Appendix E: Supporting Information

E.1.0 This section contains information that was used for the preparation of the SFRA and may need to be referenced to during the planning process. This includes:

Hydraulic Modelling
Flooding History
Flood Risk Summary in the Ouse Catchment
Flood Warning Systems
Overview of Flooding Causes
Overview of Flood Alleviation Schemes
Ouse Subcatchments and Gauging Stations
List of Main Rivers and Critical Ordinary Watercourses within Lewes District
PPS25 Guidance Tables
FD2320 Safe Access and Exit Lookup Table
Sustainable Drainage Systems (Overview)

These sections have been looked at individually within this Appendix.

OVERVIEW OF HYDRAULIC MODELLING

Hydraulic Modelling Carried Out as Part of the SFRA

During the early stages of this study, the need to carry out further hydraulic modelling to satisfy the general requirements of PPS25 and the particular needs of Lewes District Council was identified. This modelling was to investigate:

Likely effects of climate change
Consequences of improving flood defences along Lewes flood cell 4/5 and Newhaven flood compartment 4

The areas to be subject to further analysis are the North Street flood cell in Lewes Town which has a predominantly fluvial influence and the tidal part of the River Ouse at Newhaven. These two locations were simulated using separate models for a range of scenarios as explained below.

Modelling Software

An ISIS-TUFLOW linked model was constructed to simulate a range of scenarios aimed to fulfil the identified requirements of this study. The ISIS-TUFLOW model is particularly useful when assessing flood risk as the ISIS (1-Dimensional) component of the model can accurately simulate the river section of the flow whereas the TUFLOW (2-Dimensional) component can accurately simulate the flow on the floodplain.

An ISIS model for the Ouse was obtained from the EA and modified accordingly to represent the different scenarios to be analysed.

The ISIS model provided had been used to simulate fluvial and tidal events with return periods no greater than 100years. Therefore, new hydrographs had to be produced to simulate the climate change scenarios. Additionally, 21 spills were added to the model where it was practical to do so but no new reservoir units were put in place.

The ISIS model provided also had an upstream inflow unit (Ouse_Uck) for the Upper Ouse and Middle Ouse which consisted of observed data. This was subsequently modified to a Flood Estimation Handbook (FEH) inflow unit (Ouse_Uck_FEH) with parameters taken from the FEH CD ROM 2.0.

Tidal data at the downstream boundary was provided in the form of peak tide levels for the various return periods in particular years and a 100year tide provided in the ISIS model. The 100year and the peak water level were used to construct tidal curves for each tidal return period. The positive tide levels were scaled up to account for the increase in tidal level whereas the low tide levels where the stage went to negative values were left as is. Table 1 provides the peak water level for each tidal event simulated.

Year of Analysis	Return Period			
	MHWS	20yr	200yr	1000yr
2007	3.52	4.14	4.3	4.4
2115	4.66	N/A	5.5	N/A

Table 6: Extreme sea levels for various tidal set-ups (mOD)

Lewes Model

The Lewes hydrodynamic model starts at node so14402 (GR 54083, 11139) and ends at node so12412 (GR 54209, 11009) with a total river length of 2km. In order to link the 1D and 2D models using the ISIS-TUFLOW link, a number of spill units and reservoirs were removed from the original ISIS model. A number of extended sections were also edited to ensure that floodplain storage was not being represented in both the 1D domain and the 2D domain thus effectively double-counting the flow.

The 2D domain of the Lewes model covers an area of 1.43km^2 and a perimeter of 6,480m. The grid cell size used to dictate the domain over which the 2D flow was simulated was 10m. The defences were represented using polylines with the crest elevation data taken from the National Flood and Coastal Defence Database (NFCDD).

For the 2-D analysis, the buildings of Lewes were not represented within the TUFLOW model.

The scenarios modelled for Lewes are summarised below:

Fluvial Return Period	Tidal Boundary	Existing	Undefended	Raised Defence
20	MHWS (2007)			
100	MHWS (2007)			
100 +20%	MHWS (2115)			
1000	MHWS (2007)			

Table 7: Fluvial scenarios modelled for Lewes Flood Cell 4

For the undefended scenario the defences were removed along the length of the Lewes Flood Cell 4 with the elevation set on the bank to 3.5mOD. This elevation value was taken from the nodes in the ISIS model in the undefended location and all representations of the embankment within the ISIS model river sections were removed.

Output plots from the simulations were generating to show: maximum depth, maximum velocity, rate of onset and duration. The impact of the defence was also determined. For the defended 20yr event flows are constrained to the river channel.

The flow depth plots and flow velocity plots and UK Flood Hazard Class were also produced in GIS format. The UK Flood Classification is in accordance with the publication DEFRA/EA R&D Output: Flood Risk Assessment Guidance for New Development Phase 2 Draft FD2320/TR1 and TR2.

Floodplain inundation does not occur until the 100yr event and thus no grid results are shown for the 20 return period.

Defended Lewes Model

The raised defence model is designed to reflect the protection of flood cell 4/5 from flooding from either the river Ouse or from flooding upstream. To achieve this level of protection it was necessary to provide a defence line in the location of the Pells, the swimming pool and the recreation ground at the upstream side of the cell 4/5, see Figure 1 below. Additionally, it was necessary to raise the defence line adjacent cell 4/5 along the Ouse on the right bank.

Figure 1. Defence line at Pells, Lewes (Solid black line)

In the case of Lewes the embankment crest height of the raised defence was set to an arbitrary level of 10m AOD. The raised defence level was applied to the right bank of the River Ouse along the extent of flood cell 4/5. A lateral defence was also added at the upstream end of flood cell 4 as shown in Figure 1. Figure 2 shows the results of the simulations for the three scenarios and this is summarised in Table 4 with values taken from key model nodes.

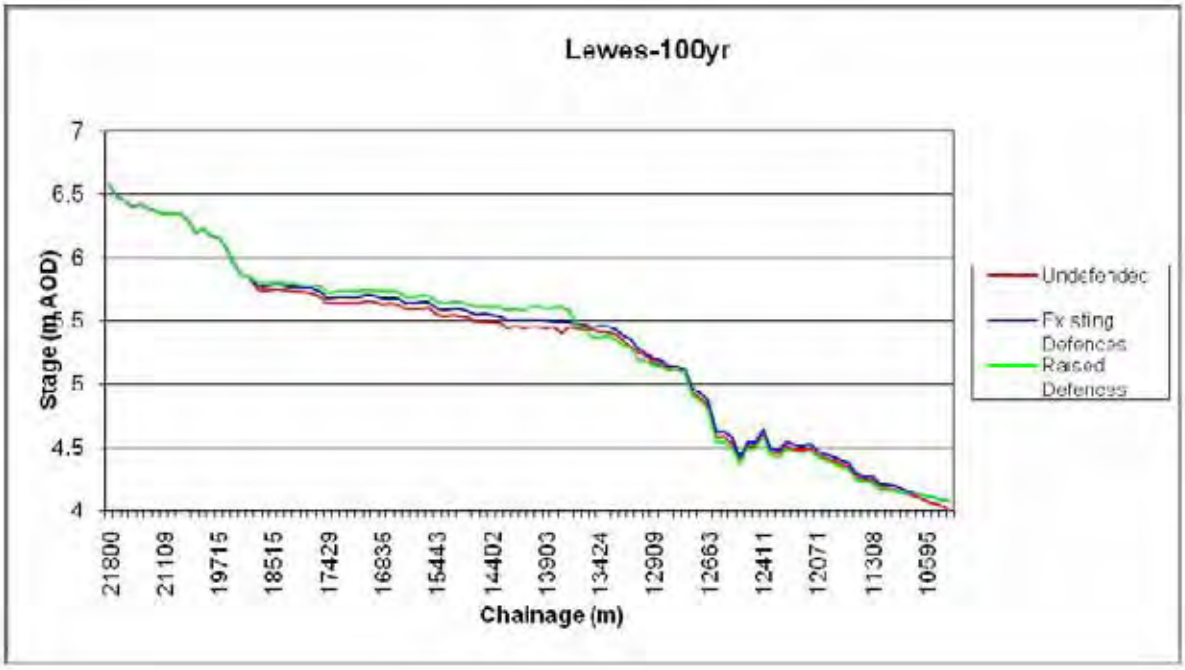


Figure 2: Long section of the River Ouse for three scenarios at Lewes

Lewes	SCENARIO: 100yr Fluvial & MHWS Tidal (2007)			
Flood Cell 4	Undefended	Existing Defences	Raised Defences	Node ID
Effect Upstream	5.627	5.673	5.718	so16237
Effect at the Site	5.442	5.479	5.583	so13505
Effect Downstream	4.414	4.441	4.392	so11808

Table 8: Summary of the effect of different scenarios within the location of flood cell 4 in Lewes (Water levels in mOD)

Table 4 shows that upstream of the raised defence site, water levels are slightly higher in the case of the raised defence as the flow does not spill out and backs up the system. The effect downstream of the site is minimal. At flood cell 4 there is a more complicated response with the reach immediately upstream of the raised defence section (so19511-so13505) were water levels are higher than the existing defended scenario. Additionally along the reach of raised defences (so13460-so12638) has lower water levels than those experienced for the current defended scenario.

Newhaven Model

The Newhaven model simulates the Fluvial-Coastal interface near the town of Newhaven between ISIS node so 3602 and so0, a river length of 3.6km. Due to the area of the flood compartment that was to be assessed, it was necessary for the Newhaven model to be of a much larger size than the Lewes model (Area=9.6 km^2 and Perimeter = 17.92km). The grid resolution was, as a result, increased to 20m. This can be justified in an area such as Newhaven as the floodplain is relatively flat.

As the Newhaven model was situated on the coast, it was necessary to add a 2D tidal boundary to the 2D domain as well as the original 1D tidal specification in the ISIS model. The tidal data used was the same as that used for the 1D tidal boundary node (so0). The tidal boundary was added to the seaward (south) side of the coastal defence and so there will be some inundation of the beach area. The level of the coastal defence suggests that the tidal boundary will not impact upon floodplain inundation. However, the tidal boundary was added to all scenarios for consistency and for potential further use of the model.

Defence levels to be used in the model were taken from a land survey data undertaken by the Environment Agency during April 2009 where spot heights were recorded. For the undefended scenario, defences were removed from the River Ouse left bank along the limit of the Newhaven Flood Compartment 4. All coastal defences were left in place. The length of the undefended section was 2.4km and the elevation was set to 3.75m. This elevation value was taken from the so2207 ISIS river section with no defence represented.

The buildings of Newhaven were not added to the TUFLOW model as a separate layer.

The scenarios modelled for Newhaven are summarised below:

Fluvial Return Period	Tidal Boundary	Existing	Undefended	Raised Defences
20	20yr (2007)			
2	200yr (2007)			
2	200yr (2115)			
2	1000yr (2007)			

Table 9: Tidal scenarios modelled for Newhaven Flood Compartment 4

Output plots from the simulations were generating to show: maximum depth, maximum velocity, rate of onset and duration. The 200yr tidal level for 2115 was 5.5m which was far beyond the threshold level of the defences. In this scenario there were a number of model instabilities due to the large amount of water upon the floodplain. As the defences were so comprehensively overwhelmed it was accepted by the Environment Agency to map the inundation up to a contour of 5.5m rather than have inaccurate model results. Therefore it is not possible to produce velocity, onset or duration results for the 200yr (2115) scenarios.

The flow depth plots and flow velocity plots and UK Flood Hazard Class were also produced in GIS format. The UK Flood Classification is in accordance with the publication DEFRA/EA R&D Output: Flood Risk Assessment Guidance for New Development Phase 2 Draft FD2320/TR1 and TR2. For the 200yr (2115) scenarios it has also been assumed that given the depth of flooding that a risk of 'Danger for All' would be applicable for this scenario.

Defended Newhaven model

As the Newhaven model is tidally influenced, the embankment crest level was set to an arbitrary height of 10m AOD. The raised defence was applied to the left bank of the River Ouse along the extent of flood compartment 4 as well as a lateral defence at the upstream limit of the flood compartment (shown in Figure 3). Figure 4 shows the results of the simulations for the three scenarios and this is summarised in Table 5 with some values taken from specific model nodes.

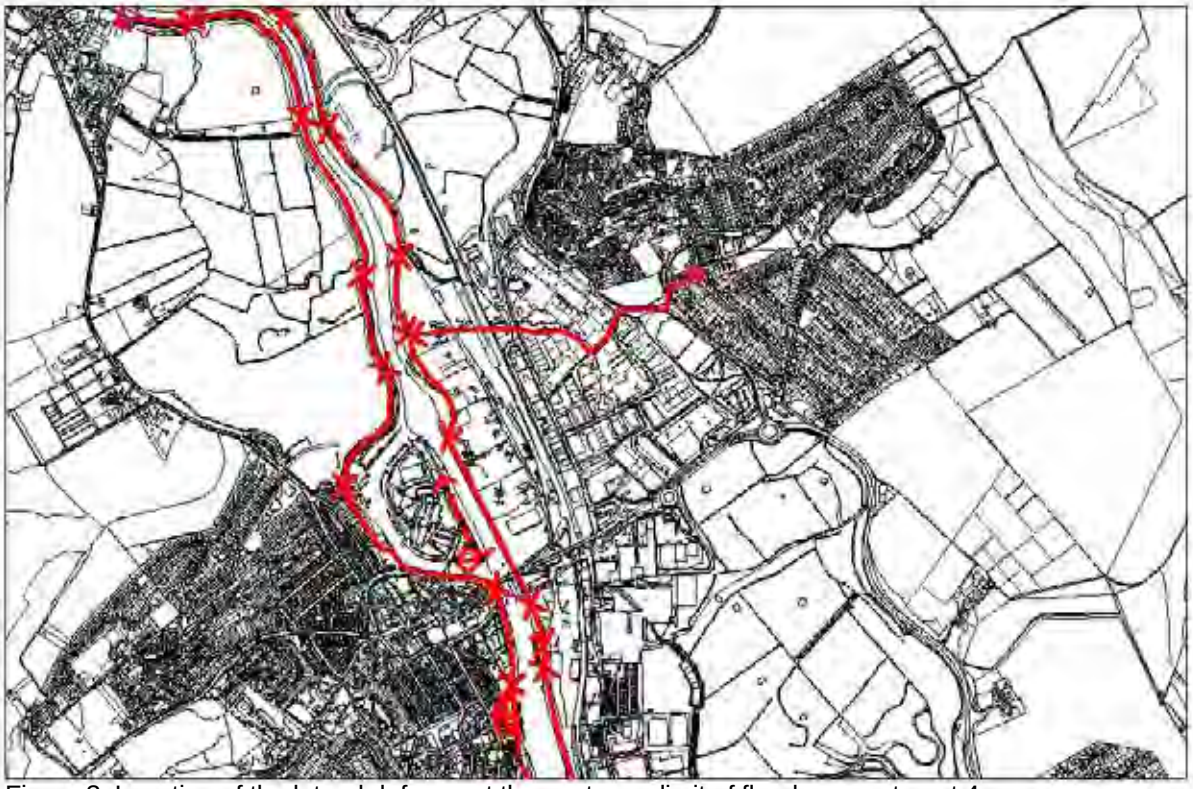


Figure 3: Location of the lateral defence at the upstream limit of flood compartment 4.

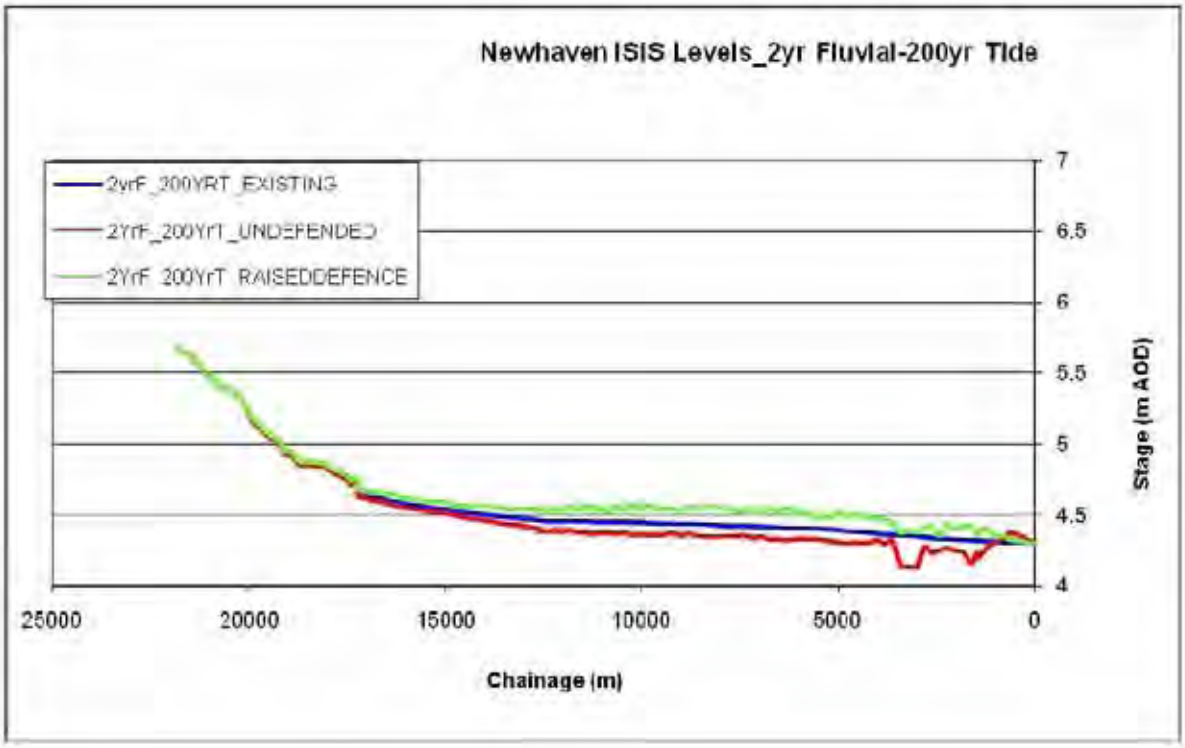


Figure 4: Long section of the River Ouse for three scenarios at Newhaven

Newhaven Flood Compartment 4	SCENARIO: 2yr Fluvial & 200yr Tidal (2007)			
	Undefended	Existing Defences	Raised Defences	Node ID
Effect Upstream	4.355	4.44	4.524	**so8797**
Effect at the Site	4.231	4.319	4.375	**so1474**
Effect at the Site	4.345	4.31	4.354	**so807**

Table 10: Summary of the effect of different scenarios within the location of flood compartment 4 in Newhaven. (Water levels in mOD)

The results from the Newhaven raised defence runs show that there is an increase in the peak water level when compared to the existing scenarios. This is due to the loss of floodplain storage in flood compartment 4 as a result of the raising of defences.

Summary

Runs were simulated for three scenarios on both the Lewes and Newhaven sections of the River Ouse. The three scenarios were the undefended, defended and raised defences. The raised defences for Lewes and Newhaven were both arbitrarily set to 10m OD. The results show that raised defences at Lewes would increase peak water levels upstream but would reduce them slightly at the site and have a small reduction downstream. By raising defences the flow is confined to the channel and limits potential overtopping. At New haven the raising of defences would lead to an increase in the simulated peak water level as floodplain storage is lost in flood compartment 4.

Hydraulic Modelling available for this study

A significant amount of work has been carried out in flood risk/prevention as a result of the 2000 floods in Lewes. A brief summary of the hydraulic models for which general details and flood outlines were made available for this study is included below.

Table 11: Summary of Hydraulic Modelling carried out for the area until

Name	Scenario	Date of	Return	Internal EA	Consultan	Model	Land Surve	Rive Surve
Adu	Defende	200	100	Not Signed	Atkins	ISIS		
Upper		2005	2, 5, 10, 25, 50, 75,		Atkin	ISIS	2000	2003
Upper	Climate	2005	100		Atkins	ISIS	2000	2003
Adu	25yr Fluvial v 20yr Tidal	2005	25:2		Atkin			
Tidal	Defende	2006	200	Not Signed	Atkins	2D		
Tidal	Areas Benefiting from	2006	200	Not Signed	Atkins	2D		
Tidal	Tidal	2006	200	Not Signed	Atkins	2D		
Lower	Oct 2000 FEO -	2005			Atkins	2D	1997	2001
Lower	Nov 2000 FEO -	2005			Atkins	2D	1997	2001
Lower	Dec 1994 -	2005			Atkins	2D	1997	2001
Lower	Undefende	2005	75.		Atkins	2D	1997	2001
Lower	Climate	2005	20		Atkins	2D	1997	2001
Lower	Existing	2005	75.		Atkins	2D	1997	2001
Lower	25yr Fluvial v 20yr Tidal	2005	25:2		Atkin			
Tidal	Areas Benefiting from	2006	10	Not Signed	Atkins	2D		
Tidal	Defende	2006	100	Not Signed	Atkins	2D		
Tidal	Undefende	2006	100	Not Signed	Atkins	2D		
Lower	Undefende		100		Atkins	2D	1997	2001
Lower	Climate		10		Atkins	2D	1997	2001
Lower			2, 5, 10, 25, 50, 75,		Atkin	2D	1997	2001
Middle	Indicative Flood Plain	2002	10		Atkin	ISIS		
Uc	Indicative Flood Plain	2002	100		Atkin	ISIS		
Upper	Indicative Flood Plain	2002	100		Atkins	ISIS		

Source: Environment

Records of Flooding

Lewes District Council, the Environment Agency and Southern Water were all contacted to obtain information on flooding records and drainage problems in the District. The locations identified as having suffered from flooding in the past are included in the Map section.

A comprehensive list of recorded flooding incidents was produced during the investigation of the 2000 floods. This is included below.

Unfortunately it has been rare for the actual extent of major floods to be recorded systematically by the appropriate authorities, and when records have been made they are often discarded or misplaced in subsequent successive reorganisations. The only flooding records found during this study have been those relating to the 1960 and 2000 floods. In this case the lack of historical records is not of critical importance as the comprehensive study carried out following the 2000 floods provides a good overview of the current flooding mechanism in the area.

The River Ouse Catchment Flood Management Plan (CFMP) identifies known and potential flood prone areas and summarises them as follows:

> Fluvial flooding in Uckfield and Lewes.
> Surface water flooding in Lewes, Barcombe and Seaford.
> Combined fluvial and tidal flooding in Newhaven, Lewes and Barcombe Mills.
> Periodic groundwater flooding from the South Downs in various locations across the catchment, including Kingston south of Lewes.

Southern Water has provided us with a table summarising surface water and combined sewer-related flooding incidents within the District in the last 10 years. This table is also included below.

FLOODING HISTORY

Event Date	Details
1852	Heavy and prolonged rainfall caused widespread flooding in the Ouse catchment. At Lewes 'torrents from hills' are reported flooding lowland areas. Train routes were blocked, properties were damaged. Massive economic losses resulted from loss of hay, corn, fruits and livestock.
1852	Serious floods in Uckfield
1865	Serious floods in Uckfield (26 October).
1875	Serious floods in Uckfield. Highest flood since 1852.
1880	Heavy rainfall recorded at Balcombe (9 October) and much flood damage.
1904	High flood waters in Lewes (31 January).
1911	November 11 recorded flooding across the Ouse catchment. At Cliffe (Lewes), river levels increased rapidly forcing dozens of occupants from bankside dwellings.
1916	Major flooding in Uckfield
1925	Major flooding in Lewes caused damage to businesses along Cliffe High Street.**)**
1943	Major flooding in Uckfield (14 January).
1952	Flooding in Uckfield (28 February).
1960	Flooding in Lewes with notable influence from the Winterbourne Stream. First week of November saw the worst floods since 1925.
1974	Major flooding in Uckfield
1979	Major flooding in Uckfield and Lewes (28 December).
1987	Event followed the notorious '1987 hurricane'. Estimated as a 1 in 45 year event by NRA. 140 properties flooded in Haywards Heath and Lindfield. Subsequently a flood relief scheme was developed for the Scrase Bridge Stream and its tributary the West Common Stream.
1993	Major flooding in Uckfield, December 30 -31, (peak flow 80 cumecs). 30 properties flooded in Lindfield and 30 in Uckfield. Flooding also in Buxted.
2000	28 May 2000 (peak flow about 85 cumecs). Flooding at Uckfield
2000	Autumn 2000; major flooding across the south east. Lewes and Uckfield severely affected. 1 - 12 October 2000 (peak flow 132 cumecs). Towns of Lewes and Uckfield cut off as all major routes flooded. Lewes railway station closed. Lewes - 817 domestic and business properties flooded. Uckfield - up to 100 business and domestic properties affected. Barcombe, Isfield and Buxted also flooded.
2002	Localised flooding in upper catchment, road flooded in Sharpsbridge .

(Source: Catchment Flood Management Plan)

FLOOD RECORDS PROVIDED BY SOUTHERN

Date of most recent incident	Town	Locality	Street	Postcode	Sewer Problem Description	Sewer Type Description	Internal Flooding	Curtilage Flooding	Highway or Open Space	GeoX	GeoY
13/10/2000	HASSOCKS	DITCHLING	BEACON ROAD	BN6 8UL	HYDRAULIC	FOUL/COMBINED		Y	Y	532582	114845
23/12/2002	HASSOCKS	DITCHLING	SOUTHVIEW	BN6 8TQ	HYDRAULIC	FOUL/COMBINED		Y		533099	116371
14/01/2004	LEWES	KINGSTON	ASHCOMBE LANE	BN7 3JZ	HYDRAULIC	FOUL/COMBINED	Y	Y		539357	108405
12/10/2000	LEWES	RINGMER	BISHOPS LANE	BN8 5LB	HYDRAULIC	FOUL/COMBINED		Y	Y	545057	112753
04/09/2000	LEWES		BROOK STREET		HYDRAULIC	FOUL/COMBINED			Y	541584	110532
12/10/2000	LEWES	RINGMER	CROCKENDALE FIELD, LEWES ROAD	BN8 5QZ	HYDRAULIC	FOUL/COMBINED		Y		545106	112608
05/01/1998	LEWES		DAVEYS LANE	BN7 2BQ	HYDRAULIC	FOUL/COMBINED	Y			542189	110588
21/05/2004	LEWES	NORTH CHAILEY	EAST GRINSTEAD ROAD	BN8 4HX	HYDRAULIC	FOUL/COMBINED	Y	Y		539176	121163
05/01/1998	LEWES		FRIARS WALK	BN7 2LF	HYDRAULIC	FOUL/COMBINED	Y	Y		541794	110016
13/11/2002	LEWES	RINGMER	GREEN CLOSE	BN8 5LG	HYDRAULIC	FOUL/COMBINED		Y	Y	545155	112727
09/01/1998	LEWES		HAM LANE	BN7 3PS	HYDRAULIC	FOUL/COMBINED		Y		542079	109312
01/11/2002	LEWES	NEWICK	JACKIES LANE	BN8 4QT	HYDRAULIC	FOUL/COMBINED		Y		541138	121566
08/09/2006	LEWES		KING HENRYS ROAD	BN7 1BT	HYDRAULIC	FOUL/COMBINED		Y		541066	110455
13/11/2002	LEWES	RINGMER	LEWES ROAD	BN8 5ND	HYDRAULIC	FOUL/COMBINED		Y		546041	112406
13/10/2000	LEWES	SOUTH CHAILEY	MARKSTAKES CORNER	BN8 4BP	HYDRAULIC	FOUL/COMBINED		Y		539282	118409
07/06/1997	LEWES		MIDDLE WAY	BN7 1NH	HYDRAULIC	FOUL/COMBINED			Y	540185	110405
05/08/2004	LEWES	SOUTH CHAILEY	MILL BROOKS	BN8 4AW	HYDRAULIC	FOUL/COMBINED		Y		538936	117298
08/02/2001	LEWES	RINGMER	MILL PATH	BN8 5JH	HYDRAULIC	FOUL/COMBINED		Y		545158	112268
04/11/1996	LEWES		NEVILL CRESCENT		HYDRAULIC	FOUL/COMBINED			Y	540305	110477
25/09/2001	LEWES		NEVILL ROAD		HYDRAULIC	FOUL/COMBINED			Y	540404	110456
19/08/2005	LEWES		PADDOCK ROAD	BN7 1UU	HYDRAULIC	FOUL/COMBINED			Y	541319	110195
12/01/2004	LEWES		PELHAM TERRACE	BN7 2DR	HYDRAULIC	FOUL/COMBINED			Y	541369	110482
24/06/2005	LEWES		QUEEN ANNES CLOSE	BN7 1BQ	HYDRAULIC	FOUL/COMBINED			Y	541084	110443
12/10/2000	LEWES	RINGMER	RUSHEY GREEN	BN8 5JB	HYDRAULIC	FOUL/COMBINED		Y	Y	545197	112257

Date of most recent incident	Town	Locality	Street	Postcode	Sewer Problem Description	Sewer Type Description	Internal Flooding	Curtilage Flooding	Highway or Open Space	GeoX	GeoY
12/01/2004	LEWES	KINGSTON	SNEDNORE, WELLGREEN LANE	BN7 3NL	HYDRAULIC	FOUL/COMBINED		Y		539671	108311
20/05/2004	LEWES	SOUTH CHAILEY	SOUTH STREET	BN8 4BB	HYDRAULIC	FOUL/COMBINED		Y		539114	118109
07/12/2006	LEWES		SOUTH WAY	BN7 1LU	HYDRAULIC	FOUL/COMBINED			Y	540400	110416
30/07/1996	LEWES		SPITAL ROAD		HYDRAULIC	FOUL/COMBINED			Y	540459	110109
06/11/2000	LEWES	PLUMPTON GREEN	STATION ROAD	BN7 3BT	HYDRAULIC	FOUL/COMBINED		Y		536387	116654
13/10/2000	LEWES		TALBOT TERRACE	BN7 2DS	HYDRAULIC	FOUL/COMBINED	Y	Y		541364	110340
12/07/2000	LEWES		THE AVENUE	BN7 1QS	HYDRAULIC	FOUL/COMBINED		Y		541248	110288
12/11/2000	LEWES		THE COURSE	BN7 1JL	HYDRAULIC	FOUL/COMBINED		Y		540979	109708
27/05/2000	LEWES	FIRLE	THE DOCK	BN8 6NY	HYDRAULIC	FOUL/COMBINED		Y		547105	107305
03/01/2003	LEWES	KINGSTON	WELLGREEN LANE	BN7 3NP	HYDRAULIC	FOUL/COMBINED		Y	Y	539886	108287
23/11/2000	LEWES	FIRLE	WICK STREET	BN8 6NB	HYDRAULIC	FOUL/COMBINED			Y	546933	107990
10/11/2000	LEWES		WINTERBOURNE LANE	BN7 1HN	HYDRAULIC	FOUL/COMBINED		Y		540551	109634
20/07/2004	LEWES		WINTERBOURNE MEWS	BN7 1HG	HYDRAULIC	FOUL/COMBINED		Y		540620	109642
08/01/2001	NEWHAVEN		AVIS ROAD	BN9 0PP	HYDRAULIC	FOUL/COMBINED		Y		544987	102351
02/01/2003	NEWHAVEN		AVIS WAY	BN9 0ED	HYDRAULIC	FOUL/COMBINED		Y	Y	545070	102038
04/11/1996	NEWHAVEN		BRIDGE STREET	BN9 9PH	HYDRAULIC	FOUL/COMBINED	Y		Y	544659	101442
31/12/2002	NEWHAVEN		CHAPEL STREET	BN9 9QD	HYDRAULIC	FOUL/COMBINED		Y		544712	101148
05/02/2001	NEWHAVEN	DENTON	DENTON ROAD	BN9 0PX	HYDRAULIC	FOUL/COMBINED			Y	545251	102421
24/10/2006	NEWHAVEN		HIGH STREET	BN9 9PG	HYDRAULIC	SURFACE WATER	Y		Y	544565	101481
21/09/1999	NEWHAVEN	NEWHAVEN	NEW ROAD	BN9 0ES	HYDRAULIC	FOUL/COMBINED	Y			544889	101919
31/12/2002	NEWHAVEN		POWELL GARDENS	BN9 0PS	HYDRAULIC	FOUL/COMBINED			Y	545069	102391
05/12/2006	NEWHAVEN		RIVERSIDE	BN9 9BG	HYDRAULIC	SURFACE WATER	Y	Y	Y	544531	101487
29/09/2005	NEWHAVEN		VALLEY ROAD	BN9 9XA	HYDRAULIC	FOUL/COMBINED			Y	544074	101786
29/09/2005	PEACEHAVEN		ARUNDEL ROAD WEST	BN107PP	HYDRAULIC	FOUL/COMBINED	Y	Y		540581	101429
03/09/2001	PEACEHAVEN		MALINES AVENUE	BN107PS	HYDRAULIC	FOUL/COMBINED	Y			540439	101206

Date of most recent incident	Town	Locality	Street	Postcode	Sewer Problem Description	Sewer Type Description	Internal Flooding	Curtilage Flooding	Highway or Open Space	GeoX	GeoY
04/09/2000	PEACEHAVEN		RODERICK AVENUE	BN108JT	HYDRAULIC	FOUL/COMBINED		Y		540936	101301
13/08/2004	PEACEHAVEN		VIEW ROAD	BN108DE	HYDRAULIC	FOUL/COMBINED		Y		541493	101740
05/09/2001	SEAFORD		BLATCHINGTON ROAD	BN252AD	HYDRAULIC	FOUL/COMBINED		Y	Y	548525	99481
14/09/2006	SEAFORD		BROAD STREET	BN251ND	HYDRAULIC	FOUL/COMBINED	Y		Y	548362	99121
12/10/2000	SEAFORD		BROOKLYN ROAD	BN252DX	HYDRAULIC	FOUL/COMBINED		Y	Y	548204	99293
03/09/2001	SEAFORD		CLAREMONT ROAD	BN252QQ	HYDRAULIC	FOUL/COMBINED			Y	547218	99504
14/09/2006	SEAFORD		CLIFF ROAD	BN251BP	HYDRAULIC	FOUL/COMBINED			Y	548816	98447
23/10/2006	SEAFORD		COLLEGE ROAD	BN251JD	HYDRAULIC	FOUL/COMBINED		Y		548442	98782
14/09/2006	SEAFORD		KIMBERLEY ROAD	BN252QG	HYDRAULIC	FOUL/COMBINED	Y	Y		547279	99616
02/06/1999	SEAFORD		LEXDEN ROAD	BN253BT	HYDRAULIC	FOUL/COMBINED	Y	Y		549075	99909
18/08/2004	SEAFORD		MANOR ROAD	BN254NL	HYDRAULIC	FOUL/COMBINED		Y		549614	99166
13/09/2006	SEAFORD		RICHMOND TERRACE	BN252AE	HYDRAULIC	FOUL/COMBINED		Y		548244	99302
27/09/2001	SEAFORD		SEAFIELD CLOSE	BN253JR	HYDRAULIC	FOUL/COMBINED		Y	Y	549847	100125
12/10/2000	SEAFORD		SOUTHDOWN ROAD	BN254PD	HYDRAULIC	FOUL/COMBINED	Y			548962	99142
05/11/1996	SEAFORD		STAFFORD ROAD	BN251UE	HYDRAULIC	FOUL/COMBINED	Y			548456	99358
18/08/1999	SEAFORD		STEYNE ROAD	BN251HA	HYDRAULIC	FOUL/COMBINED	Y			548246	98863

Information obtained from: Sussex Ouse 12th October 2000 - Flood Report (March 2000)

CATCHMENT FLOOD HISTORY

1671: Lower Ouse, (Lewes)
"...the water was so hi in the clif [Cliffe] that men waded up to their middle by the bridge" [64]

January 1726: Lower Ouse, (Lewes)
A great flood washed away the timber Cliffe Bridge in Lewes [75]

January 1772: Lower Ouse, (Lewes)
Flooding of the Cliffe area of Lewes was reported, with boats reported as floating around the Bear Inn (now Argos). [84] The Winterbourne valley was also reported to have flooded. [90]

1801: Lower Ouse, (Lewes)
Flood water reached Swing-pump Alley (later called North Court) causing a fire when it poured over unslaked lime [84]

29th January 1814: Lower Ouse, (Lewes)
Following a thaw of snow, the flooding in Lewes was the worst in living memory, with one diarist recording that "the water came into Cliffe Church and stood over a foot deep in the Belfry". [75] This flood was reported as being more than six inches (150mm) higher than that of 4th October 1852, but lower than that of 23rd October 1852. [84]

19th September 1829: Lower Ouse, (Lewes)
This flood was reported to be similar to that of 4th October 1852. [84]

4th, 23rd and 31st October 1852: Uck, Lower Ouse, (Uckfield), (Lewes)
Significant flooding occurred on October 4th in Lewes (Malling St. and Cliffe were flooded) and Barcombe with flood water being reported as being only six inches off flowing through the tunnel to Lewes Station, whilst the railway embankment to Offham was covered with water. The Sussex Express newspaper said, "We have not had a similar flood since the 19th September 1829...". [84]

Further disastrous flooding was recorded on 23rd and 31st October [2], with that of October 23rd being regarded as the worst in living memory. "The water rose on the north side of Lewes bridge to 13'6" above low water mark, which was higher than it had been for 55 years...At Uckfield bridge the water was highest during the evening of 26th, when the flood very nearly reached the front of the Bell Inn." [77]

The great flood in Lewes was reported as being a result of very heavy rain combining with spring tides. The Keymer branch railway line was reported as being under water 4 inches deeper than on the 4th October, and this flood was generally regarded as the highest in living memory. [84]

4th December 1852: Winterbourne
Flooding was reported along the Winterbourne Stream as a result of extremely high groundwater levels. The Sussex Express reported that " these springs have not risen so high within the memory of man" leading to "an extraordinary flow of water". [84]

31st October 1865: Uck, Lower Ouse, Winterbourne, (Uckfield), (Lewes)
The Sussex Express reported a great flood, possibly a little lower than that of 1852. No direct mention was made of flooding from the Winterbourne, although it is believed that general groundwater levels in the chalk Downs were exceptionally high. [84] An unprecedented 11.23 inches (285mm) of rain fell on the Uck catchment during October and the resulting flood waters, again almost reached the Bell Inn in Uckfield. [77] One undated Southern Water Authority report suggests that this was the highest water level to have ever been recorded in Uckfield – exceeding the levels of both 1852 and 1960. [80]

1875: Uck, (Uckfield)
A rainfall observer noted that this flood was the "highest since 1852" [2]

December 1876: Lower Ouse
A rainfall observer at Glynde noted the greatest rainfall in 21 years. [2]

January 1877: localised
The Brighton to Lewes road was reported as "impassable near Newmarket Tavern – 500 yards each side of the tavern deeply flooded..." as a result of high spring flows at Ashcolme, Newmarket and Moulscombe. [84] The indications are that flooding on the Winterbourne was probable.

October 1880: Upper Ouse
A rainfall observer at Balcombe Place recorded: "the heaviest fall of rain I ever registered in 24 hours, viz 2.56 inches; the floods were tremendous and did much damage" [2]

17th November 1894: Lower Ouse, Winterbourne, (Lewes)
The Sussex Express reported floods and high tides around Lewes with some water on railway lines. The Winterbourne was not thought likely to have had significant spring flows at the time. [84], although flooding in the Winterbourne valley is reported. [90]

January 1904: Lower Ouse, (Lewes)
Extensive flooding was reported in Lewes. [2]

19th November 1911: Lower Ouse, Winterbourne, (Lewes)
Serious flooding occurred in the Ouse valley at a time when ground water levels in the Winterbourne area were likely to have been very high. The rapidly rising River Ouse flood waters were reported as driving rats out of their river bank holes and into trees! [64]The Lewes to Burgess Hill railway line is known to have been completely flooded between Lewes and Hamsey, in floods which were reported to have been the worst for nearly 20 years [84] (ie probably since 1894).

December 1915: Lower Ouse, Winterbourne, (Lewes)
After 3 or 4 days of heavy rain it was reported on the 10th of December that the Ouse overtopped its banks flooding many low lying fields to a depth of two or three feet. On the 27th of December the Winterbourne burst its banks flooding about 80 houses with up to three or four feet of water. Flooding was also recorded at Lewes Secondary School where the footbridge over the Stream was damaged beyond repair and in Eastport Lane. Indications are that there was about 2 feet of water in St.Pancras (Spring) Gardens, Rotten Row and Winterbourne Hollow. [84]

1916: Uck, (Uckfield)
Major flood incident in Uckfield [87]

16th January 1918: Uck, (Uckfield)
Uckfield was reported as being "seriously flooded". [54]

28th December 1924 – 3rd January 1925: Lower Ouse, Winterbourne, (Lewes)
The highest tide for 13 years combined with a long spell of wet and stormy weather to create flooding all along the Ouse valley from Newhaven to beyond Barcombe Mills, including the Cliffe High Street in Lewes. The flooding was reported as the worst since 1911. [84] The Winterbourne was also recorded as flooding [90]

16th November 1929: Uck, (Uckfield)
Uckfield was reported as being "seriously flooded". [54]

20th November 1935: Winterbourne, (Lewes)
The Sussex Express reported prolonged and severe flooding along the Winterbourne, with the worst flooding since at least 1915, after an exceptionally wet year. Over 7" of rain was recorded in Lewes in the first twenty days of November. At least 15" of floodwater was reported in the streets and depths of 6" to 18" in houses. The Southover High Street culvert was thought by many to be responsible for the flooding. [84]

25th January 1939: Uck, (Uckfield)
Uckfield was reported as being "seriously flooded". [54]

14th January 1943: Uck, (Uckfield)
Uckfield was reported as being "seriously flooded". [54]

11th November 1950: localised
Flooding reported at Newick and Plumpton Mill [83]

28th November 1950: Upper, Middle and Lower Ouse
Flooding reported at Newick, Plumpton Mill, East Chillington, Goldbridge, between Barcombe and North End, and on Ranscombe Marshes. [83]

21st February 1951: Upper Ouse
Flooding reported at Goldbridge [83]

8th November 1951: Lower Ouse
Flooding reported between Barcombe and Lewes, and downstream of Lewes, including Glynde. [83]

28th February 1952: Uck, (Uckfield)
Uckfield was reported as being "seriously flooded". [54]

28th November 1952: Upper and Middle Ouse, Uck
Flooding reported at Freshfield, Sheffield Bridge, Fletching, Goldbridge, and Sharpsbridge, as well as at Shortbridge on the Shortbridge Stream and at Isfield Mill at the downstream end of the Uck. [83]

21st February 1953: Upper Ouse
Flooding reported at Sharpsbridge [83]

7th March 1954: Uck
Flooding reported at Hempstead Mill [83]

15th January 1955: Middle Ouse
Flooding reported at Barcombe [83]

12th January 1956: Uck
Flooding reported at Isfield sluice [83]

28th December 1956: Uck
Flooding reported at Hemstead Mill. [83]

2nd February 1957: Middle Ouse
Flooding reported at the Anchor Inn, near Barcombe [83]

4th February 1957: Middle Ouse
Flooding was reported at Offham, the Anchor Inn, Barcombe, Goldbridge, and Sharpsbridge, on the middle section of the Ouse. [83] Flood flow recorded at Hamsey Gauging Station = 87.5 m^3/s (highest recorded until 3rd Nov. 1960) [27].

8th February 1957: Middle Ouse
Flooding reported at Offham, Anchor Inn, Sharpsbridge and Goldbridge [83]

15th February 1957: Lower Ouse
Flooding reported at Lewes Sailing Club and downstream of Southerham Bridge on the Lower Ouse [83]. Peak river level at the Lewes Corporation Yard gauge was recorded as 12.40mAOD [33]

14th March 1957: Uck
Flooding reported at Little Horsted. [83]

4th – 6th November 1957: Uck, Lower Ouse, (Uckfield)
Flooding reported at the Anchor Inn, Barcombe, in Offham and in Uckfield. [83]

27th January 1958: Lower Ouse
Flooding reported at Barcombe Mills [83]

27th June – 1st July 1958: Uck
Flooding reported at Hempstead Mill [83]

16th December 1958: Middle Ouse
Flooding reported at Goldbridge and Sharpsbridge [83]

16th January 1959: Lower Ouse
Flooding reported upstream of Lewes to Barcombe. [83]

14th October 1959: Upper Ouse
Flooding reported at Goldbridge [83]

3rd November 1960: Upper, Middle and Lower Ouse, Uck, Winterbourne, (Uckfield), (Lewes)

Following the wet winter of 1959/60 and an unusually wet summer of 1960 (the July-October national total of 21.0" was the highest recorded for that period since records began in 1727), the ground at the end of October 1960 was completely saturated. Over the 19th October to 1st November heavy rainfall across the whole catchment led to serious, though not exceptional, widespread flooding - which appeared to have peaked by the afternoon of the 1st November. However further heavy rainfall on the 2nd and 3rd of November led to record floods in almost every part of the catchment – with Lewes being particularly devastated. This second period of rainfall was not in itself extraordinary, but it was concentrated particularly on the catchment areas of the River Uck and Winterbourne Stream. The River Uck flood flows passed rapidly downstream through Uckfield to Isfield and Barcombe and then on to Lewes and this together with the prevailing flood conditions throughout the area led to the

catastrophic flooding experienced in Lewes. Records for Hamsey gauging station upstream of Lewes show that at that location the Ouse, having initially peaked at about 4.50m (14'9") AOD on the 1st November had fallen to about 3.91m (12'10") AOD by 6am on the 3rd November before rising rapidly to 5.32m (17'5½") AOD by about midnight. [27]

Severe flooding was also reported in Uckfield, and the Ouse valley was extensively flooded from Rodmell to beyond Barcombe. However flooding on the Ouse upstream of Gold Bridge was reported as not being exceptional. In Lewes flood conditions persisted throughout the 4th of November and did not recede to any great extent until after the midday high tide on the 5th of November. [26]
The East Sussex River Board Report into the flood event refers to two distinct 'waves' of flood water travelling down the Ouse into Lewes. The first of these, originating in the Uck catchment, moved rapidly down the valley to join the existing flood waters of 1st November which by then were receeding. About 6 hours later the second wave of flood water travelled down from the Upper Ouse. The combined effect of these two flood waves, on top of the existing flood waters, resulted in the dramatic and sustained flood levels in Lewes.

The 3rd November midday high tide led to some overtopping of embankments downstream at Rodmell, Ranscombe and Glynde Reach, but conditions downstream of Lewes were not regarded as extraordinary, the available storage capacity was not fully utilised and levels fell with the ebb tide. In Lewes however the water levels continued to rise rapidly throughout the afternoon and evening, as the flood waters from the uplands began to build up, constricted by the Old Cliffe Bridge. The fastest recorded rises were 500mm in 2 hours at the Corporation Yard level recorder and 350mm in 2 hours at the Gasworks recorder., although there were unconfirmed newspaper reports of a 900mm rise in 2 hours. The river banks were overtopped resulting in flooding of the Malling Brooks, Malling Street, South Street and Cliffe High Street areas. Urban and industrial areas on the west bank were also flooded. The flood waters peaked in Lewes with the following high tide at about 12:30am on the 4th November, this being one of the highest of the current spring tides.

The exceptional rainfall also led to extensive flooding in the Winterbourne Stream area. The catchment's chalk block was saturated to a level of about 48.8m (160') AOD, resulting in exceptional quantities of water discharging to the surface through springs in the vicinity of the Newmarket Inn. Flooding began on the 2nd November and increased substantially on the 3rd November, peaking about the same time as the Ouse. It was estimated by one report that flow in the Winterbourne Stream was in the region of 19.8 m^3/s (700 cusecs) – about seven times the capacity of the long culvert under the railway, causing backing up and flooding upstream of the culvert entrance. An alternative report quotes a more realistic flow of 4.25m^3/s. [85]

The high river levels in the Ouse surcharged the Winterbourne's outlet and caused much of the stream flow to go into storage. However the flooding of low lying land downstream of the railway culvert from the Ouse meant that significant storage areas were already flooded, and the flooding in the Winterbourne Valley was accordingly exacerbated further. The floodwaters remained at sustained high levels for several days.

Approximately 400 residential, commercial and industrial properties in Lewes were affected by the flooding from the Ouse and the Winterbourne Stream. The railway station and the A27 Lewes-Brighton road were flooded for several days. For the first time in 150 years flooding caused the Bonfire Night celebrations - a significant local event in Lewes - to be cancelled. [84]

LEWES	November 1960		October 2000
Peak Water Level at Gold Bridge	13.29 mAOD	[27]	13.963m AOD
Peak Water Level at Sharps Bridge	12.10 mAOD	[27]	-
Peak Water Level at Barcombe Mills u/s/ (Flow)	6.50m (21'4") AOD	[27]	7.759m AOD
Peak Water Level at Hamsey FB	5.32m (17'5½") AOD	[27]	-
Peak Level at The Pells and Landport Sewage PS	5.15mAOD	[84]	-
Peak Water Level at Lewes Corporation Yard	4.97 mAOD	[27]	5.8m AOD
Peak Water Level u/s of Cliffe Bridge	4.95m (16'3") AOD	[27]	5.5m AOD
Peak Water Level at Lewes Gas Works	4.37m (14'4") mAOD	[27]	5.07m AOD
Peak flow at Gold Bridge	58.7 m^3/s	[27]	est. 85m^3/s
Peak flow at Barcombe	170.6 m^3/s	[94]	est. 200m^3/s
Peak flow at Hamsey	approx 184 m^3/s	[27]	-
Peak flow at Lewes	approx 200 m^3/s	[84]	> 200m^3/s
No. of residential properties flooded (Mallings/Cliffe areas)	226	[27]	439
No. of residential properties flooded (Lewes-elsewhere)	84	[27]	174
No. of commercial/industrial properties flooded	90	[27]	222
No. of properties evacuated	89	[27]	-

Winterbourne	November 1960		October 2000
Peak Flow at Winterbourne Gauging Station	4.25 m^3/s	[85]	2.813m^3/s
Peak Flow at Cattle Market	4.45 m^3/s	[85]	-
Peak level at Cattle Market	approx 5.65 mAOD	[85]	approx 4.88m AOD
Peak flow (see also above)	19.8 m^3/s	[84]	
Peak level at Railway station (platforms 2/3)	4.95mAOD	[84]	4.80m AOD
Peak Level at Winterbourne Outfall	4.38mAOD	[84]	5.07m AOD

Uckfield	November 1960		October 2000
Peak Water Level at Hastingford Bridge	44.20m (145'0") AOD	[102]	-
Peak Water Level at Buxted Bridge	27.22m (89'3½ ") AOD	[102]	28.230m AOD
Peak Water Level at Hempsted Mill	22.92m (75'2½") AOD	[102]	23.342m AOD
Peak Water Level at Uckfield High St.	20.00m (65'7") AOD	[71]	21.0-21.23m AOD
Peak Water Level at Uckfield Level Crossing	19.99m (65'7") AOD	[102]	-
Peak Water Level at Isfield	10.73m (35'2½") AOD	[102]	14.062

Although the November 1960 flood is particularly remembered for its impact on Lewes, other parts of the catchment were also flooded. In Uckfield flood waters were recorded as being the worst since 1917 and only just below the levels reached in 1865. The railway track and station were flooded along with 27 properties around the High Street and local roads. [2] [27] The flood waters were recorded being about two feet above road level at its lowest point in the High Street, with the shops there being flooded to a depth of about eighteen inches. [102] Further upstream, Hempstead Mill was flooded to a depth of eighteen inches, and the Old Mill at Buxted was also flooded. [2]

The 1960 event was initially described as a 1:100 year event in Lewes but the Section 24(5) Report of October 1978 [89] and in the 1975 Winterbourne Flood Survey Report [84] describe it as a 1:50 year event.

Note: [102] gives peak levels at a number of points around the catchment, especially on minor tributaries.

December 1960, Winterbourne, (Lewes)
Flood of similar magnitude to November 1974. [85]

4th January 1961: localised
Flooding reported at Offham [83]

30th January 1961: Upper Ouse
Flooding reported at Goldbridge [83]

9th March 1961: Winterbourne, (Lewes)
Flooding reported on the Winterbourne [83]

2nd September 1963: Uck (Uckfield)
Flooding reported at Uckfield Mill and Isfield gauging station.[83]

5th-12th November 1963: Uck
Flooding reported at Isfield [83]

18th - 19th November 1963: Lower Ouse, Uck
Flooding was recorded at Isfield, Barcombe Mills and Rodmell.[83] At Uckfield Road Bridge Gauging Station a peak flow of 56.6 m^3/s (2000 cusecs) and level of 19.30m (63'4" ft) AOD was recorded [101]
16/11/00: Alternative report gives flow of 34.5 m^3/s (1220 cusecs) & level of 18.90m (62.0 ft) AOD. [86]

27th November 1963: Lower Ouse
Flooding reported at Rodmell Brooks [83]

March 1964: Upper Ouse
Flooding reported at Shortbridge on the Shortbridge Stream [83]

19th June 1964: Uck
Flooding reported at Hempstead Mill [83]

20 November 1965: Uck
Flooding of rural areas [2]. At Uckfield Road Bridge Gauging Station, peak flow of 44.2 m^3/s (1561.2 cusecs) and level of 19.02m (62.4 ft) AOD recorded [101]

The peak flow at Isfield Weir has been estimated as 57m^3/s [10]

December 1965: Upper and Lower Ouse (Lewes)
Flooding reported at Fletching, Offham and in Lewes, including at Harveys Brewery.[83]

28th February 1967: Lower Ouse (Lewes)
Flooding reported in Lewes where the Ouse overtopped the Winterbourne outfall. [83]

8th March 1967: localised
Flooding reported at Offham. [83]

5th October 1967: Lower Ouse (Lewes)
Flooding reported in Offham and Lewes. [83]

16th September 1968: Upper and Middle Ouse
Flooding of rural areas across the catchment, including Barcombe. [2] [83]

October 1968: Uck
Flooding reported at Hemstead Mill. [83]

13th March 1969: Uck
Flooding reported at Hemstead Mill. [83]
The Peak flow at Isfield Weir has been estimated as 46m^3/s [10]

11 February 1974: Upper and Middle Ouse, Uck, (Uckfield), (Lindfield)
This event was described as being less severe than the flood of November 1974, but significant flooding nevertheless took place in Lindfield and roads were flooded throughout the upper and middle Ouse catchments, including at Freshfield, Fletching, Anchor Inn, Barcombe and Offham, as well as the Wild Boar bridge across the Cockhaise Brook. [83] Hempstead Mill and Uckfield were also flooded on the Uck. Average antecedent 7 day and 5 day rainfalls across the Ouse and Uck catchments are reported as 80mm and 63mm respectively, with about 44mm falling in 24 hours at Holywell rain gauge. Peak Mean daily flow at Isfield Gauging Station was recorded as approximately 21.7 m^3/s. [2] The peak water level at Uckfield Road Bridge was recorded as 19.5 mAOD [89]

The peak flow at Isfield Weir has been estimated as 58m^3/s [10]

22 November 1974: Uck, Upper, Middle and Lower Ouse, Winterbourne, (Lindfield), (Uckfield)
Flooding occurred after a week of severe rainfall conditions followed on from two months of heavy rainfall. Antecedent 7 day and 5 day rainfalls at Holywell rain gauge are reported as being over 100mm and 77mm respectively, with about 38mm falling in 24 hours.

Flooding occurred in 27 properties in Uckfield and in several properties in Lindfield and Sharpsbridge. In Uckfield it was reported that flood waters flowing across the Olives Meadow flood plain only partially returned into the bypass channel, with part of the flow being diverted by localised high spots to flow along the northern edge of the meadow, across the Keymarkets car park and into the supermarket. The old bus station (at the High St/Bell Lane junction) was reported as being 2' under water. It is also reported that the footpath alongside Uckfield Mill was under 4' of water. Peak Mean daily flow at Isfield Gauging Station was recorded as approximately 28.2 m^3/s. The following peak flows were recorded:
Bevern Stream 20.7m^3/s
Goldbridge 86.9m^3/s

Whilst flooding of the Ouse valley occurred between Barcombe and Hamsey, downstream of Hamsey and in Lewes flooding directly from the River Ouse was avoided as a consequence of the improvements made under the River Ouse TRW IS. The peak river level at Lewes Gas Works was recorded as 3.47mAOD (compared to the flood defence level of 4.72mAOD). Nevertheless there does appear to have been surface water flooding of the Malling Brooks area in Lewes.[59] where depths of 0.8m were recorded. [89]

The Winterbourne Valley flooded as a result of high spring fed flows and surface run-off in the saturated subcatchment. A peak flow at the Winterbourne gauging station site of 3.01m^3/s was recorded (corresponding flow at the Cattle Market estimated as 3.16m^3/s) A peak level of approximately 4.8mAOD was recorded at the Cattle Market. Approximately 102 properties were affected by floodwaters including a school, and railway services were disrupted. Flooding of the Winterbourne would probably have been much worse had river levels in the Ouse peak not been receding at the time of the peak flow in the Winterbourne. As a result of this flood a report was undertaken jointly by East Sussex County Council, Lewes District Council, and Southern Water Authority into the causes of the flooding and possible alleviation measures. [85]

Peak Water Levels recorded at the river gauging stations were as follows:

	November 1974		October 2000
Ouse			
Peak Water Level at Gold Bridge	13.86 mAOD	[71]	13.963m AOD
Peak Water Level at Anchor Weir	7.52 mAOD	[71]	8.181m AOD
Peak Water Level at Barcombe Mills (u/s)/(Flow)	6.43 mAOD	[71]	7.759m AOD
Peak Water Level at Barcombe Mills (d/s)	6.27mAOD	[71]	-
Peak Water Level at Lewes Corporation Yard	4.01 mAOD	[71]	5.80m AOD
Peak Water Level at Lewes Gas Works	3.49 mAOD	[71]	5.07m AOD
Peak Water Level at Southease Bridge	3.86 mAOD	[71]	3.864m AOD
Uck			
Peak Water Level at Uckfield High Street	19.90 mAOD	[71]	21.0-21.23m AOD
Estimated Peak Flow at Isfield Weir [10]	$70m^3/s$		$113m^3/s$

27th January 1975: Upper Ouse
Minor flooding of agricultural land reported in the upper Ouse catchment. Antecedent 7 day and 5 day rainfalls at Holywell rain gauge (near Horsted Keynes) was reported as 70mm and 66mm respectively. Peak Daily Mean Flow at Isfield Gauging Station was recorded as approximately $20m^3/s$. [2]

28th December 1979: Upper, Middle and Lower Ouse, Uck, Winterbourne, (Uckfield), (Lewes)
Following heavy rainfall and gales on the preceeding day (when nearly 70mm of rain fell in 24 hours at Holywell rain gauge), traditional valley flooding occurred along the River Ouse floodplain from Staplefield to Lewes, and from above Buxted to Isfield on the River Uck, with similar surface flooding occurring along most of the tributaries. Much of the flooding was as a result of accumulations of surface water.

In Uckfield flooding occurred around the High Street area as a result of blocked drains, surface water flooding and water flowing off the meadow upstream of the High Street. Water levels inside Keymarkets supermarket (now Somerfield) were reported as being between 6" and 9". The flood waters did not flood Boots. The river was reported as being within channel both downstream of the High Street bridge, and upstream as far as the railway bypass channel.

Extensive flooding was also reported in Balcombe (where 80 sheep were drowned), Newick, Sheffield Park and Barcombe. Peak Daily Mean Flow at Isfield Gauging Station was recorded as approximately $25m^3/s$. [2]

Whilst the new flood banks at Barcombe contained the river flows throughout, the tidal embankments at the downstream end of Hamsey Cut (which had not been raised under the River Ouse Improvement Scheme due to ongoing landowner negotiations) were overtopped during one high tide, and flood water flowed down to the Pells on the west (right) bank where the pavement by SEEboard offices was flooded to a maximum depth of about 380mm (15"). Lower Stoneham Farm on the east bank was also flooded.

Within Lewes the River Ouse's defences contained the flow with levels which peaked at 3.85m for about an hour over the (neaps) high tide. This was reported as leaving 760mm-915mm (30"-36") freeboard to the flood banks downstream of Lewes, but only about 300mm (12") freeboard upstream of Lewes. [91]

Extensive surface flooding was reported in the Laughton Levels, and in the Ranscombe, Rodmell and Newhaven areas. [91]

	December 1979		October 2000
Shell Brook			
Peak Water Level at Ardingly (Shell Brook)	38.58 mAOD	[102]	-
Ouse			
Peak Water Level at Ardingly	37.00 mAOD	[102]	36.690m AOD
Peak Water Level at Gold Bridge	13.74 mAOD	[102]	13.963m AOD
Peak Water Level at Isfield FB	10.35 mAOD	[71]	-
Peak Water Level at Barcombe Mills (u/s)/(Flow)	6.38 mAOD	[102]	7.759m AOD
Peak Water Level at Barcombe Mills (d/s)	6.23mAOD	[102]	-
Peak Water Level at Hamseyplace FB	4.76 mAOD	[102]	-
Peak Water Level at Lewes Corporation Yard	4.01 mAOD	[102]	5.80m AOD
Peak Water Level at Lewes Gas Works	3.72 mAOD	[102]	5.07m AOD
Peak Water Level at Southease Bridge	3.86 mAOD	[71]	3.864m AOD
Bevern Stream			
Peak Water Level at Clappers Bridge	10.35 mAOD	[102]	11.038m AOD
Uck			
Peak Water Level at u/s Uckfield	20.12 mAOD	[102]	-
Peak Water Level at d/s Uckfield	18.91 mAOD	[102]	-
Peak Water Level at Isfield Mill	13.63 mAOD	[102]	-
Estimated Peak Flow at Isfield Weir [10]	$69m^3/s$		$113m^3/s$

According to the Section 24(1a) Report the highest daily mean flows, recorded to date (June 1980) were as follows [94]***:***

River	Gauging Station	Records began at Gauging Station	Max. D.M.F. to June. 1980 (Ml/d)	Date of Max D.M.F.
Winterbourne	Winterbourne	c. 1965	278.5	25 Nov. 1974
North End Stream	Allington Lane	c. 1964	101.5	10 July 1968
Ouse	Gold Bridge	c. 1959	7510.1	22 Nov. 1974
Ouse	Barcombe Mills	c. 1956	18792.3	22 Nov. 1974
Bervern Stream	The Gote	c. 1973	6.4	21 Nov. 1974
Bevern Stream	East Chillington	c. 1966	291.2	4 Nov. 1967
Bervern Stream	Clappers Bridge	c. 1969	2180.5	7 Feb. 1974
Clayhill Stream	Old Ship	c. 1969	519.7	21 Nov. 1974
Cockhaise Brook	Holywell	c. 1971	643.6	10 Feb. 1974
Uck	Isfield	c. 1964	6534.6	13 Feb.1974

Note: Flow duration curves given for Gold Bridge (1960-1976), Barcombe Mills (1956-76) and Isfield (1964-76) [94]

25th November 1982: Lower Ouse

The following peak levels were recorded:

Hamsey Gauging Station	3.62m AOD
Downstream end of Hamsey Cut	3.50m AOD
Lewes Corporation Yard	2.93m AOD

Although an inspection between Hamsey and Lewes after the event found that the river had been contained within the floodbanks throughout this stretch, it noted that the embankments had settled in places by between 0.3m and 0.6m from their design level of 4.88m (16') AOD. [95]

Peak flow at Isfield Weir has been estimated as $51m^3/s$ [10]

21st November 1986: Middle Ouse
Flooding reported at Barcombe [99]

9/10 October 1987: Upper and Middle Ouse

	October 1987	October 2000
source: [102]	mAOD	mAOD
Peak Water Level at Barcombe d/s	6.13	-
Peak Water Level at Barcombe Mills	6.82	-
Peak Water Level at Freshfield Bridge	22.99	23.10
Peak Water Level at Isfield	10.77	14.062
Peak Water Level at Uckfield d/s	18.2	-
Peak Water Level at Uckfield u/s	19.2	-
Peak Water Level at Buxted	26.73	28.23

This flood event occurred following the infamous '1987 hurricane' and followed very heavy rainfall across the catchment, with both the one and three day duration levels being reported as the highest since records began in 1957, estimated by the NRA to be a 1:45 rainfall event. The antecedent 7 day and 5 day rainfalls at Holywell rain gauge are reported as 100mm and 61mm respectively. The ground was saturated after several months of heavy rainfall, and a few days of particularly heavy rain the week before the hurricane, which meant that there was almost instantaneous run-off. Flooding occurred in Haywards Heath and Lindfield where approximately 140 properties were inundated, and at high tide in Barcombe. Peak Daily Mean Flow at Isfield Gauging Station was recorded as approximately 30m^3/s. [72][2]

Following the flooding in Haywards Heath, Mouchel and Partners were commissioned jointly by Southern Water and the Mid Sussex County Council to study the flooding problems in the Scrace Valley the National Rivers Authority initiated flood defence improvements to the Scrace Bridge Stream and its tributary the Common Stream

31st January 1990: Middle Ouse
Flooding of the area between Isfield and Barcombe Mills occurred after 2 days of heavy rain (85% of average monthly rainfall) fell on ground already saturated after two months of persistent rain, and combined with a 0.22m surge on a spring tide. [72] The owner of the Anchor Inn, Barcombe reported being flooded for the seventh time since January 1962. [99]

Peak flow at Isfield Weir has been estimated as 53m^3/s [10]

30th – 31st December 1993: Uck, Upper and Middle Ouse, (Uckfield), (Lindfield)
This flooding resulted from a combination of events. Consistent rainfall throughout December had left the ground saturated, so that the heavy rainfall across the upper and mid Ouse catchments of 30th December resulted in almost instantaneous run-off. At each rain station from Ardingly to Crowborough and at Barcombe, the 24 hour rainfall records for the 30th December are reported as being approximately 1:10 year rainfall events. This coincided with surges of 0.35m and 0.47m on the two high tides, and a breach in the banks of a lake in Maresfield. The result was flooding of the upper and middle Ouse valley, and in Lindfield (30 properties flooded), Uckfield (30 properties flooded) and Buxted. Peak Mean Daily Flow at Isfield Gauging Station was recorded as approximately 38m^3/s. A peak flow of 140m^3/s was recorded at Barcombe – over 1.6 times the channel capacity. [2] [72]

Peak flow at Isfield Weir has been estimated as 83m^3/s [10]

As a result of this flood, which was particularly severe in Uckfield – despite the flood defence works undertaken between 1978 and 1981 - the NRA commissioned Babties to undertake a detailed study of further flood alleviation options. This Study reported that the December 1993 flood in Uckfield was

attributable to a combination of the intensity of rainfall, the temporary blockage of the flood relief arch, and the recent urban expansion of Uckfield, and that the flood event had a return period of the order of 1:20 years.

The maximum water level recorded at Isfield Gauging Station (where the river remained in bank) was 13.74mAOD. The peak water levels at the High Street Bridge were estimated as 19.35mAOD (upstream) and 18.95mAOD (downstream), with a level of 20.70mAOD observed at the upstream flood relief arch beneath the railway. The analysis undertaken showed that in Uckfield the river remained in bank downstream of the road bridge, but water levels considerably exceeded both the right and left bank levels upstream of the bridge.[7]

25th – 26th December 1999: Uck, Middle Ouse, (Uckfield)
Following heavy rainfall on the 24th and 26th December, exacerbated by high tides and westerly winds, flooding was reported in Barcombe (3 properties) at the Anchor Inn and in Uckfield (3 properties).[2]

Peak flow at Isfield Weir has been estimated as $57m^3/s$ [10]

28 May 2000: Uck, (Uckfield)
Uckfield Mill and High Street were seriously flooded.

12th October 2000: Upper, Middle and Lower Ouse, Uck Winterbourne, (Uckfield), (Lewes)

6th November 2000: Uck, (Uckfield)
Uckfield Mill and High Street were seriously flooded, in an event similar to that of 28th May 2000.

Flood Sources and Risk							
CFMP area sub-division	**Flood source and type**	**Location**	**Assessment of flood risk**				
			Water depth	**Flood duration**	**Water velocity**	**Receptor type**	**Estimated overall risk**
Upper Ouse	Surface water flooding generated by impermeable geology and soils along with land management activities in the catchment.	Freshfield - affected by field run-off and out of bank flow.	Shallow	Short	Moderate	2	**Low**
	Surface water flooding.	Slaugham.	Shallow	Short	Low	3	**Low**
	Fluvial flooding - West Common Stream and Scrase Bridge Stream.	Haywards Heath and Lindfield.	Shallow	Short	Moderate	2	**Medium**
	Fluvial flooding from Cockhaise Brook.	Cockhaise Mill Farm - bridge constricts flow and water backs up causing flooding and drains also surcharge.	Shallow	Short	Moderate	2	**Medium**
	Fluvial flooding from River Ouse.	Sheffield Bridge, 2 properties affected in 2000 to depth of 1m. A275 also affected.	Shallow	Short	Moderate	2	**Low**
	Run-off from agricultural land, highway drainage and surface water.	Wivelsfield Green.	Shallow	Short	Moderate	2, 3, 4	**Medium**
	Sewer flooding.	Haywards Heath.	Shallow	Short	Low	1	**Low**
Middle Ouse	Fluvial flooding from the Shortbridge Stream.	Road flooding at Sharpsbridge.	Shallow	Moderate	Moderate	2, 3	**Medium**
	Fluvial flooding from the River Ouse.	Isfield and Barcombe Mills.	Moderate - deep	Moderate	Moderate	1, 4	**Medium**
	Fluvial flooding from Bevern Stream.	Plumpton Green - bridge constricts flow and causes backing up and flooding of the High Street.	Moderate	Short	Moderate	2, 3	**Medium**
Lower Ouse	Fluvial flooding from River Ouse and Winterbourne stream.	Lewes and surrounding areas.	Moderate - high	Moderate	High	1, 3, 4	**High**
	Fluvial flooding from the Glynde Reach, which is affected by tides in the Ouse.	Surrounding agricultural land. Railway line affected.	Shallow	Moderate	Low	4	**Medium**
	Surface water generated from run-off from the impermeable clay catchment and surcharged drainage system.	Hamsey - septic tank flooding.	Moderate	Short	Low	1	**Medium**
	Fluvial flooding from River Ouse	Villages around Lewes and Ringmer	Shallow	Long	Low	2	**Medium**
	Sewer flooding	Lewes, Ringmer and Seaford.	Shallow	Short	Low	2, 4	**Low**

Flood Sources and Risk							
CFMP area sub-division	**Flood source and type**	**Location**	**Assessment of flood risk**				
			Water depth	**Flood duration**	**Water velocity**	**Receptor type**	**Estimated overall risk**
	Groundwater flooding - groundwater fed springs and run-off from the South Downs.	Lewes and surrounding areas.	Moderate	Long	Moderate	1	**Medium**
	Surface water.	Southerham - surface water flooding from surcharged drainage worsened by rusted flap valves permanently open.	Shallow-Deep	Long	Low	2, 3	**Medium**
	Fluvial flooding from Cockshut Stream and surface water.	Rodmell Brooks, floodwater from storage area between bypass and Lewes mixed with flow from the Cockshut stream near the A27 culvert and flowed back onto Brooks via an underpass.	Moderate	Moderate	Low	2, 3	**Low**
Uck	Fluvial flooding from the River Uck.	Uckfield.	Deep	Short	High	1, 3	**High**
	Surface water and fluvial flooding from River Uck.	Buxted culvert under road crossing is under capacity, causing water to back up.	Moderate	Short	High	2, 3	**Medium**

Primary source: Sussex Ouse 12th October 2000 flood report

Locations listed above can be found on figure 2.10 or figure

Receptor
1) More than 10 people and properties affected **2**) Less than 10 people and properties affected **3**) Any roads or railways affected **4**) Agricultural land

Water
Shallow <0.3m, moderate 0.3-1m, deep

Flood
Short <3 hours, moderate 3-6 hours, long >6

Water
Low <0.5m/s, medium 0.5-1.5m/s, high

Source: River Ouse Catchment Flood Management Plan - Consultation Scoping Report, October

Flood Warning Systems

Following the Easter 1998 floods the Environment Agency introduced new flood forecasting, warning and management structures and procedures, developed under their "Changing Needs in Flood Defence" project. The 12th October 2000 flood was probably the first major incident in the UK under this new system.

The Environment Agency carries out flood forecasting, warning and incident management for the River Ouse catchment from its Sussex Area office. The following sources are used in this process:

The hydrometric network.
HYRAD rainfall radar.
Weekly soil moisture information.
Regular Meteorological Office weather forecasts and warnings.

The EA Flood Warning service provides information to the public and enables people at risk to be promptly warned, reducing the financial and personal cost of flooding from tidal and fluvial sources. The service currently relies on members of the public registering on to the system.

The flood warning service plays a significant role in flood risk management. However, its effectiveness is compromised in areas where the catchment responds rapidly to storm events. Additionally, the service is not set up to take full account of the complexities of groundwater flooding.

Most reaches of the River Ouse have a lead time for flood warning in excess of two hours and although short they are considered adequate. However, that is not the case on small flashy rivers, such as those in the upper catchments. There are uncertainties associated with flood warnings due to the various factors associated with flood prediction.

The Environment Agency issues flood warnings to the emergency services, local authorities, media, and the public. These are disseminated by a number of methods including:

Floodline Warning Direct - simultaneously by telephone, mobile, pager and fax.(incorporating the Automatic Voice Messaging AVM system) E-mail and SMS facility to follow.
Website (www.environment-agency.gov.uk/floodwarning). Met
Office weather forecasts. Local Radio. Television.
Ceefax page 419.
Vehicle mounted loudhailer. Flood
Warden Scheme. Variable display
boards

The Environment Agency also operates a flood warning telephone service known as, Floodline [0845 988 1188], which gives advice and information. In addition, the Floodline 24 hour recorded message service will give information about flood warnings in force anywhere in England and Wales.

Flood warning signs are also operated in the town of Lewes and Uckfield which display the current flood warning in force. These signs are described below:

Flood Watch means flooding of low-lying land and roads is expected in the (xxx) area. Be aware! Be prepared! Watch out!

Flood Warning means flooding of homes and businesses is expected in the (xxx) area, act now!

Severe Flood Warning means severe flooding is expected in the (xxx) area. There is extreme danger to life and property. Act now!

All Clear means flood Watches or Warnings are no longer in force in the (xxx) area.

The customer charter standard is to issue all warnings at least two hours in advance of any possible flooding.

The fluvial flood warning areas within the River Ouse catchment are:

1. Scrase Bridge Stream at Lindfield. River
2. Uck from Buxted to Isfield.
3. River Ouse from Lindfield to Isfield. River
4. Ouse from Isfield to Barcombe.
5. River Ouse from downstream of Barcombe to Lewes.
6. River Ouse from downstream of Lewes to Newhaven.
7. Winterbourne Stream in Lewes.

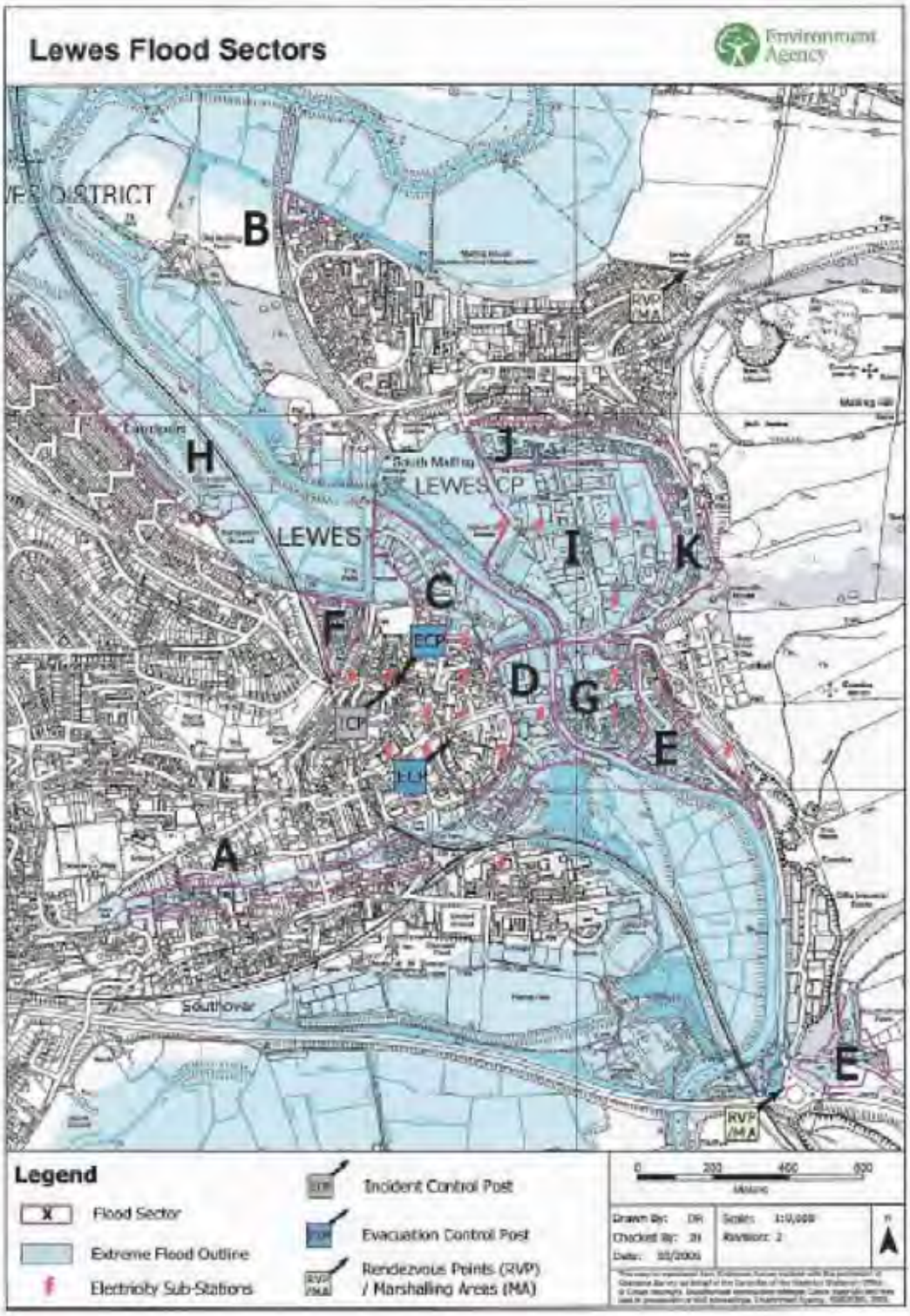
From the above list, only areas 1 and 2 are outside Lewes District.

Flood Wardens play an essential role in the community by promoting awareness of flood risk; making the necessary local arrangements for flood emergencies; and assisting the emergency services when required.

The Lewes Flood Warden Network acts as a focus for community self-help during flood emergencies. The Flood Wardens are volunteers who are based locally and with essential general knowledge of the area. The town of Lewes is organised into eleven sectors, each with its own co-ordinator and several wardens, who have their own "beat" of around 20-30 houses. The Flood Warden Network is supported by the authorities, who provide the required support to those involved.

A series of Flood Plans are produced on a local basis to provide a framework for the co-ordinated inter-agency response to flooding or the threat of flooding in the area. The only areas within Lewes District with a formulated Flood Plan are Lewes Town and Seahaven. Details of the recognised flood risk sectors in these two areas of Lewes District are included below.

Source: Lewes Flood Plan


Lewes Flood Sectors
Environment Agency
DISTRICT
B
H
J
LEWES CP
LEWES
I
K
C
F
ECP
D
G
E
ICP
A
Southover
E
RVP
/MA
Legend
Flood Sector
Extreme Flood Outline
Electricity Sub-Stations
Incident Control Post
Evacuation Control Post
Rendezvous Points (RVP)
/ Marshalling Areas (MA)
0
200
400
600
Metres
Drawn By: DR
Checked By: JH
Date: 10/2006
Scale: 1:10,000
Revision: 2
N