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Flood Risk Assessment

Proposed development at

**59 Bayford Road
Littlehampton, West Sussex**

On behalf of

Mr Richard Bailey

February 2013

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with the Technical Guidance to the National Planning Policy Framework in respect of the proposed development on the site of the existing residential property of 59 Bayford Road, Littlehampton on behalf of Mr Richard Bailey.
- 1.2 The development proposals are for the subdividing of the existing five bedroom house to form two flats each with two bedrooms within the same footprint. This is an increase in dwellings but a reduction in bedrooms.
- 1.3 A desktop study of records of historic flooding in the vicinity of the site has revealed that flooding has occurred within Bayford Road within the last year from exceptional rainfall but the site itself was unaffected and is at a higher level. There are no records of the existing house at 59 Bayford Road flooding from any source.
- 1.4 The site is shown within the current and future 1:100 year fluvial and 1:200 year tidal flood zone but would be protected by the new flood defences on the River Arun which have recently been announced as funded and due to start. Once the flood defences are in place the site will effectively be within Flood Zone 1 at low risk from tidal or fluvial flooding.
- 1.5 There is no increase to the impermeable area of the site and no change to the manner in which the development drains surface or foul water.
- 1.6 Both flats would have all sleeping accommodation on the first floor or higher and neither would have a basement.
- 1.7 There is no increase in flood risk to or from the property by the development.
- 1.8 This report concludes that the proposed development is suitable at this location.

2 Existing Site

2.1 Site Location

2.1.1 The development site is the residential property of 59 Bayford Road, Littlehampton at postcode BN175HN and grid reference TQ028018.

2.1.2 The site is approximately 150m to the east of the River Arun and approximately 550m north of Littlehampton Beach at the mouth of the River Arun.

2.1.3 The site is within the Environment Agency's Littlehampton Flood Warning Area.

2.1.4 A copy of the site location plan is attached in Appendix 1 at the rear of this report.

2.2 Site Description

2.2.1 The site is approximately 200m² in area and is currently occupied by a single residential property with a footprint of approximately 75m² together with a garage and hardstanding to the west.

2.2.2 Vehicular access to the site is available via an existing crossover from Clifton Way.

2.2.3 Architectural drawings indicating the existing and proposed layouts are attached in Appendix 2 at the rear of this report.

2.3 Drainage

2.3.1 The property forms part of a Victorian terrace and surface water from the roof is currently drained partly to the frontage road and partly to the public foul / combined sewer.

2.3.2 Foul drainage is discharged to the existing public foul water sewer to the rear of the property.

3 Proposed Development

3.1 Description

- 3.1.1 The development proposals are the conversion and subdivision of the existing five bedroom residential dwelling to provide two self contained two bedroom flats within the existing building.
- 3.1.2 The division provides more sought after accommodation in a central town location and there is a decrease in bedrooms. A typical occupancy of two to three persons in each flat would be equal to a four or five person family in the existing house.
- 3.1.3 The existing garage will be removed and two parking spaces will be served from the existing footway crossover from Clifton Road to the rear of the property.
- 3.1.4 Architectural drawings indicating the existing and proposed layouts are attached in Appendix 2 at the rear of this report.

3.2 Drainage Strategy

- 3.2.1 No alteration to the existing house building or external drainage system is required or proposed and the roof drainage and foul drainage will remain unaltered by the development.
- 3.2.2 The new parking spaces will be constructed as a permeable surface thereby slightly reducing the total onsite impermeable area and rate and volume of offsite run off.

4 Hydrology and Flood Defences

4.1 Hydrology and Ground Conditions

- 4.1.1 In terms of the river catchment the site is adjacent to the mouth of the River Arun which is highly influenced by the tide at this point.
- 4.1.2 Local borehole logs indicate several metres of clays and sands over the underlying chalk stratum with groundwater struck at typically 3m depth below ground level.

4.2 Existing Flood Defences

- 4.2.1 The Flood Defences on the River Arun are managed by the Environment Agency's Arun and Western Streams Catchment Flood Management Plan. The current policy for this section is to take further action to reduce flood risk.
- 4.2.2 This section of the coast is managed by the River Arun to Worthing Coastal Defence Strategy and the Beachy Head to Selsey Shoreline Management Plan. The current policy is to hold the line east of the Arun.
- 4.2.3 The sea defences on Littlehampton seafront are sea walled, groyned, shingle beach with an estimated standard of protection of a 200 year return period tidal event.
- 4.2.4 The flood defences on the east side of the River Arun are currently a mixture of concrete, masonry and sheet pile walls considered to be in fair condition with a varying standard of protection of between a 50 and 200 year return period event.

4.3 Littlehampton East Bank Flood Scheme

- 4.3.1 The East Bank Flood Scheme was recently announced by the Environment Agency as approved, funded and going ahead. Site investigation to inform the detailed design commenced in August 2012.
- 4.3.2 The new flood defences are to protect up to 1,900 homes from risk of tidal and fluvial flooding including properties on Bayford Road.
- 4.3.3 The new defences are predominantly steel sheet pile walling with concrete capping creating a riverfront walkway and raising the height of the river bank typically to approximately 4.9 – 5.3m AOD. This is above the current Environment Agency 200 year and 1000 year return period modelled flood levels and up to the future year 2115 modelled flood level including current predictions for sea level increases due to climate change.

5 Flood History and Flooding Potential

5.1 Flood History

- 5.1.1 There are reports of the east bank area flooding in February 1983 from a combined tidal and fluvial event caused by overtopping of the River Arun. The Arun SFRA and EA historic flood map identifies the area of the flooding neither of which affect Bayford Road or the property itself.
- 5.1.2 The extreme rainfall in June 2012 caused widespread flooding across the County and caused a cluster of properties to be affected in the South Terrace area of Littlehampton including basements in and adjacent to the southern end of Bayford Road from surface water flooding and the inability of the highway drains and foul sewers to convey the large quantities of rainwater from up to 178mm of rainfall over a 24 hour period.
- 5.1.3 Bayford Road was reportedly closed while West Sussex Fire Service used pumps to remove up to 1.5m of water from basements. The event has been assessed by WSCC as Lead Local Flood Authority and is estimated to statistically represent a 200+ return period rainfall event. 59 Bayford Road does not have a basement and the existing house was not flooded by this very extreme event.
- 5.1.4 Maps of flooding instances from the Environment Agency, SFRAs and WSCC report on the June 2012 flooding are attached in Appendix 3 at the rear of this report.

5.2 Flooding from Rivers and Seas

- 5.2.1 The Environment Agency has provided the following modelled flood levels for the site specific location:

Return Period (years)	Modelled Flood Levels (metres AOD)
200	4.17
1000	4.38
200 + Climate Change to 2115	5.28

- 5.2.2 The site is currently shown by both and Environment Agency's detailed flood maps and the Arun SFRA flood zone maps as being susceptible to the 0.5% annual chance (200 year return period) tidal event and the 1% annual chance (100 year return period) fluvial event. Both of these extents do not account for flood defences.

5.2.3 The actual current risk as shown within the Arun SFRA and WSCC SFRA includes the site within the 200 year return period tidal flood extent but not the 100 year return period fluvial event. This does not account for the East Bank Flood Scheme.

5.2.4 The site is included within the 2056 and 2106 predicted future risk of fluvial and tidal flooding based on current predictions of climate change shown within the Arun and WSCC SFRAs. These assessments do not account for the East Bank Flood Scheme which would protect the site up to the EA's 2115 flood risk model tidal prediction.

5.2.1 Copies of the relevant maps from the Strategic Flood Risk Assessments and Environment Agency's Flood Maps are located in Appendix 4 at the rear of this report.

5.3 Flooding from Groundwater

5.3.1 The Arun SFRA and WSCC SFRA identify large areas along the coast as having high potential for groundwater flooding. In practice this location is too close to the sea for groundwater to rise significantly above sea level.

5.3.2 The site is not shown within a groundwater emergence zone and there have not been issues with groundwater exceeding ground level at this location.

5.3.3 The property does not have a basement and the site is considered to be at low risk of flooding from groundwater sources.

5.4 Flooding from Surface Water Runoff and Overland Flow

5.4.1 The Arun SFRA identifies the area around the site as urban. It does not identify the site as having a previous instance of surface water flooding. This predates the June 2012 rainfall event which is discussed in the section within this FRA on historic flooding.

5.4.2 The area is not identified as being prone to flooding from overland flow.

5.5 Flooding from Sewers, Drains and Other Infrastructure

5.5.1 There are instances of flooding from sewers shown in the area of the site within the Arun SFRA but none in Bayford Road or at the site itself.

5.5.2 There are instances of flooding from sewers shown in the area of the site within the WSCC SFRA.

5.5.3 There is no risk from reservoirs, canals or other manmade sources in this area.

6 Mitigation

6.1 Flood Defences

6.1.1 The currently available analysis and modelling does not account for the new flood defences due to be constructed for the Arun East Bank Flood Scheme.

6.1.2 The new defences will protect the development site from all but the most extreme flood events which corresponds to a low risk.

6.2 Sleeping Accommodation

6.2.1 No habitable rooms have been positioned on the ground floor. This significantly reduces the risk to residents in the event of a catastrophic flood defence failure.

6.3 Flood Warning

6.3.1 The site is within the Environment Agency's Littlehampton Flood Warning Area. Updates for the flood warning area are available by calling Floodline on 0845 988 1188, selecting option 1.

6.3.2 Flood warnings are also issued on local radio, television and the internet as well as directly by telephone, mobile, email, SMS text message, fax or pager to people signed up to the Environment Agency's Floodline Warnings Direct service.

6.3.3 The Environment Agency's advanced flood warnings can predict a significant tidal flood event several days if not weeks in advance allowing a significant evacuation time if required.

7 Residual Risk

7.1 Flood Source and Mechanism

- 7.1.1 With the new flood defences in place the site is not at risk of flooding from a storm less extreme than a 1:1000 year event. The mechanism would be overtopping of the beach and river defences at high tide. This is considered a low risk.
- 7.1.2 In the event that the flood defences were to fail the site would be located within an area at risk from tidal and fluvial flooding. However, there is a reduced likelihood of flood defence failure once the new defences are installed given they will be newly constructed and therefore in a very good condition. This is considered a low risk.
- 7.1.3 The site is at low risk of flooding from surface water, foul and highway drainage sources, the flood mechanism would be surface water ponding on the roads and low lying areas potentially contaminated with foul sewage. These type of flooding would be driven by extreme rainfall and the site was shown to be unaffected by the June 2012 rainfall event.

7.2 Flood Routing

- 7.2.1 Overland flood routing through this area is southwards towards the coastline.
- 7.2.2 In the event of a flood affecting the area flood waters would ultimately drain via a combination of the public sewers and highways drains to the River Arun to the west.

7.3 Duration

- 7.3.1 Both tidal and fluvial flood events would occur at high tide and the duration that the flood water would affect the area is directly related to the rate at which the flood water could drain back to the River Arun following a significant storm event. Previous events have required pumping of water in basements.
- 7.3.2 Given the location of the site close to the drainage outlets on the River Arun and the lack of basement it is not expected any duration affecting the property itself to be any longer than a high tide.

7.4 Safe Access

- 7.4.1 Given the East Bank Flood Defence Scheme the site would have safe access for the present day and future year 200 year tidal and 100 year fluvial events.

7.4.2 The Arun and WSCC SFRAs identify the site within an area of 0.25 - 0.5m flood depth and a flood water velocity of 0 - 0.5m/s without the East Bank Flood Defence Scheme.

7.4.3 It could be expected this depth and velocity would reduce for an event which exceeded the new standard of protection but to take the precautionary principle safe access still may not be available and residents at the site may need to stay in their homes during peak water levels. This is an extreme case and it is more likely that vulnerable residents would have been evacuated.

7.5 Impact of Flooding

7.5.1 In the event of a greater than 200 year return period event overtopping the beachfront or river defences and the site flooding to low level at high tide there would potentially be damage to the property but the risk to human safety would be minimal as all habitable rooms are on the first floor or higher. This represents a very low risk.

8 The Sequential Test and Exception Tests

8.1 Vulnerability

- 8.1.1 The development site is currently developed and occupied by residential use and will remain so after development. This use is classified as more vulnerable.

8.2 Flood Zone

- 8.2.1 The Environment Agency flood map and flood modelling does not account for the presence of the existing or future flood defences and identifies the site within Flood Zone 3.
- 8.2.2 The WSCC and Arun SFRAs confirm that the development site is currently protected from fluvial flooding and identifies the actual risk of flooding to the site.
- 8.2.3 The flood defences constructed as part of the Littlehampton East Bank Flood Scheme will protect the site from both the 0.5% annual chance tidal and 1% annual chance flood event for the foreseeable future and will reduce the actual flood risk at the site to a low risk corresponding to Flood Zone 1.

8.3 Application

- 8.3.1 The Technical Guidance to the National Planning Policy Framework identifies the development proposals as more vulnerable and as appropriate in Flood Zones 1 and 2 without application of the Exception Test. The flood risk vulnerability classification at the site is unchanged by the proposed development.
- 8.3.2 Given the presence of the proposed flood defences on the River Arun and the existing sea defences along the coastline the site will effectively be within Flood Zone 1 and the Sequential Test is passed.
- 8.3.3 The proposed development is considered suitable at this location and the Exception Test is not considered necessary.

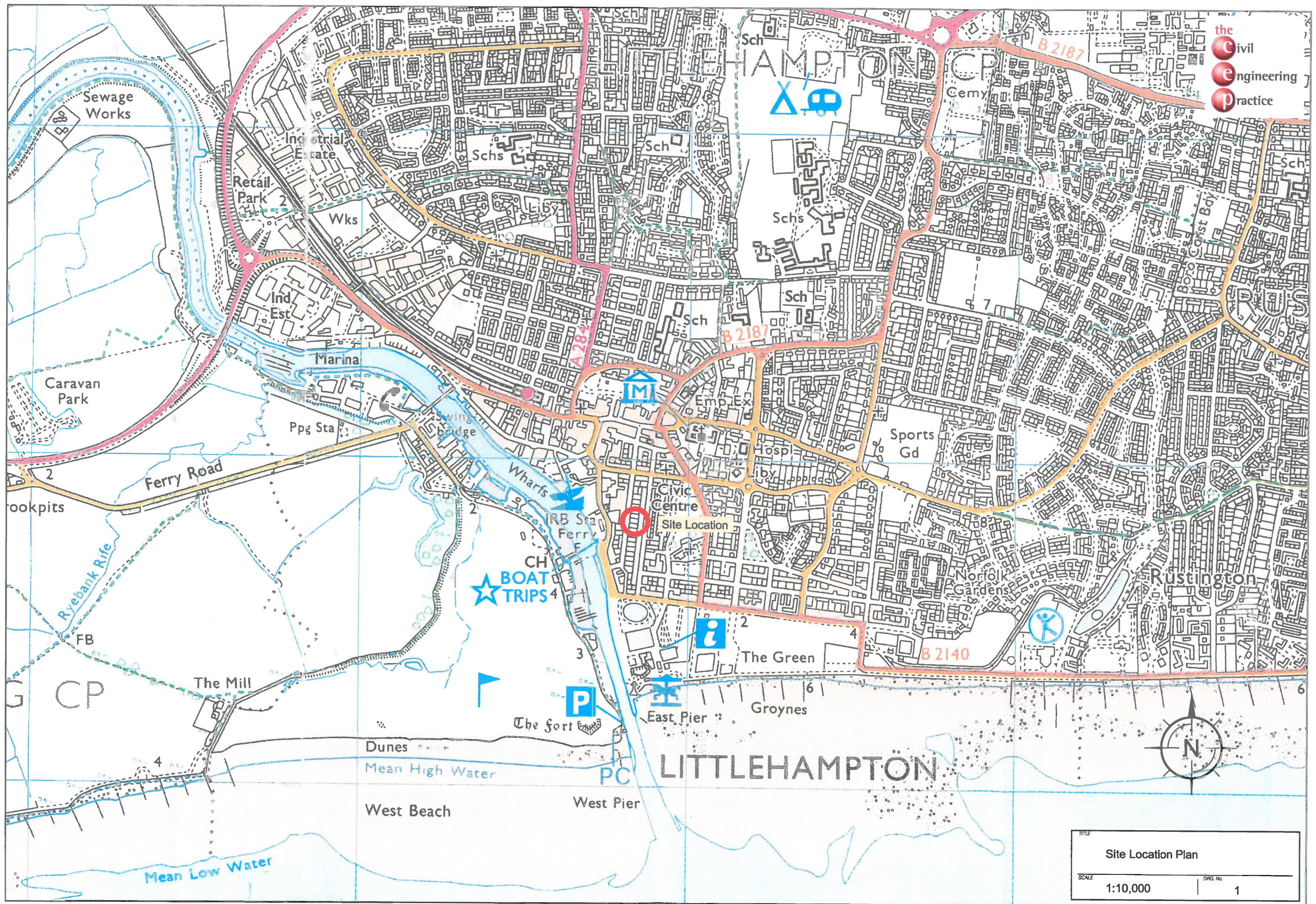
9 Conclusions

- 9.1 There are historic flood events affecting the area but not the site itself including fluvial and surface water flooding.
- 9.2 The standard of protection afforded by the Littlehampton East Bank Flood Scheme will reduce the risk of flooding from rivers and seas to a low risk corresponding to Flood Zone 1.
- 9.3 There is no change to the use of the site other than a subdivision of the existing property to provide two self contained dwellings.
- 9.4 The site is currently developed, within a residential area and is suitable for continued residential use demonstrating that the Sequential Test has been passed.
- 9.5 Foul drainage is connected to the public foul sewer via the existing on site connections and will remain so. The small potential increase in residents would produce a negligible increase in foul flows.
- 9.6 There will be a decrease in impermeable area due to the development and the existing surface water drainage system will be reused in its present form.
- 9.7 There is no increase in flood risk to the surrounding area due to development which is considered safe and appropriate for the location.

10 List of Appendices

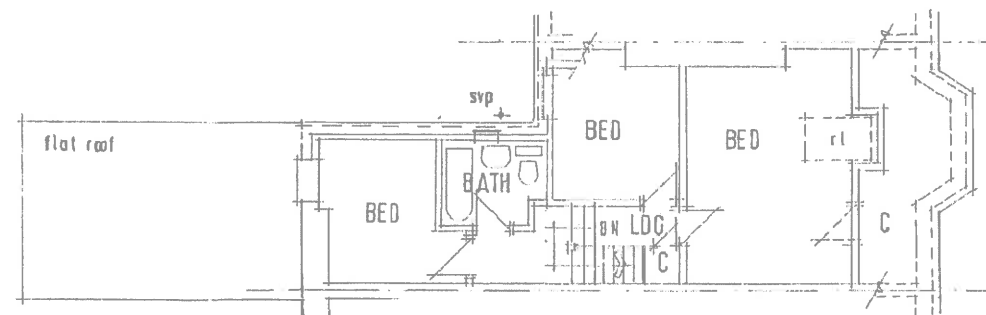
Appendix 1	Site Location Plan
Appendix 2	Architectural Plans
Appendix 3	Maps of Historic Flooding
Appendix 4	SFRA and Environment Agency Flood Maps

Appendix 1
Site Location Plan

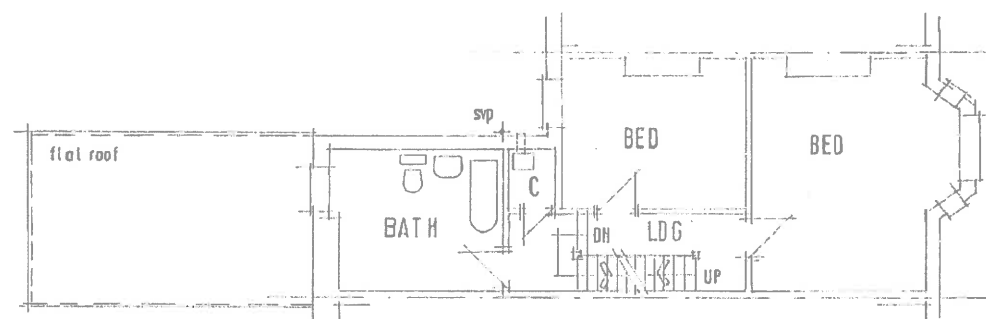


Appendix 2

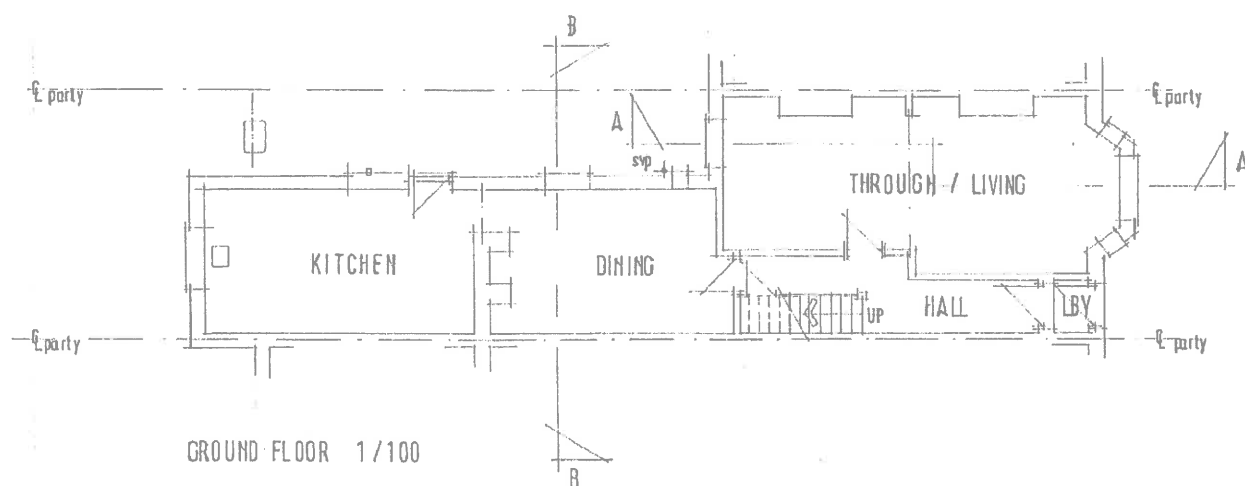
Architectural Layout Plans



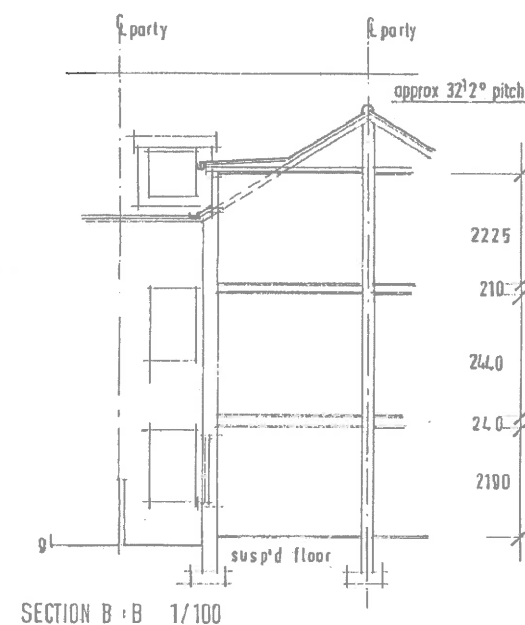
SECOND FLOOR / ROOF 1/100



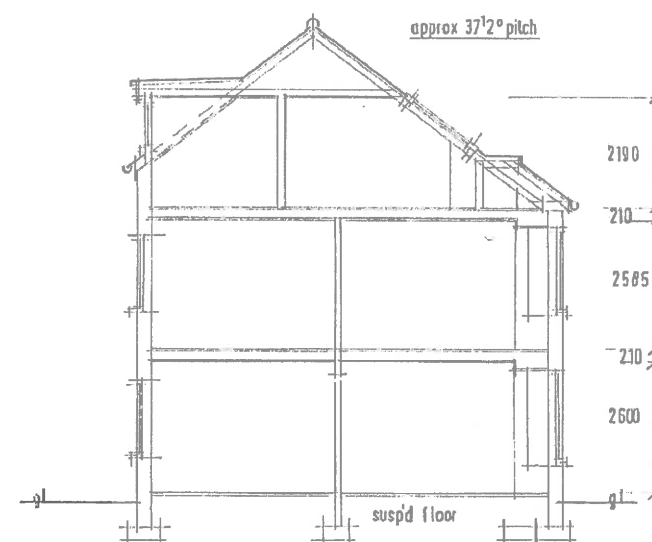
FIRST FLOOR 1/100



GROUND FLOOR 1/100



SECTION B-B 1/100



SECTION A-A 1/100

THE CIVIL ENGINEERING PRACTICE

20 FEB 2013

RECEIVED

TREVOR E. UNSTED LTD

R.B.S. HOUSE • 59-61 SEA LAKE • RUSTINGTON • WEST SUSSEX • BN16 2HQ Tel: 01903 858990

Client: MR. R. BAILEY.

Project: CONVERSION TO FORM 2 NO MAISONETTES
AT 59, BAYFORD ROAD, LITTLEHAMPTON,
W/ SUSSEX, BN 17, 5HH.

Drawing: EXISTING

Scale: AS SHOWN

Drawing No.:

Date: NOV 2012.

12/ 3 996 / 2

Drawn: tu

Revisions:

Copyright:

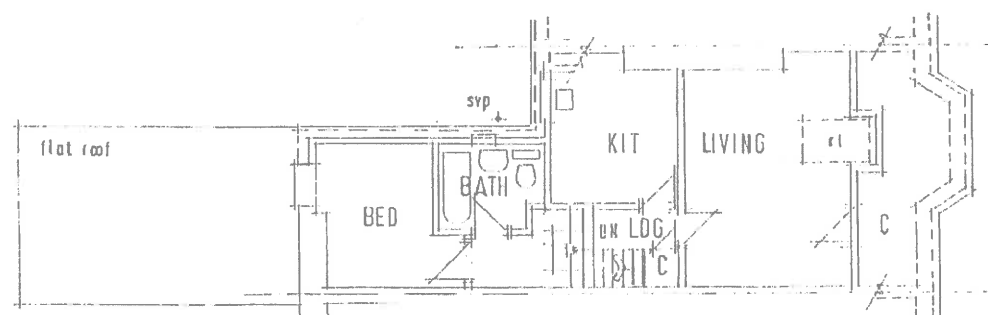
The contractor must check all dimensions and levels on site and no dimensions are to be scaled from drawings.

It is the contractor's responsibility to ensure compliance with all statutory authority requirements, carry out works with total regard to existing and retained structure. Works and materials to latest CP/BS.

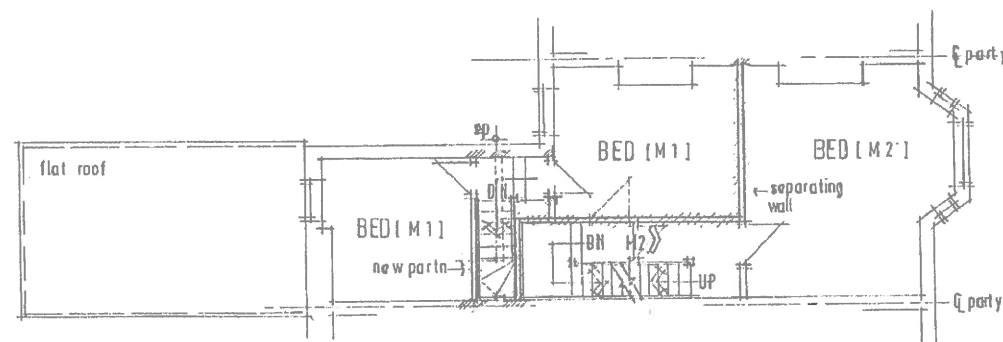
Drawing to be read in strict accordance with engineer's information where applicable.

All structural timber C16 unless otherwise noted. All structural and external timber pressure impregnated with preservative, cut ends site swabbed with Cuprinol or similar treatment.

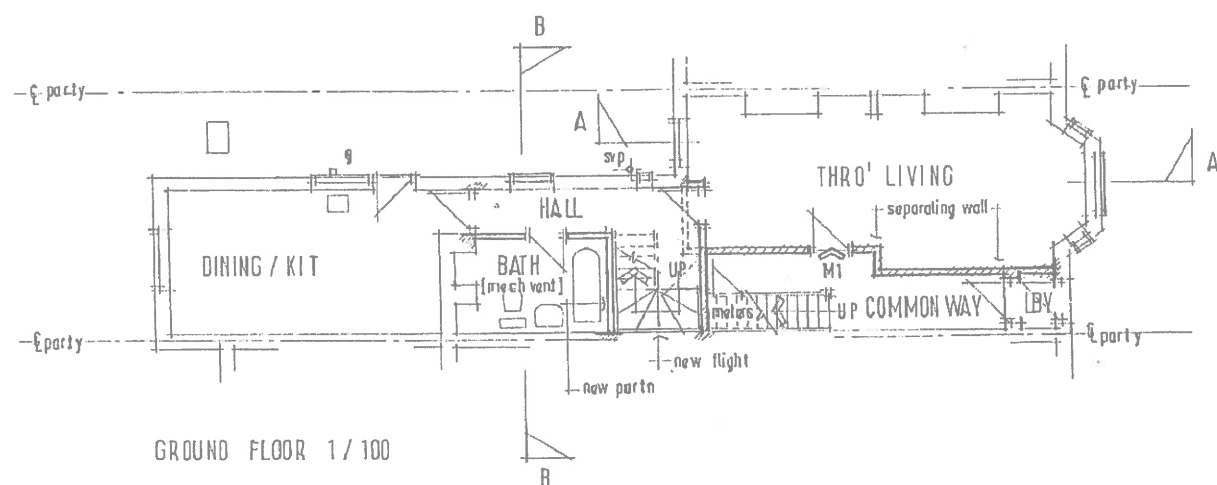
Local authority to witness satisfactory test on all new and affected foul/storm drainage.



SECOND FLOOR / ROOF 1/100



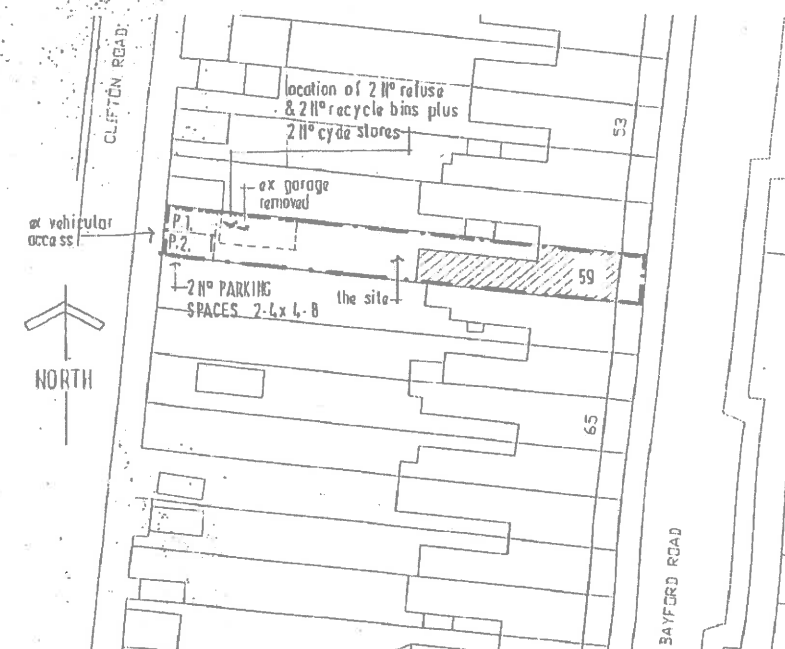
FIRST FLOOR 1/100



GROUND FLOOR 1/100

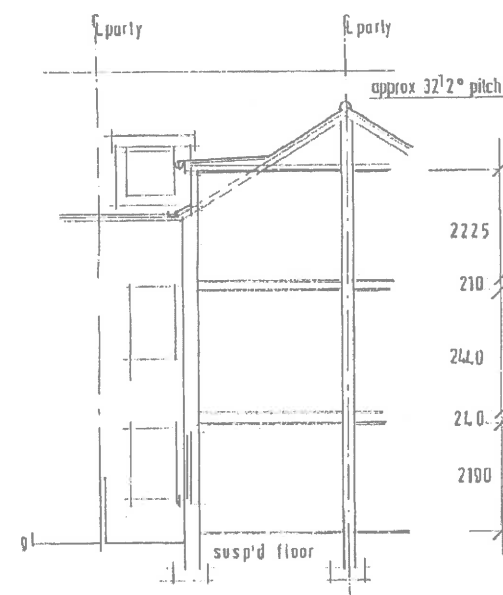


LOCATION 1/1250

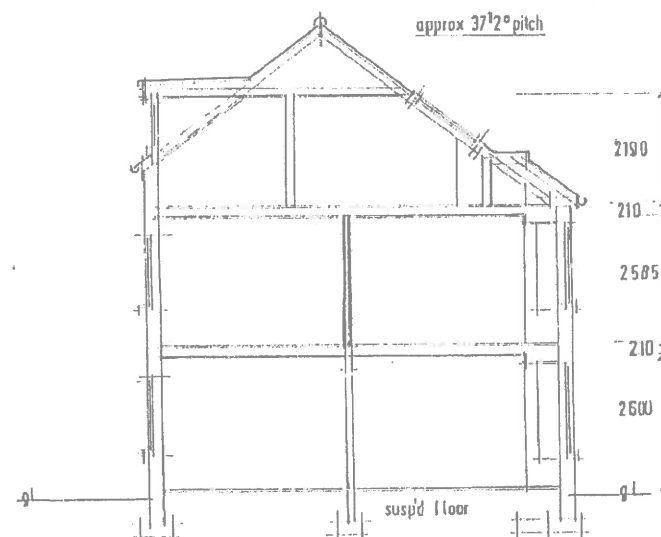


BLOCK PLAN 1/500

NOTE: THERE IS NO EXTERNAL ALTERATION TO THE BUILDING PROPOSED
THUS ROOF PLANS & ELEVATIONS ARE NOT RELEVANT.



SECTION D : B 1/100



SECTION A : A 1/100

THE CIVIL ENGINEERING PRACTICE

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R.B.S. HOUSE • 59-61 SEA LANE • RUSTINGTON • WEST SUSSEX • BN11 6 2RQ Tel: 01903 859090

Client: MR: R. BAILEY.

Project: CONVERSION TO FORM 2H° MAISONNETTES
AT 59; BAYFORD ROAD; LITTLEHAMPTON;
W/ SUSSEX; BN 17; 5 H.H.

Drawing: PROPOSED

Scale: AS SHOWN Drawing No.:

Date: JAN 2013

12/ 3 996 / 3

Drawn: J.U. Revisions:

Copyright:

The contractor must check all dimensions and levels on site and no dimensions are to be scaled from drawings.

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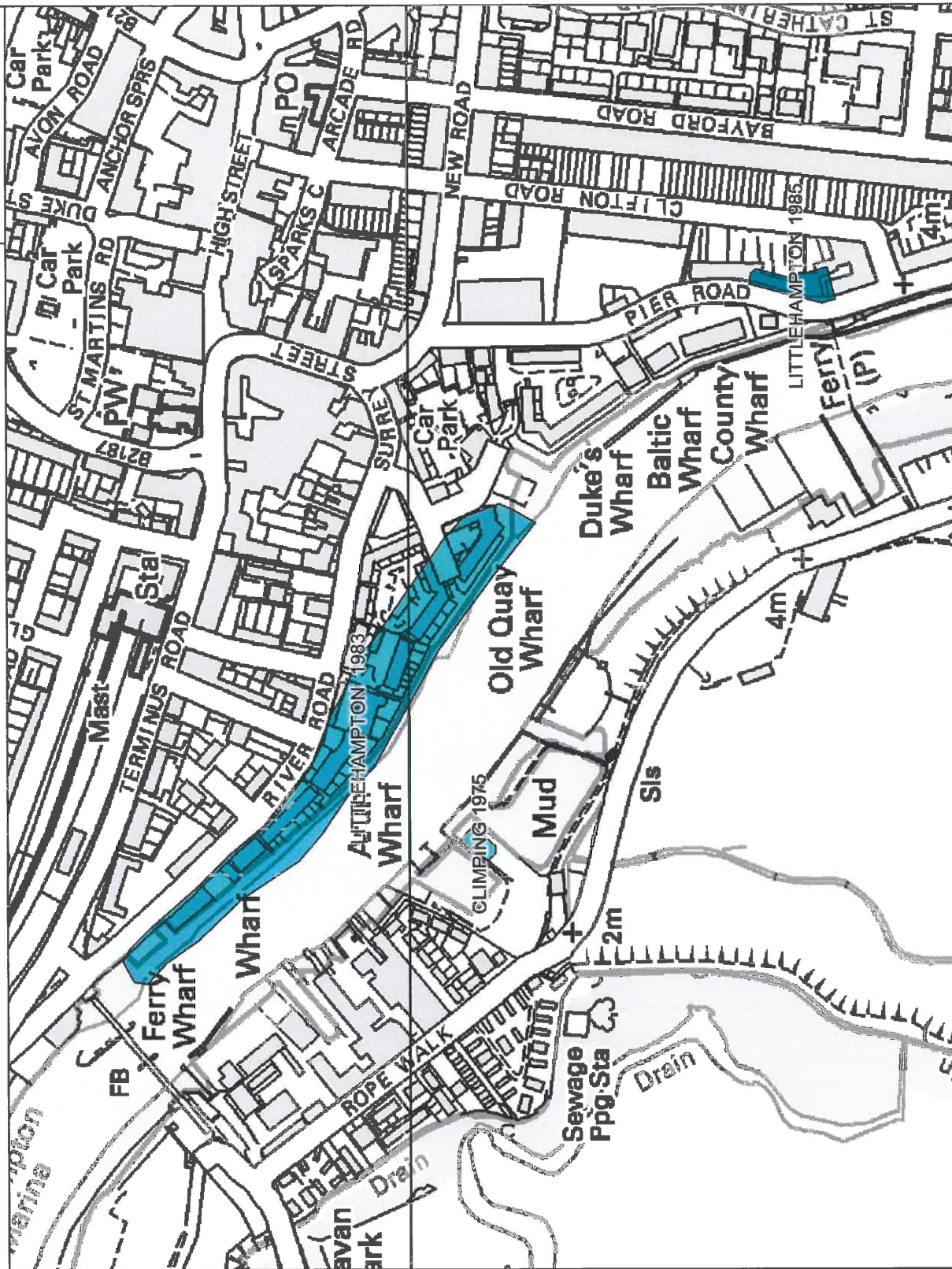
Local authority to witness satisfactory test on all new and affected foul/storm drainage.

Appendix 3
Maps of Historical Flooding

Flood History - Littlehampton [Approximate recorded flood extents]



Legend
 Flood Event Outlines

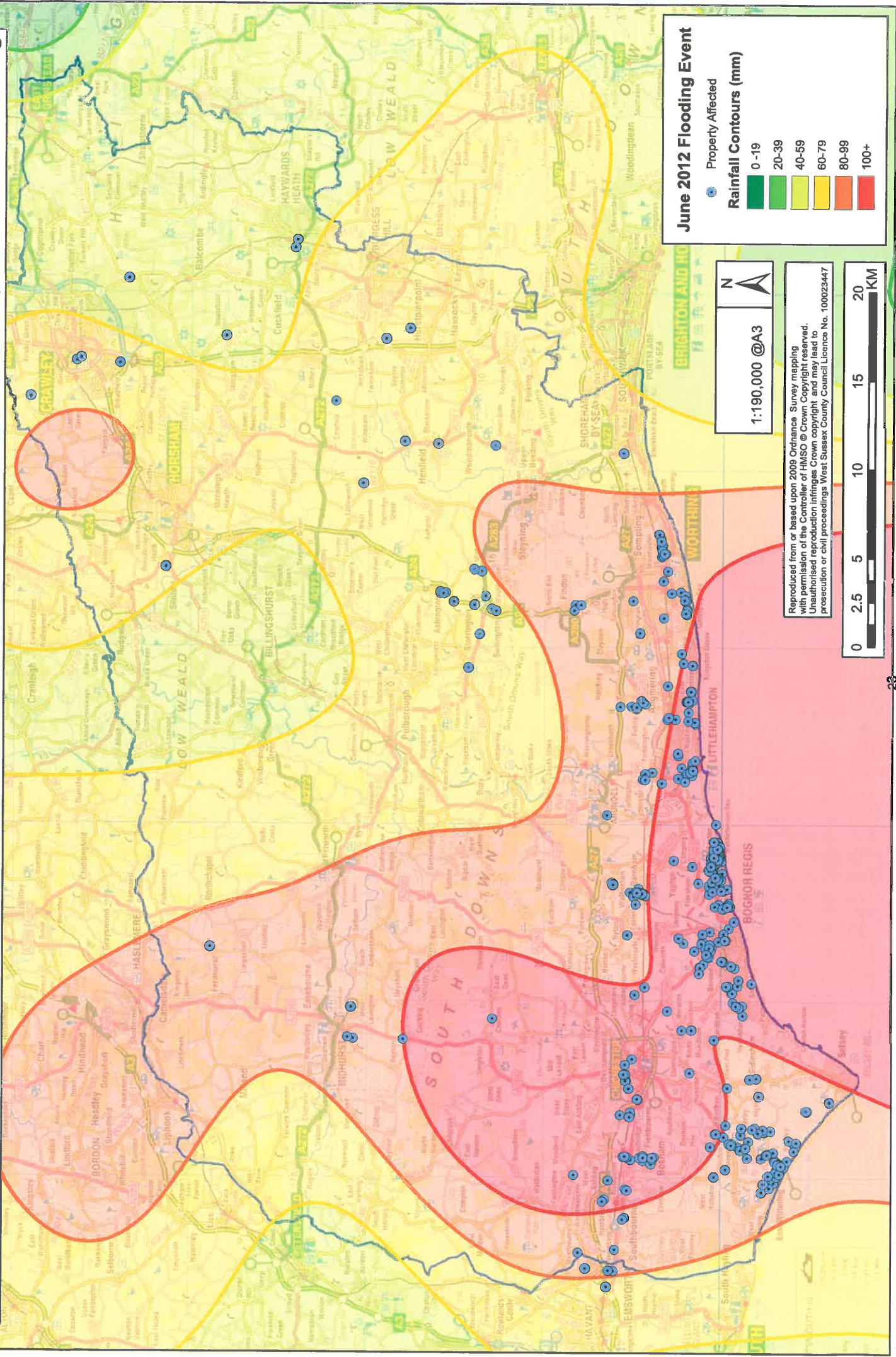


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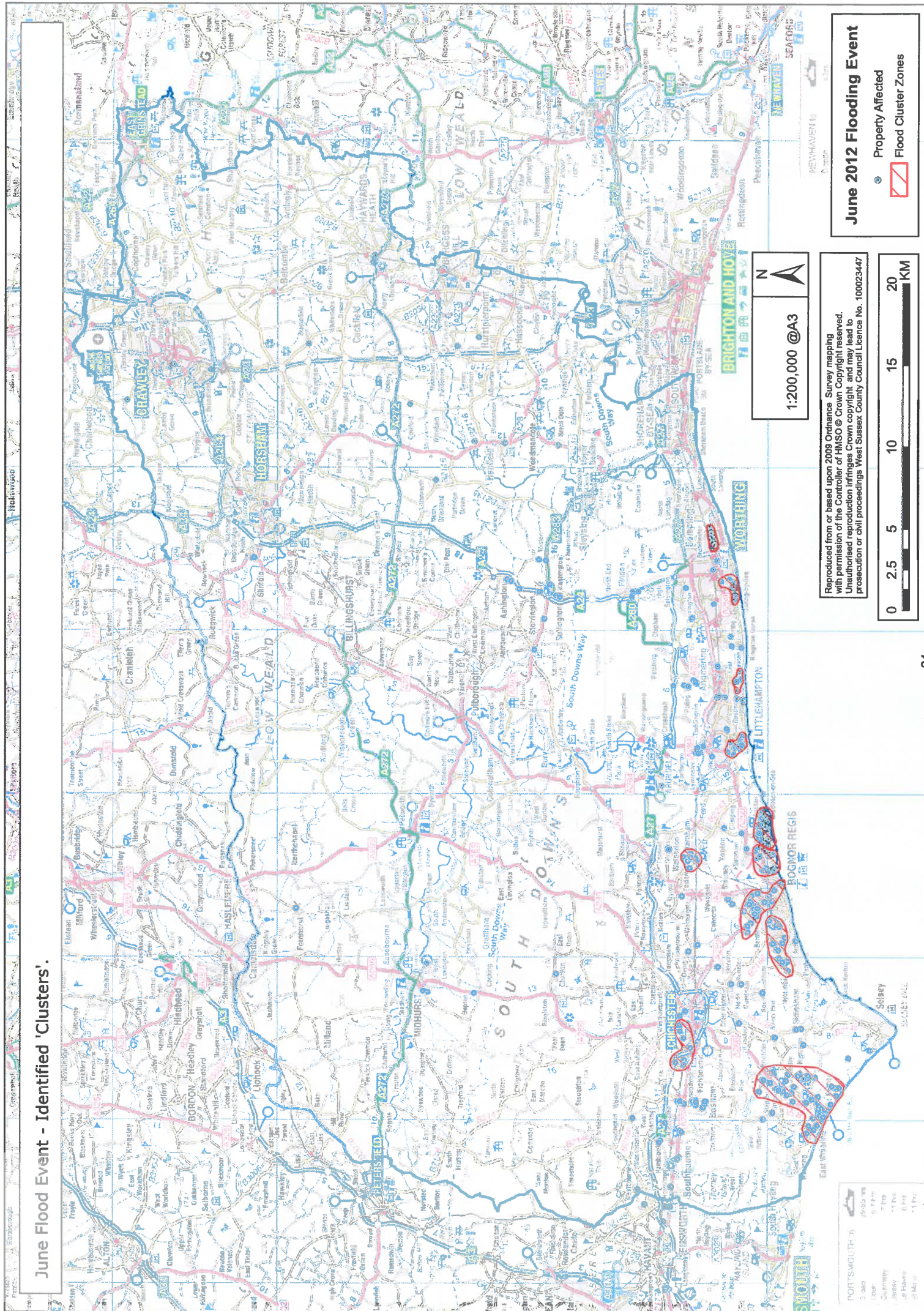


0 38 76 114 m.

Isohyet map showing approximate rainfall coverage and properties affected during June 2012 flooding



June Flood Event - Identified 'Clusters'.



June 2012 Flooding Event

- Property Affected
- Flood Cluster Zones

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1:200,000 @A3





Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

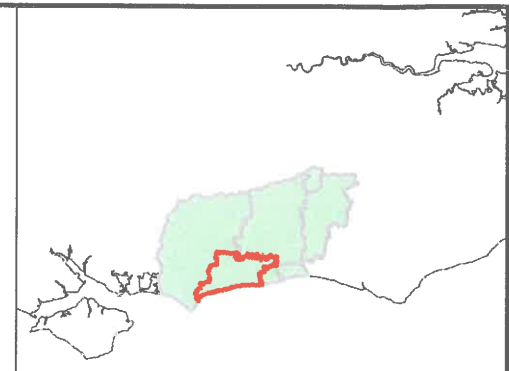
Arun District Council SFRA

Map S - Historic Incidents of Flooding from Sewers



CAPITA SYMONDS

- Legend**
- Arun District Boundary
 - Historic Incidents of Sewer Flooding



0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_S.wor



Notes:

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Arun District Council SFRA

Map H - Historic Flood Events



CAPITA SYMONDS

Legend

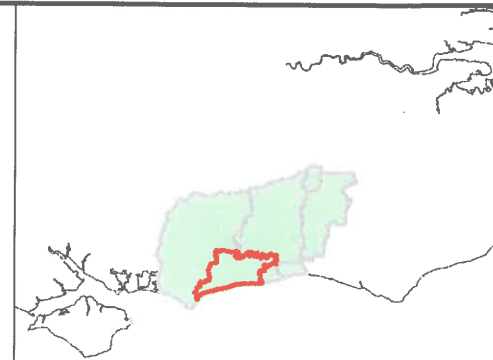
— Arun District Boundary

Historic Flood Events - Points

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

Historic Flood Events - Areas

- Coastal
- Tidal
- Fluvial
- Surface Water
- Unknown



Scale at A3: 1:80,000

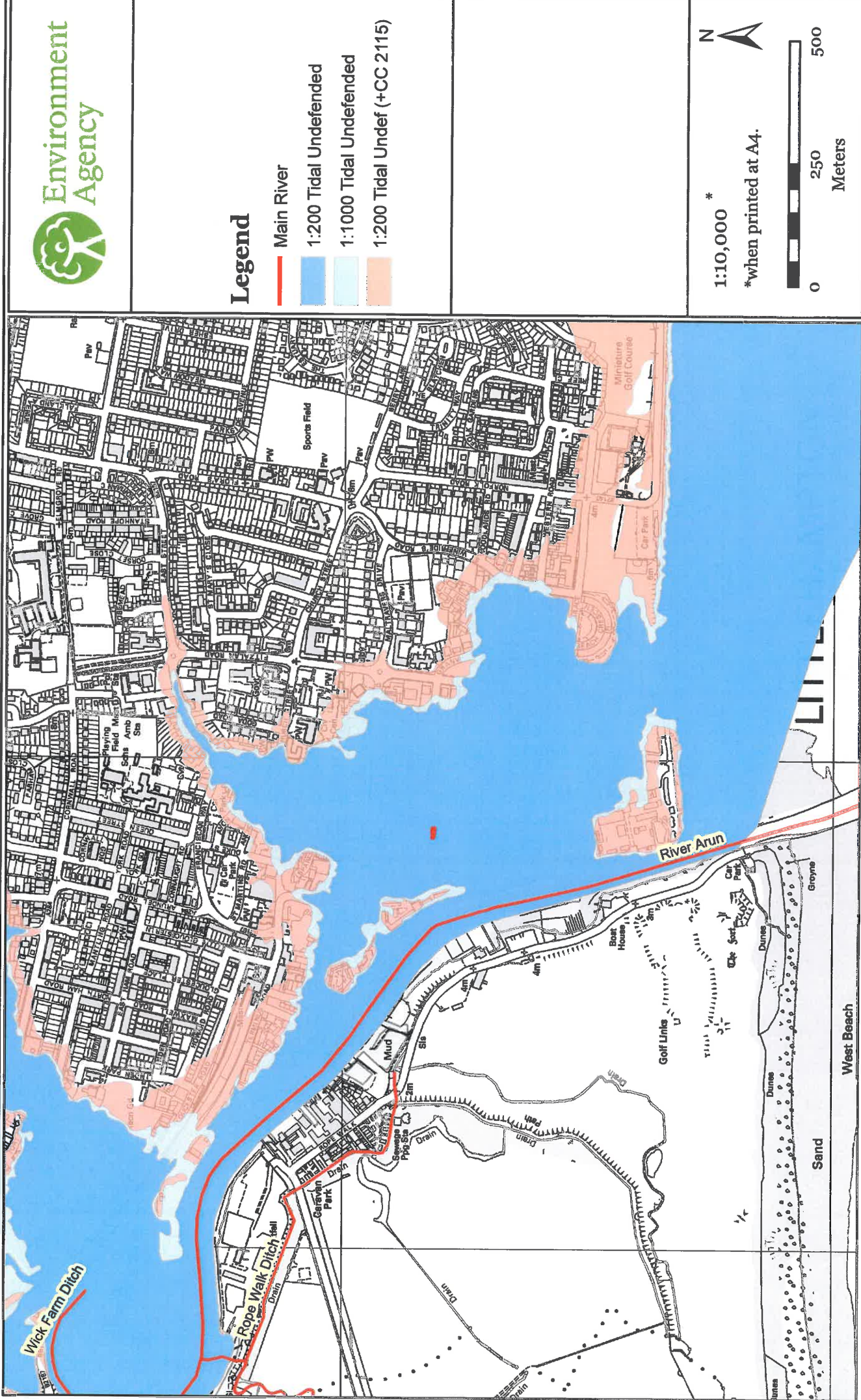
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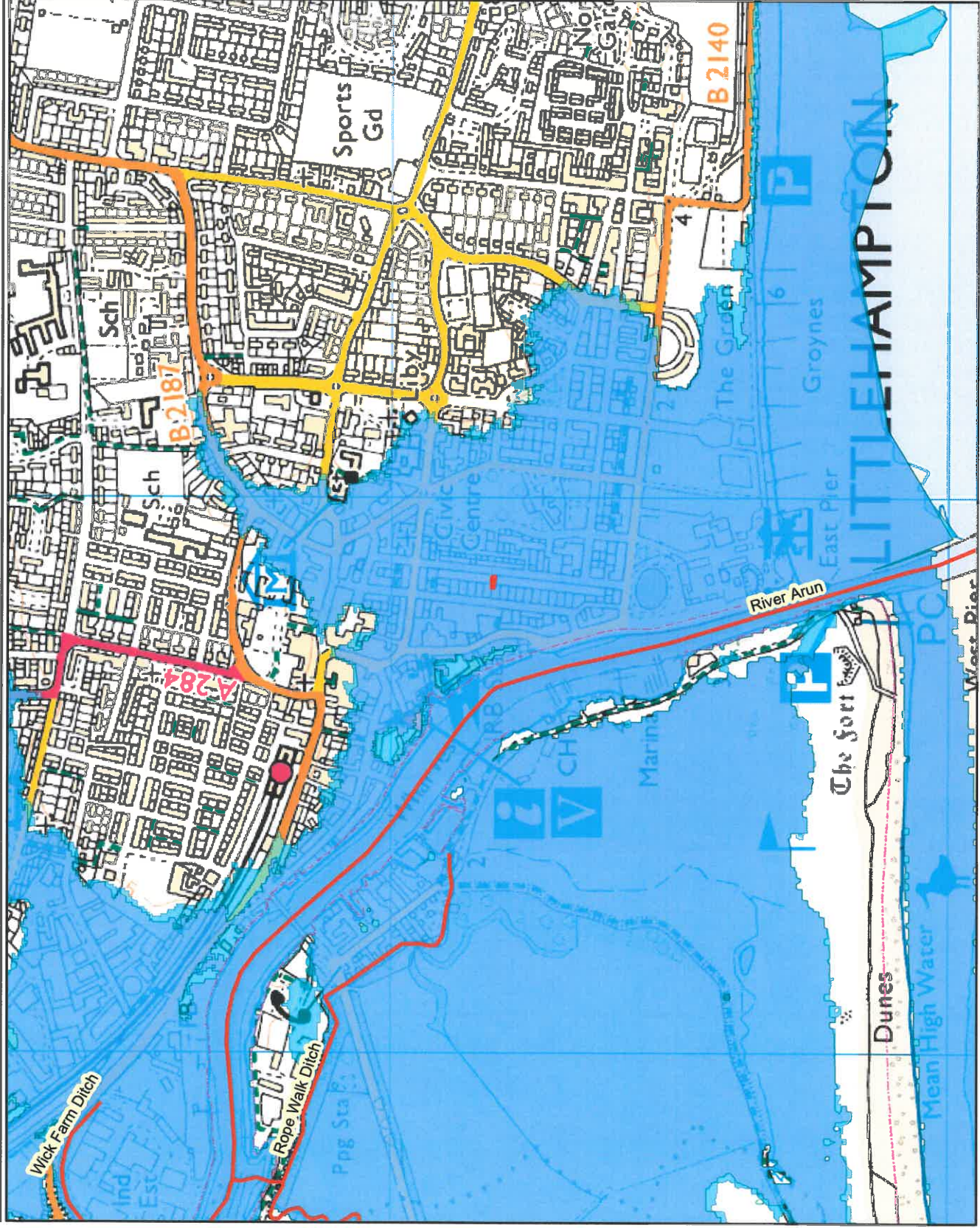
Map_H.wor

Appendix 4

SFRA and Environment Agency Flood Maps



Flood Map Centered on 59 Bayford Road, Littlehampton BN17 5HN - Created 13/02/2013 [Ref: SSD/0402/LT]



Legend

- Main River
- Defences
- Areas Benefiting From Defences
- Flood Storage Area
- 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 an 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.

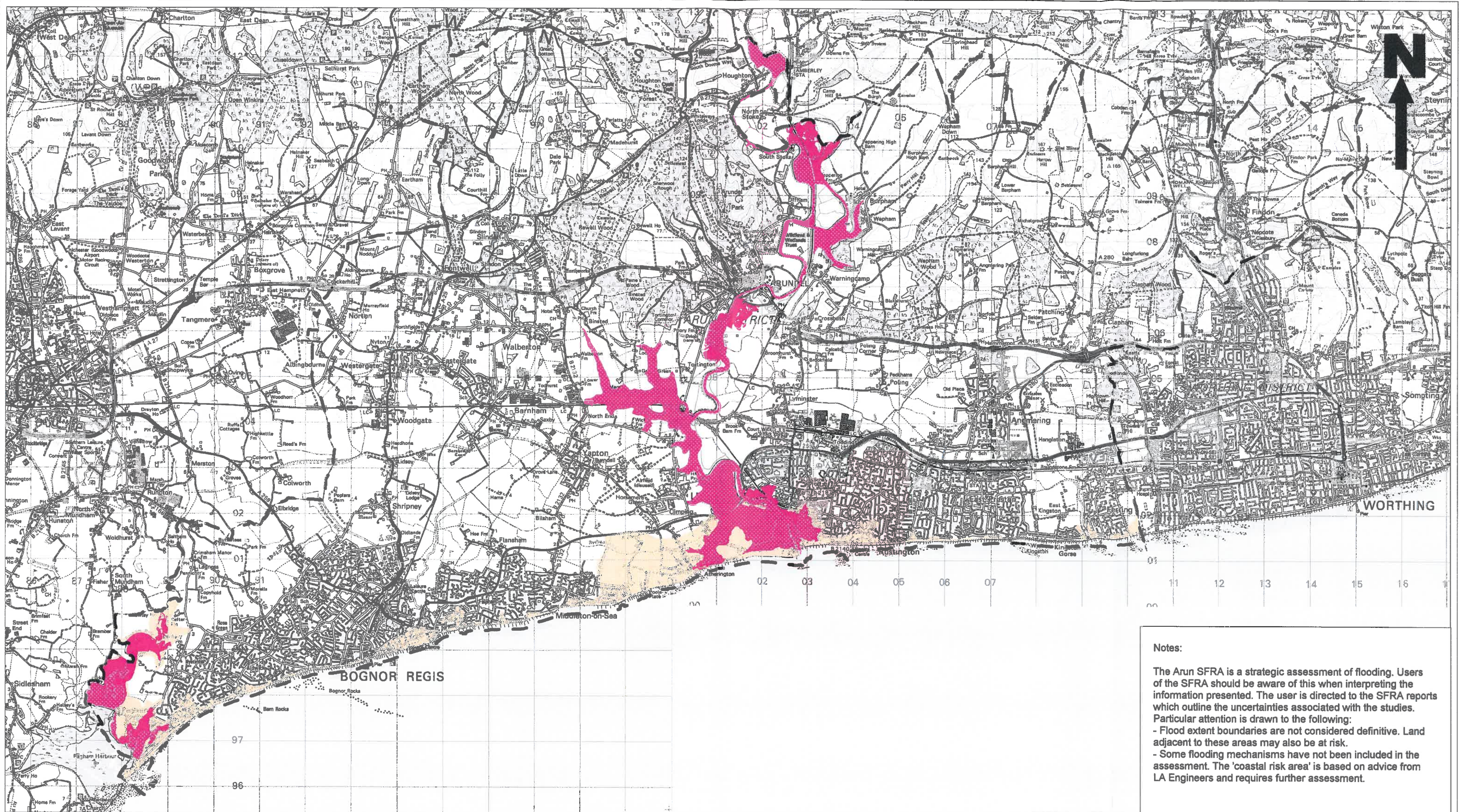
Flood Zone 2

Shows the extent of an extreme flood from rivers of the sea with up to a 1 in 1000 chance of occurring each year.

1:10,000 *

*when printed at A4.





Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

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- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

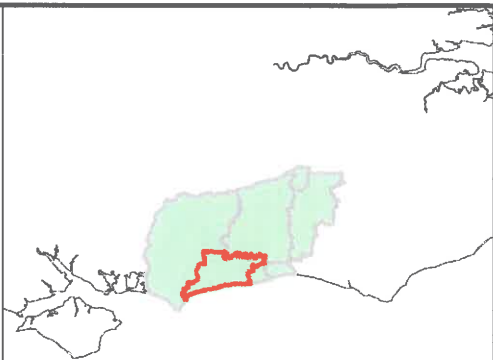
Arun District Council SFRA

Map A1-T - Actual and Residual Flooding from the Sea



CAPITA SYMONDS

- Legend**
- Arun District Boundary
 - Actual Defended Tidal Flood Risk (0.5% AEP, 2006)
 - Residual Defended Tidal Flood Risk (0.1% AEP, 2006)
 - Coastal Risk Area



Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-T.wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

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Arun District Council SFRA

Map A2-T - Flood Depth - Actual Risk of Flooding from Sea



ARUN DISTRICT COUNCIL

CAPITA SYMONDS

Legend

- Arun District Boundary
- Coastal Risk Area

Actual Risk Flood Depths (m) (0.5% AEP, 2008)
0.00 - 0.25
0.25 - 0.50
0.50 - 0.75
0.75 - 1.00
1.00 - 1.25
1.25 - 1.50
1.50 - 1.75
1.75 - 2.00
2.00 - 2.25
≥ 2.25
Unknown



0 2 4

Kilometres

Scale at A3: 1:80,000

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Map_A2-T.wor



Notes:

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Arun District Council SFRA

Map A3-T - Flood Velocity - Actual Risk of Flooding from the Sea



CAPITA SYMONDS

Legend

 Arun District Boundary
  Coastal Risk Area

Actual Indicative Tidal Flood Velocities (0.5% AEP, 2006)	
0.0 - 0.5	2.5 - 3.0
0.5 - 1.0	3.0 - 3.5
1.0 - 1.5	3.5 - 4.0
1.5 - 2.0	4.0 - 4.5
2.0 - 2.5	Unknown



0 2 4

Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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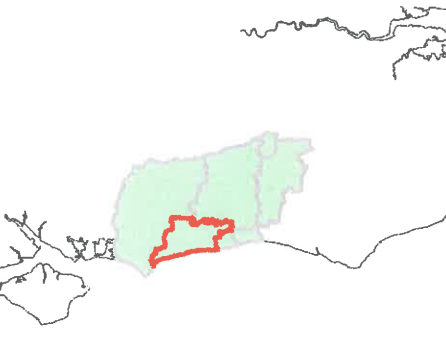
Map_A3-T.wor



Notes:

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- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA Map A1-F - Actual and Residual Risk of Flooding from Rivers  CAPITA SYMONDS	Legend  Arun District Boundary  Actual Defended Fluvial Flood Risk (1% AEP, 2006)  Residual Defended Fluvial Flood Risk (0.1% AEP, 2006)	 Scale 0 2 4 Kilometres Scale at A3: 1:80,000 Date: 31/01/2008 Note the property of this drawing and design is vested in Capita Symonds Limited and must not be copied or reproduced in any way without their written consent. Based on Ordnance Survey mapping and reproduced by Capita Symonds Ltd licence no. 100018487 (2008) with the permission of the Controller of Her Majesty's Stationery Office Crown copyright Map_A1-F.wor
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Notes:

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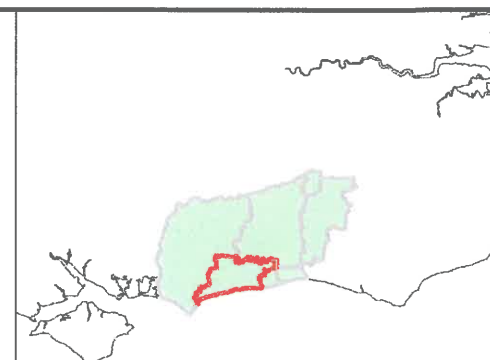
Arun District Council SFRA

Map A2-F - Flood Depth - Actual risk of Flooding from Rivers



CAPITA SYMONDS

Legend



Scale at A3: 1:80,000

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Map_A2-F.wor



Notes:

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Arun District Council SFRA

Map A3-F - Flood Velocity - Actual Risk of Flooding from Rivers



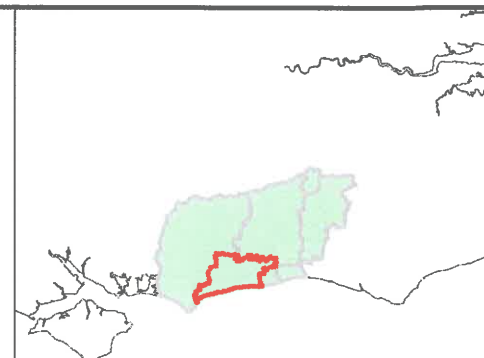
CAPITA SYMONDS



Arun District Boundary

Actual Indicative River Flood Velocities
(1% AEP, 2006)

0.0 - 0.5	2.5 - 3.0
0.5 - 1.0	3.0 - 3.5
1.0 - 1.5	3.5 - 4.0
1.5 - 2.0	4.0 - 4.5
2.0 - 2.5	Unknown



Kilometres

Scale at A3: 1:80,000

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Map_A3-F.wor