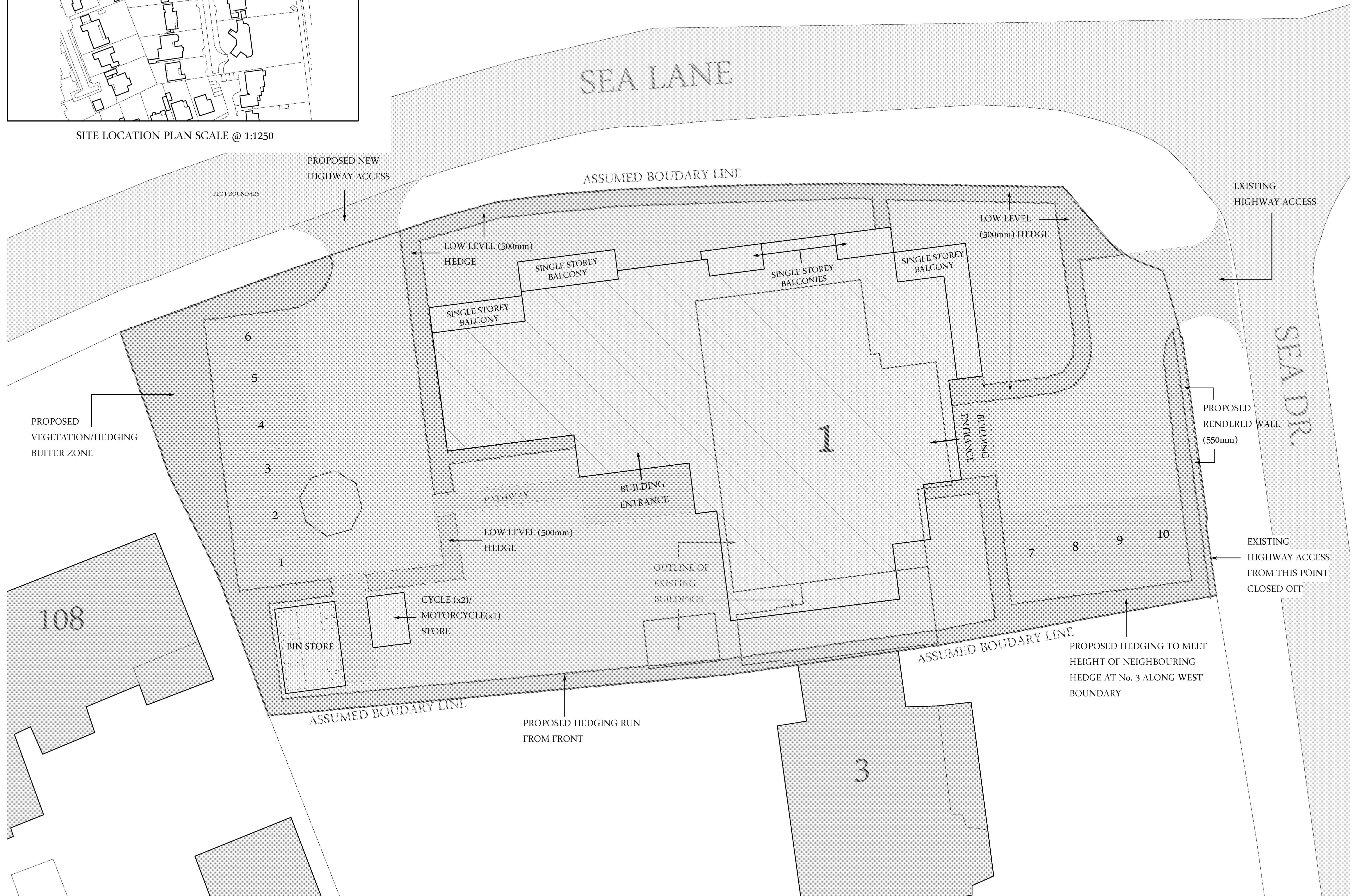
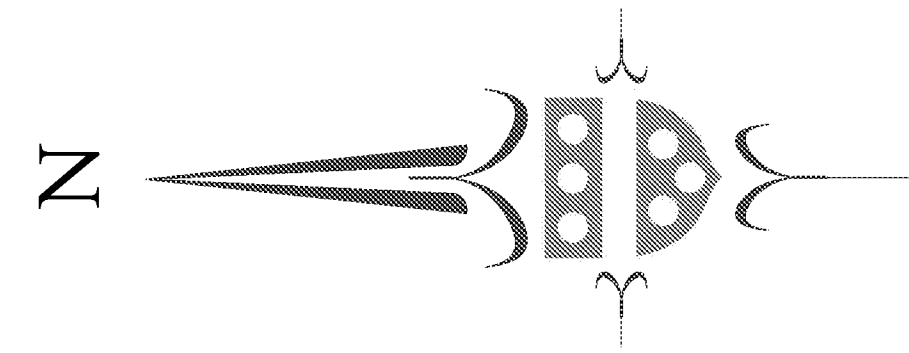
Appendices



Appendix A Architects Layout GA



SITE LOCATION PLAN SCALE @ 1:1250



- CURB STONE
- HEDGING/VEGETATION
- ASSUMED SITE BOUNDARY
- EXISTING BUILDING OUTLINE
- SINGLE STOREY BALCONIES
- FULL HEIGHT PROPOSED BUILDING FOOTPRINT

0 2 4 6 8 10

SCALE @ 1:200

Do not scale from these drawings, all dimensions to be checked on site.

JOB: 1 SEA DRIVE, FERRING, WORTHING BN12 5HD
DWG: PROPOSED SITE PLAN

JOB NO: 046
DWG. NO: 046/PL02
REVISION:
SCALE: 1:200 @ A1
DATE: 23/08/2016
DRAWN BY: RYAN GODFREY
CHECKED BY: MICHAEL T LUCAS
DWG. STATUS: PLANNING



LUCAS DESIGN
11A WEST STREET, REIGATE
SURREY, RH2 9BL
Tel: 01737 243 340 Fax: 01737 244 836
Email: info@lucas-design.co.uk
www.lucas-design.co.uk

Appendix B Environment Agency Product 4 Flood Data

Our ref: SSD26113

Date: 03/11/2016

Dear Liam Foord

Provision of Product 4 for address: 1 Sea Drive, Ferring. BN12 5HD

Thank you for your request of 14/10/2016 to use Environment Agency data, Product 4. The information is attached.

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

The property is in an area located within Flood Zone 3 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.

Please find attached a copy of the Flood Map for Planning (Rivers and Sea) for the area relating to your address.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

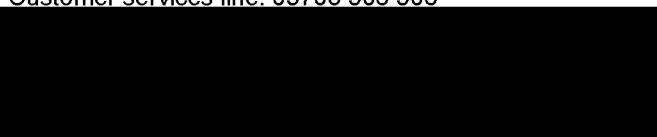
<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD
Customer services line: 03708 506 506



Supporting Information

Flood Defences

Coastal protection is offered by Local Authority maintained shingle beaches. Please see the attached map.

Flood History

We do not have any records of previous flood events affecting this area. For a more comprehensive flood history I would suggest also contacting Arun District and Worthing Borough Councils.

Model Information

The attached flood levels, depths and outlines have been taken from the 2012 Arun to Adur Flood Modelling study. These levels represent defended and undefended tidal flood risk.

Please note the defended scenarios include the beach profile and show flooding from wave overtopping of defences. The undefended scenarios do not include any wave overtopping. The calculations used to generate estimated wave overtopping volumes require defence crest, toe and profile information which are obviously not available for an undefended scenario. As such, you may see greater flood extents for the defended scenarios rather than the undefended.

Please be aware that in February 2016 the Environment Agency updated its guidance on climate change allowances. The standard allowance of adding 20% to peak flows – as per previous guidance in the National Planning Policy Framework, may not be applicable for the purposes of informing development proposals. Please visit <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for further information.

Please note our records are not comprehensive and may not include all events, you can contact your Local Authority to check if they hold any relevant information regarding your application.

You are encouraged to use and re-use this information freely and flexibly, with only a few conditions. Details of which can be found here:

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

If you have any queries or would like to discuss the content of this letter further please call us on 03708 506506.

Yours faithfully

Eleonora Pilla

West Sussex PSO Team

Enc. Flood Map for Planning (Rivers and Sea) / Node point locations / Flood levels/depths / Modelled flood outlines / Flood Defence Locations

Flood Map for Planning (Rivers and Sea) centred BN12 5HD. Created 03/11/2016



Scale 1: 10,000



Flood Map for Planning (Rivers & Sea)

- Sealed Main Rivers
- 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.

Flood Defence Locations centred BN12 5HD. Created 03/11/2016

Legend

Defences

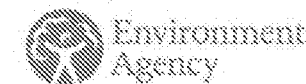
-  Embankment
-  Wall
-  Flood Gate
-  Demountable Defence
-  Bridge Abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes
-  Culvert



0 100 200 300
Metres



Modelled Flood Outlines centred on 1 Sea Drive, Ferring, BN12 5HD. Created 03/11/2016 (Ref: SSD26113)



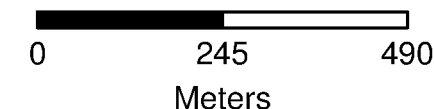
Legend

- Main River
- Site Boundary
- 5% AEP (2012) (Undefended)
- 0.5% AEP (2012) (Undefended)
- 0.1% AEP (2012) (Undefended)
- 0.5% AEP (2115) (Undefended)

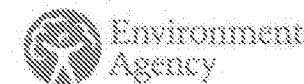
Climate Change (CC) extent based on an increase of 20% in river flows.

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

Scale: 1:10,000



Modelled Flood Outlines centred on 1 Sea Drive, Ferring, BN12 5HD. Created 03/11/2016 (Ref: SSD26113)



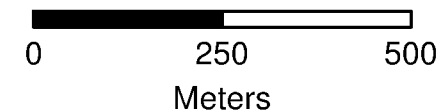
Legend

- Main River
- Site Boundary
- 5% AEP (2012) (Defended)
- 0.5% AEP (2012) (Defended)
- 0.1% AEP (2012) (Defended)
- 0.5% AEP (2115) (Defended)

Climate Change (CC) extent based on an increase of 20% in river flows.

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

Scale: 1:10,000



Product 4 Flood Risk Data Requested by: Liam Foord

Site: 1 Sea Drive, Ferring, BN12 5HD

Table 1: Water Levels: Tidal Undefended

Node Reference	NGR		Modelled Flood Levels in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			5%	0.5%	0.5% (2115)	0.1%
1	509968	101607	0	0	0	0
2	509991	101610	0	0	0	0
3	509988	101623	0	0	0	0
4	509984	101599	0	0	0	0
5	509999	101641	0	0	0	0

Table 2: Water Levels: Tidal Defended

Node Reference	NGR		Modelled Flood Levels in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			5%	0.5%	0.5% (2115)	0.1%
1	509968	101607	0	5.34	5.48	5.39
2	509991	101610	0	0	5.48	5.39
3	509988	101623	0	0	0	0
4	509984	101599	5.24	5.34	5.48	5.39
5	509999	101641	0	0.0	5.46	0

Table 3: Water Depth: Tidal Undefended

Node Reference	NGR		Modelled Flood Depth in Metres			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			5%	0.5%	0.5% (2115)	0.1%
1	509968	101607	0	0	0	0
2	509991	101610	0	0	0	0
3	509988	101623	0	0	0	0
4	509984	101599	0	0	0	0
5	509999	101641	0	0	0	0

Table 4: Water Depth: Tidal Defended

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

Node Reference	NGR		Modelled Flood Depth in Metres			
	Easting	Northing	Defended Annual Exceedance Probability			
			5%	0.5%	0.5% (2115)	0.1%
1	509968	101607	0	0.07	0.22	0.12
2	509991	101610	0	0	0.07	0.02
3	509988	101623	0	0	0	0
4	509984	101599	0.13	0.23	0.38	0.28
5	509999	101641	0	0	0.21	0

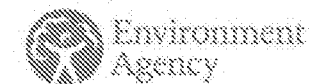
All levels taken from: Arun to Adur Flood Modelling, completed in 2012 by JBA Consulting

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

Produced on 03/11/2016

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

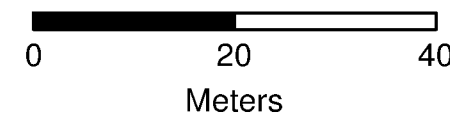
Modelled site node points centred on 1 Sea Drive, Ferring, BN12 5HD.
Created 03/11/2016 (Ref: SSD26113)



Legend

- Site Nodes
- Site Boundary

Scale: 1:750



Use of Environment Agency Information for Flood Risk Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

You should refer to the Environment Agency's Flood Risk Standing Advice, Planning Practice Guidance, and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<https://www.gov.uk/flood-risk-assessment-standing-advice>

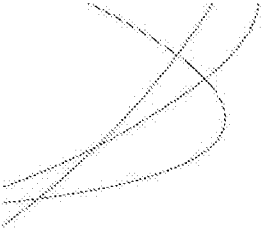
<http://planningguidance.planningportal.gov.uk/>

<http://www.planningportal.gov.uk/planning/planningpolicyandlegislation/previousenglishpolicy/ppqpps/pps25>

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.



Appendix C LPA Response

Mark Akmenkalns

From: Thomas Callaway <Thomas.Callaway@arun.gov.uk>
Sent: 21 October 2016 13:40
To: Liam Foord
Cc: Paul Cann
Subject: RE: 1 Sea Drive, Ferring

Hi Liam

In addition to the flood zone information that you have already seen, our SFRA mapping shows an occurrence of sewer flooding near to the application site. It would be best to follow this up with Southern Water, who may have more information.

Regards

Tom

Thomas Callaway | Drainage & Coastal Engineer, Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37818 | External: +44 (0) 1903 737818 | Fax: +44 (0) 1903 716019 | E-mail: Thomas.Callaway@arun.gov.uk
Arun is Working in Partnership with Chichester District Council

Visit our web site at www.arun.gov.uk and www.chichester.gov.uk



Save the environment - think before you print

From: Paul Cann
Sent: 14 October 2016 10:44
To: Thomas Callaway
Subject: FW: 1 Sea Drive, Ferring

Able to help?

Paul Cann
Senior Engineer (Drainage & Coastal)

Paul Cann | Senior Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: Second Floor, Arun Civic Centre, Maltravers Road, Littlehampton, BN17 5LF

Internal: 37819 | External: +44 (0) 1903 737819 | Fax: +44 (0) 1903 716019 | E-mail: Paul.Cann@arun.gov.uk
Arun is Working in Partnership with Chichester District Council

Visit Arun's web site at <http://www.arun.gov.uk/> and www.chichester.gov.uk



Save the environment - think before you print

From: Liam Foord [<mailto:l.foord@rgpdesign.co.uk>]
Sent: 14 October 2016 09:54
To: Paul Cann
Subject: 1 Sea Drive, Ferring

Hi Paul,

I am putting together a FRA for the above site and wondered if there were any records of flooding in the area?

I can see from the EA maps that the site is partially in Zones 2 and 3 so I have requested their detailed flood data but any other info you have would be much appreciated,

As it is on the Arun/Worthing border I have also contacted Ken Argent.

Many thanks

Regards

Liam Foord
Director

T 01243 210418
M. 07786 544147
E. l.foord@rgpdesign.co.uk
W. www.rgp.co.uk



Transport Planning and Infrastructure Design Consultants

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<http://www.arun.gov.uk>

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DX 57406 Littlehampton

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Mark Akmenkalns

From: Ken Argent <ken.argent@adur-worthing.gov.uk>
Sent: 24 October 2016 12:09
To: Liam Foord
Subject: Re: 1 Sea Drive, Ferring

Sorry mate, only returned from holiday on Thursday, still trying to catch up.

we have no flooding records of property in that area.

Sea Lane is supposed to suffer surface water flooding but no records

Ken Argent

Engineer, Adur & Worthing Councils

Phone: 01903221374

Email: ken.argent@adur-worthing.gov.uk

Website: www.adur-worthing.gov.uk

Address: Engineering Team, Worthing Town Hall, Chapel Road, Worthing, West Sussex, BN11 1HA



On 14 October 2016 at 09:53, Liam Foord <l.foord@rgpdesign.co.uk> wrote:

Hi Ken,

Hope you're well? I am putting together a FRA for the above site and wondered if there were any records of flooding in the area?

I can see from the EA maps that the site is partially in Zones 2 and 3 so I have requested their detailed flood data but any other info you have would be much appreciated,

As it is on the Arun/Worthing border I have also contacted Paul Cann.

Many thanks

Regards

Liam Foord
Director

T 01243 210418
M. 07786 544147
E. L.Foord@rgpdesign.co.uk
W. www.rgp.co.uk

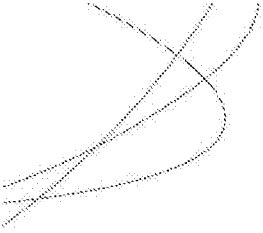


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Appendix D Microdrainage / Run-off Calculations

RGP Design Limited				Page 1	
Metro House		1 Sea Drive			
Northgate		Ferring			
Chichester PO19 1BE		Porous Paving & Soakaway			
Date Oct 2016		Designed by LDF			
File INFILTRATION SYSTEM.SRCX		Checked by			
XP Solutions		Source Control 2016.1			
<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 3747 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	4.270	0.870	0.0	16.1	O K
30 min Summer	4.596	1.196	0.0	22.2	O K
60 min Summer	4.887	1.487	0.1	28.8	O K
120 min Summer	4.995	1.595	0.1	35.7	O K
180 min Summer	5.043	1.643	0.2	39.7	O K
240 min Summer	5.074	1.674	0.2	42.4	O K
360 min Summer	5.117	1.717	0.2	46.3	O K
480 min Summer	5.148	1.748	0.2	49.0	O K
600 min Summer	5.172	1.772	0.2	51.1	O K
720 min Summer	5.190	1.790	0.2	52.8	O K
960 min Summer	5.217	1.817	0.2	55.2	O K
1440 min Summer	5.249	1.849	0.2	58.0	O K
2160 min Summer	5.266	1.866	0.2	59.5	O K
2880 min Summer	5.272	1.872	0.2	60.1	O K
4320 min Summer	5.276	1.876	0.2	60.4	O K
5760 min Summer	5.273	1.873	0.2	60.1	O K
7200 min Summer	5.264	1.864	0.2	59.3	O K
8640 min Summer	5.253	1.853	0.2	58.4	O K
10080 min Summer	5.240	1.840	0.2	57.2	O K
15 min Winter	4.384	0.984	0.0	18.2	O K
30 min Winter	4.749	1.349	0.0	25.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	125.353	0.0	23		
30 min Summer	84.267	0.0	38		
60 min Summer	54.074	0.0	68		
120 min Summer	33.506	0.0	128		
180 min Summer	24.949	0.0	188		
240 min Summer	20.093	0.0	246		
360 min Summer	14.773	0.0	366		
480 min Summer	11.871	0.0	486		
600 min Summer	10.010	0.0	606		
720 min Summer	8.703	0.0	726		
960 min Summer	6.973	0.0	964		
1440 min Summer	5.093	0.0	1442		
2160 min Summer	3.711	0.0	2104		
2880 min Summer	2.961	0.0	2424		
4320 min Summer	2.150	0.0	3156		
5760 min Summer	1.711	0.0	3968		
7200 min Summer	1.432	0.0	4760		
8640 min Summer	1.240	0.0	5616		
10080 min Summer	1.098	0.0	6360		
15 min Winter	125.353	0.0	23		
30 min Winter	84.267	0.0	38		
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RGP Design Limited				Page 2	
Metro House		1 Sea Drive			
Northgate		Ferring			
Chichester PO19 1BE		Porous Paving & Soakaway			
Date Oct 2016		Designed by LDF			
File INFILTRATION SYSTEM.SRCX		Checked by			
XP Solutions		Source Control 2016.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	4.950	1.550	0.1	32.4	O K
120 min Winter	5.048	1.648	0.2	40.2	O K
180 min Winter	5.099	1.699	0.2	44.7	O K
240 min Winter	5.134	1.734	0.2	47.8	O K
360 min Winter	5.184	1.784	0.2	52.2	O K
480 min Winter	5.220	1.820	0.2	55.4	O K
600 min Winter	5.247	1.847	0.2	57.8	O K
720 min Winter	5.269	1.869	0.2	59.8	O K
960 min Winter	5.301	1.901	0.2	62.7	O K
1440 min Winter	5.340	1.940	0.2	66.1	O K
2160 min Winter	5.366	1.966	0.2	68.4	O K
2880 min Winter	5.372	1.972	0.2	69.0	O K
4320 min Winter	5.367	1.967	0.2	68.5	O K
5760 min Winter	5.355	1.955	0.2	67.5	O K
7200 min Winter	5.336	1.936	0.2	65.8	O K
8640 min Winter	5.315	1.915	0.2	63.9	O K
10080 min Winter	5.291	1.891	0.2	61.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
60 min Winter	54.074	0.0	68		
120 min Winter	33.506	0.0	126		
180 min Winter	24.949	0.0	184		
240 min Winter	20.093	0.0	244		
360 min Winter	14.773	0.0	362		
480 min Winter	11.871	0.0	480		
600 min Winter	10.010	0.0	596		
720 min Winter	8.703	0.0	714		
960 min Winter	6.973	0.0	946		
1440 min Winter	5.093	0.0	1404		
2160 min Winter	3.711	0.0	2080		
2880 min Winter	2.961	0.0	2712		
4320 min Winter	2.150	0.0	3380		
5760 min Winter	1.711	0.0	4320		
7200 min Winter	1.432	0.0	5192		
8640 min Winter	1.240	0.0	6056		
10080 min Winter	1.098	0.0	6960		
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RGP Design Limited		Page 3
Metro House	1 Sea Drive	
Northgate	Ferring	
Chichester PO19 1BE	Porous Paving & Soakaway	
Date Oct 2016	Designed by LDF	
File INFILTRATION SYSTEM.SRCX	Checked by	
XP Solutions	Source Control 2016.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.075

Time (mins)	Area	Time (mins)	Area
From: To: (ha)		From: To: (ha)	
0 4 0.030		4 8 0.045	

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RGP Design Limited		Page 4
Metro House	1 Sea Drive	
Northgate	Ferring	
Chichester PO19 1BE	Porous Paving & Soakaway	
Date Oct 2016	Designed by LDF	
File INFILTRATION SYSTEM.SRCX	Checked by	
XP Solutions	Source Control 2016.1	

Model Details

Storage is Online Cover Level (m) 5.400

Complex Structure

Cellular Storage

Invert Level (m) 3.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00360 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00360

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	19.5	19.5	1.700	0.0	65.9
1.600	19.5	65.9			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00360	Width (m)	10.8
Membrane Percolation (mm/hr)	1000	Length (m)	27.5
Max Percolation (l/s)	82.5	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.800	Membrane Depth (m)	0

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