Sector 'A'	**Winterbourne**
Population	Approx 250 residents
Evacuation routes (Vehicular)	1. Bell Lane, Winterbourne Hollow, Western Road, High Street, Fisher Street, Town Hall. 2. Bell Lane, Southover High Street, Priory Street, Station Road, Station Street, Fisher Street, Town Hall.B2102 - West
Schools.	1. Western Rd Community Primary. Southover High St. Approx: 200 children aged 4 to 11. 2. Southover C of E Primary , Potters Lane. Approx: 300 children aged 4 to 11.
Rec: Rest Centre.	Town Hall.
Other information	1. St Andrew's Surgery, Southover Rd. Unlikely to flood but access may be affected due to road closures. Liaise with P.C.T. 2. Responds to underground streams. 3 Warden beats.

Sector 'B'	**Monks Way / Mantell Close**
Population	Approx 30 residents.
Evacuation routes(Vehicular)	Old Malling Way, Church Lane, Hereward Way, Community Centre.
Rec: Rest Centre.	Malling Community Centre.
Other information	• First sector to flood in 2000. • 1 Warden beat. • Southern Water pumping station. **Schools:** Nil

Sector 'C'	**North Street.**
Population	Approx 45 residents – predominantly Commercial
Evacuation route(s) (Vehicular)	North Street, Little East Street, Eastgate Street, Friars Walk, Station Street, Fisher Street, Town Hall.
Rec: Rest Centre.	Town Hall.
Other information	• Rapid inundation from Pells area before overtopping of river wall. • 5 Warden beats. **Schools:** Nil

Sector 'D'	**Eastgate / Friars Walk.**
Population	Approx 200 residents.
Evacuation routes (Vehicular)	Eastgate, Friars walk, Station Street, Fisher Street, Town Hall
Rec: Rest Centre.	Town Hall.
Other information	**Rest homes** • Greyfriars Court. 43 flats approx: 40 elderly but ambulant residents. Warden in attendance. Flood plan, relocate ground floor to higher floors • Leighside House. 29 flats approx 35 elderly but ambulant residents. Potentially some wheelchair users. • Flooded very quickly after overtopping of river wall. 4 Warden beats. **Schools:** Nil

Sector 'E'	**South Street.**
Population	Approx 350 residents.
Evacuation route(s)(Vehicular)	1. South Street, Phoenix Causeway, Eastgate Street, Friars Walk, Station Street, Fisher Street, Town Hall. 2. South Street, Malling Street, Malling Hill, Orchard Road, Spences Lane, Community Centre.
Rec: Rest Centre(s).	Town Hall / Malling Community Centre.
Other information	Floods from South end first, relatively steadily. 8 Warden beats. **Schools:** Nil

Sector 'F'	**The Pells.**
Population	Approx 100 residents.
Evacuation routes (Vehicular)	St John's Hill, Pelham Terrace, Talbot Terrace, Toronto Terrace, St John's Terrace, Mount Pleasant, West Street, Market Street, Little East Street, Eastgate Street, Friars Walk, Station Street, Fisher Street, Town Hall.
Schools.	Lewes New School. Talbot Terrace. (Private) 48 children aged 2.5 to 11.
Rest Centre.	Town Hall.
Other information	Relatively slow & steady inundation 5 Warden beats.

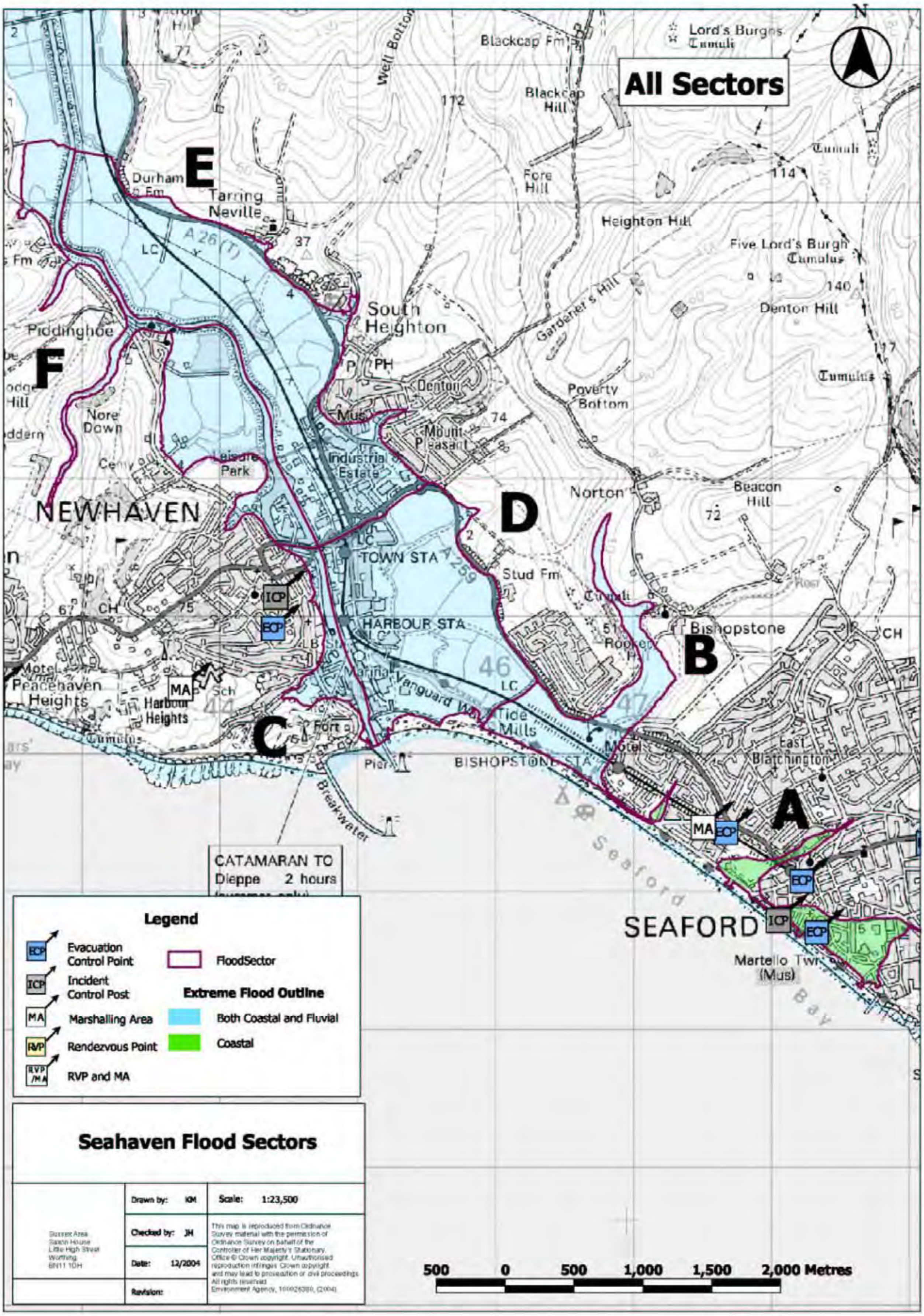
Sector 'G'	**Cliffe High Street**
Population	Approx 500 residents.
Evacuation routes (Vehicular)	Cliffe High Street, South Street, Malling Street, Phoenix Causeway, Eastgate Street, Friars Walk, Station Street, Fisher Street, Town Hall.
Rec: Rest Centre.	Town Hall.
Other information	**Rest homes** • St Thomas Court. Approx: 50 elderly residents with varying degrees of mobility. Resident Warden. Flood plan, relocate ground floor to higher floors • Included many commercial premises. Abandoned on safety grounds in 2000 due to speed & depth of flooding. • 14 Warden beats **Schools:** Nil **Riverside Surgery:** Needs to be given High priority via P.C.T. **Phoenix Centre:** Elderly Day Care Centre.

Sector 'H'	**Landport.**
Population	Approx 100 residents.
Evacuation routes (Vehicular)	Landport Road, Offham Road, Prince Edwards Road, Neville Road, Spital Road, Western Road, High Street, Fisher Street, Town Hall
Rec: Rest Centre.	Town Hall.
Other information	• Relatively steady inundation. • Southern Water Pumping Station. • 2 Warden Beats. **Schools:** Nil

Sector 'I'	**Mallings Brook..**
Population	No residents. Commercial properties only
Evacuation route(s) (Vehicular)	1. Brooks Road, Southdowns Road, Mayhew Way, Church Lane, Hereward Way, Community Centre. 2. Brooks Road, Malling Street, Malling Hill, Orchard Road, Spences Lane, Community Centre.
Rec: Rest Centre.	Malling Community Centre..
Other information	• Entirely Commercial. • Flooded from both Spences Lane & Malling Ditch. Southern Water Pumping Station. • 2 Warden beats. **Schools:** Nil

Sector 'J'	**Spences Lane / Orchard Road.**
Population	Approx: 500 residents.
Evacuation routes (Vehicular)	Orchard Road, Spences Lane, Community Centre.
Rec: Rest Centre.	Malling Community Centre..
Other information	• Started to flood under Mayhew Way and then rapid inundation. • 8 Warden beats. **Schools:** Nil

Sector 'K'	**Malling Street.**
Population	Approx: 80 residents.
Evacuation routes (Vehicular)	Malling Street, Malling Hill, Orchard Road, Spences Lane, Community Centre.
Rec: Rest Centre.	Malling Community Centre.
Other information	• Very rapid inundation • 7 Warden beats. **Schools:** Nil



Source: Seahaven Flood Plan

Sector 'A'	**Seaford South**
Population	1700 approx.
Evacuation route(s)	1. Pelham Road
	2. Crouch Lane/East Street
	3. Sutton Avenue
Other information	**Includes:** • Almost entirely residential. • Southern Water facility at Splash Point. • Large areas of open low-lying recreational land such as The Salts and below Splash Point. NB – There is an area based around Brooklyn Road that is low-lying and subject to ponding in the event of heavy rain. There are 65 residential and 18 commercial properties. The resident population is about 150 (contained within the overall sector figure above) and the evacuation route would be via Claremont Road and Station Approach. **Schools:** • Seaford Head Lower School, Steyne Road, Tel: 01323 872709 will require <u>urgent</u> consideration depending on the time of day and school term. • Annecy Catholic Primary School, Sutton Avenue Tel: 01323 894892, not in but close to flood area. **Pre-school/Childcare:** Nil. **Nursing/Residential Homes:** • Beachside, Cricketfield Road, Tel: 01323 893756 • Hillersdon Court Rest Home, 18 College Road Tel: 01323 897706

Sector 'B'	**The Buckle and Bishopstone**
Population	40 approx.
Evacuation route(s)	1. Claremont Road
	2. Marine Road / A259 Buckle By-pass
	3. Bishopstone Road /A259
Other information	**<u>The Buckle</u>** Priority must be given to those seafront residential dwellings between Bishopstone Station and Buckle Drive including the Buckle Caravan & Camping site. **Access/Egress:** In the event of severe flooding residents of Sunnyside Caravan site may experience access/egress problems with implications for vulnerable persons. **Nursing/Residential Homes:** • By Buckle Court, Marine Parade Tel: 01323 898094 **<u>Bishopstone</u>** The flood threat to Bishopstone is to low lying farm land and not residential premises. **Access/Egress.** There is a risk to road access/egress if the A259 were flooded which would result in the residential area being isolated. Consideration should be given to vulnerable persons who would be most at risk from protracted isolation. **Schools:** Nil **Pre-school/Childcare:** Nil. **Nursing/Residential Homes:** Nil

Sector ‘C’	**Newhaven West**
Population	630 approx.
Evacuation route(s)	1. High Street
	2. South Way
	3. South Road
	4. Bay Vue Road
	5. Fort Road
	6. Gibbon Road
Other information	**Includes:** • Commercial premises in lower area of town centre. • Seahaven Leisure Centre. • Chapel Street Health Centre. • Newhaven Police Station (rear access). • Newhaven Marina. **Access/Egress** In the event of flooding serious access problems would arise for: • Chapel Street. • Residential developments along Riverside, West Quay and Fort Road. • Meeching Quarry Industrial Estate. • Court Farm Road. **Schools:** The following are close to the flood sector: Grays School, Western Road, Newhaven Tel: 01273 513968 Southdown Junior School, Church Hill, Newhaven Tel: 01273 514532 **Pre-school/Childcare:** Pebbles Under 5 Playgroup, Catholic Church Hall, Fort Road. Mon-Fri 9.15 am- 1pm. Contact: Supervisor 01273 516099. Nippers, (incl. Nippers Afterschool Club) Shakespeare Hall, Fort Road, Mon-Fri 8am-6pm. Contact: 01273 514440 **Nursing/Residential Homes:** Nil

Sector ‘D’	**Newhaven East**
Population	300 approx.
Evacuation route(s)	1. Railway Road/Drove Road
	2. North entrance to Newhaven Harbour.
Other information Other information (continued)	**Includes:** • Small number of dwellings in Railway Road, Transit Road, Norton Road. Norton Terrace, Beach Road. • Entire Newhaven Port. • Drove Road Retail Park (B&Q etc) • Large factories off Railway Road (Parker Pen etc.) • Southern Water Sewage works, Beach Road. • Otherwise flat, open land (Ouse Estuary). **Access/Egress** In the event of flooding of the A259 serious access/ egress problems will arise for the entire sector. Prompt evacuation will need to be undertaken. **Newhaven Port** In the event of the threat of a serious flood affecting the harbour, the Port Authorities will evacuate all large ships/ferries from the harbour to open sea to avoid damage to the ships and berths. **Schools:** Nil

	Pre-school/Childcare: Railway Nursery, Norton Terrace, Mon – Fri 8 am-6pm. Contact: Manager 01273 510777 **Nursing/Residential Homes:** Nil

Sector 'E'	**Newhaven North East**
Population	Residential: Confined to properties in Powell Gardens & Denton Road and low lying areas of Avis Road. Approx .150 people in 51 properties. Industrial: The vast majority of the 272 premises in the sector are industrial. Therefore the population is swollen to an unknown figure during the working day reducing to primarily the residents of above locations during the evenings and weekends.
Evacuation route(s)	1. New Road
	2. A259 The Drove/Drove Road
	3. Avis Way/Avis Road
Other information	**Includes:** • Largely industrial premises over North Quay, New Road, Avis Way Industrial Estate and South Heighton. Pollutant possibilities should be an early consideration. • Residential properties in Powell Gardens & Denton Road and low lying areas of Avis Road will require early consideration.. • Sector contains electricity supply installations. • Sainsbury's , • The Drove, Travel Lodge, Denton Corner. • Ambulance Station, Avis Way. • Paradise Park (Garden Centre) • The Three Ponds Caravan Park, South Heighton • Itford Farm to the north on A26. **Access/Egress:** In the event of flooding of the A26 from Tarring Neville south, including New Road and B2109 Avis Road to Denton Corner there will be significant access/egress difficulties to the Mount Pleasant, Denton and South Heighton areas. Although not threatened by flooding they could be isolated and early consideration should be given to the needs of vulnerable persons. **Schools:** The following school is close to the flood sector: Denton Community School, Acacia Road, Denton Tel: 01273 513377.
Other information (continued)	**Pre-school/Childcare:** Bubbles Playschool, Denton Road, Mon-Fri 9 – 12pm. Contact: 01273 513852 / 01273 513878. **Nursing/Residential Homes:** Nil

Sector 'F'	**Newhaven North West**
Population	220 approx.
Evacuation route(s)	1. A259, North Way (Denton Island)
	2. C7, Lewes Road
Other information	**Includes:** • Residential properties in Willow Walk/Lewes Road. • Denton Island – Business & Commercial premises. • Civic Amenities site, Lewes Road. • Piddinghoe Parish. • Southease Parish. **Access/Egress:** In the event of the A259 North Way, Newhaven becoming inundated, vehicular movement will be severely impaired. This will also apply to the C7 between

	Newhaven and Southease, potentially isolating Piddinghoe Village. **Schools:** The following schools are close to the flood sector: 1. Meeching Valley Primary School, Valley Road, Newhaven Tel: 01273 514300. 2. Rodmell CE Primary School, Rodmell Tel: 01273 473916. **Pre-school/Childcare:** Denton Island Nursery, Mon – Fri 8am-6pm. Contact: Manager 01273 515125. **Nursing/Residential Homes:** Nil

OVERVIEW OF FLOODING CAUSES

Overtopping of Sea Defences

Man-made defences predominantly in the form of seawalls protect a significant part of the lower lying lengths of the English coast. These defences range from simple earth embankments through vertical concrete walls and onto more complex composite structures often involving wave return walls and/or rock armouring. Regardless of the structural type, the purpose of the seawall is usually to prevent erosion of the coastline and to reduce the risk of marine inundation of the hinterland.

Overtopping of sea defences generally occurs as a result of waves running up the face of the seawall or waves breaking on the seaward face of the structure and producing significant volumes of splash. Another less significant way of overtopping is in the form of spray generated by the action of wind on the wave crests immediately offshore of the wall. Without the influence of a strong onshore wind however this spray will not contribute to any significant overtopping volume.

Coastal defences are likely to be tested more rigorously in the future by the predicted effects of climate change. The latest figures for sea level rise forecast suggest that long lengths of the sea defences will be unable to cope with significant events during their design life.

Overflowing of Watercourses

When the flow in a river or stream exceeds the capacity of the channel to convey that flow, either because of limited cross-sectional area, limited fall, or a restricted outfall, then the water level in that channel will rise until the point is reached where the banks of the channel are overtopped. Water will then spill over the channel banks and onto the adjoining land. With an upland river the adjoining land is its natural flood plain, which will generally be of limited extent and fairly well defined.

In the case of a major river, such as the Ouse, the floodplain may be a kilometre or more in width, though it may not be equally distributed on either side of the river channel. However, due to local variations in geomorphology, the width of the floodplain may vary considerably from point to point along the river valley. Floodplains are characterised by flat, riparian land along the valley floor. In pre-industrial England, such land was regarded as liable to flooding and was traditionally reserved for grazing and stock rearing and human settlements were almost always established beyond the edge of the floodplain. In the industrial age and more recent times with different priorities, pressures for development have resulted in the widespread colonisation of floodplains, often with steps taken to mitigate the associated risks of flooding.

When overtopping of an embanked watercourse occurs, the depth of water flowing over the floodwall or embankment will probably be small, a few centimetres at most. The bank will act like a weir and the rate of flow per unit length will be relatively modest and this, combined with the limited duration of the overtopping, will limit the volume of water cascading over the defences to cause flooding. If overtopping does occur and the protected area is of considerable extent, any flooding that results will often be disruptive rather than be disastrous. The situation becomes far more critical if overtopping of an earth embankment erodes its crest, leading to a breach in the embankment.

The areas surrounding the River Ouse are protected by flood defences which include both "hard" (e.g. concrete flood walls) and "soft" (e.g. earth embankments) defences and the risks and consequences of these embankments breaching must be considered.

Breaching of Embankments

Breaching is a potential problem for all flood defences regardless of the way they are constructed. However, it is more likely to affect earth embankments.

An earth embankment may be breached as a direct result of overflowing. Overtopping of a bank, especially when concentrated over a short length of bank, results in a rapid flow of water down the rear slope of the bank. This can cause erosion, which starts at the rear of the bank and works its way forward towards the channel. As the crest of the bank is washed away the flow through the small initial gap increases and a small breach is created. This becomes steadily bigger as water flows through it, eroding the sides and base of the breach, and a rapid and progressive failure of the embankment follows. Complete collapse of the bank may take only minutes. The contents of the embanked channel then pour through the breach and across the surrounding land.

A tarmac road or dwarf floodwall along the crest of a floodbank may inhibit the rate of initial erosion and postpone or even prevent the creation of a breach, depending upon the duration of overtopping. Experience, fortunately limited, shows that when a fluvial floodbank breaches, even if not by overtopping, it does so near the peak of the flood when the flow in the river and hence flood levels are at or near their maxima. Experience also suggests that breaches in river embankments usually extend from 20 to 30 metres in length and rarely grow to more than forty metres. Unlike tidal defence floodbanks, once a breach in a fluvial floodbank has occurred there will be a reduction in flood levels in the river as water flows through the breach. This reduces the stress on neighbouring floodbanks along the same reach of river, thus considerably reducing the risk of further breaches in the same area.

The design of a floodbank (or floodwall) incorporates a certain level of freeboard to allow for uncertainties, bank settlement, wave action, etc. but the height of any floodbank is determined primarily by the peak height of the design flood. Because of freeboard, the return period of the flood which gives rise to overtopping must be greater than that of the design flood. The return period of flooding from a breach caused by overtopping will be essentially the same as for the far less severe flooding resulting from that overtopping alone, but it must be borne in mind that breaches in earth embankments can occur from causes other than overtopping and may thus have return periods significantly less than the that for which the embanked channel was designed.

Apart from overtopping, breaches in floodbanks can occur where weak spots in the bank have been created over a long period by gradual leakage through the bank at old, forgotten structures buried in the bank such as culverts or sluices (“slackers”), or where the activities of burrowing animals such as rabbits or coypu have impaired the integrity of a floodbank. These inherent weaknesses may not be readily apparent under normal conditions but when an exceptional hydraulic gradient through the bank arises during flood conditions, a failure may occur, quickly giving rise to a breach. This may well happen in a flood of considerably lesser magnitude and return period than the design flood. Furthermore, since the inherent weakness tends to increase slowly with age, the fact that a bank did not fail in an earlier flood does not guarantee that it will not fail in a comparable (or even a lesser) flood at some time in the future.

Mechanical, Structural or Operational Failure

Although less common than overtopping or breaching of defences, flooding can also be caused by the mechanical or structural failure of engineering installations such as land drainage pumps (or their power supplies), sluice gates (or the mechanism for raising or lowering them), lock gates, outfall flap valves etc. Such failures are, by their nature, more random and thus unpredictable than the failures described in the previous sub-Sections, and may occur as a result of any number of reasons. These include poor design, faulty manufacture, inadequate maintenance, improper operation, unforeseen accident, vandalism or sabotage.

Structural failure, in this context, is also taken to include the failure of "hard" defences in urban areas such as concrete floodwalls. "Hard" defences are most unlikely to fail by the overtopping / erosion / breaching sequence experienced by earth embankments. Their failure tends to be associated with the slow deterioration of structural components, such as rusting of steel sheet piling and concrete reinforcement, or the failure of ground anchors. Such deterioration is often difficult to detect and failure, when it occurs, may well be sudden and unforeseen. Structural failure of "hard" defences is most likely to happen at times of maximum stress, when water levels are at their highest during a flood. Failure of hydraulic structures and "hard" defences can, under certain circumstances, be precipitated by the scouring of material from beneath their foundations by local high velocity flows or turbulence, especially under flood conditions.

Flooding can also be caused or exacerbated by the untimely or inappropriate manual operation of sluices, or by the failure of the person or organisation responsible to open or close a sluice at a critical time. Responsibility for the operation of sluices rests with various public bodies as well as riparian landowners. Operational failures of this nature generally occur during a flood event and their results are to exacerbate rather than to cause flooding, and their impact is normally limited in extent.

Flooding, especially that caused by overflowing of watercourses, can be exacerbated by other operational failures. These failures can also include neglected or inadequate maintenance of watercourses resulting in a reduction of their hydraulic capacity. Flooding can also be caused or exacerbated by bridge or culvert blockages, although these are not necessarily due to maintenance failures and may be caused by debris, natural or man-made, swept along by flood flows.

The risks associated with this category of failures are almost impossible to quantify, especially as experience has shown that there is a joint probability relationship between this class of failure and flooding resulting directly from extreme meteorological events. It can of course be argued that if a risk of this type was quantifiable and found to be finite then action should already have been taken to alleviate the risk. Even an assessment of relative risk for failures of this type must depend on a current and detailed knowledge of the age and condition of plant, its state of maintenance, operating regime etc at a significant number of disparate installations.

Localised Flooding

Almost all localised flooding of a serious nature occurs as a result of a severe convective storm, localised in extent and duration and generally during the summer. This flooding can, however, be exacerbated by two factors, blockages in the local surface water drainage system or by "floodlocking". Each of these factors is considered separately below. In some instances, in what would otherwise have been a relatively moderate rainstorm, these factors can themselves be the cause of flooding.

Intense storm rainfall, particularly in urban areas, can create runoff conditions which temporarily overwhelm the capacity of the local sewer and drainage system to cope with the sudden deluge. Localised “flash” flooding then occurs. In upland areas with small, relatively steep, impermeable catchments, this may result in quite severe flooding over a limited area, often with a considerable depth and velocity of flood water. The duration of such flooding is usually relatively short but this does not mitigate its impact for those affected, especially when the flooding may have developed suddenly and unexpectedly.

Localised flooding can also occur in urban areas where a stream or watercourse has been extensively culverted. In its natural state, if the channel capacity of a stream is exceeded the channel will overflow along a considerable length and the resultant flooding is distributed over a wide area. If, however, the stream runs through a long culvert and the hydraulic capacity of that culvert is exceeded under flood conditions the culvert becomes surcharged at its upstream end. Water levels will then rise rapidly and localised flooding upstream of the culvert, often quite serious, can occur. The flood water, in attempting to follow the natural line of the culverted watercourse, may also flow through the built-up area above the line of the culvert. This applies equally to many larger surface water sewerage systems in urban areas which are, in effect, culverted watercourses.

Local flooding is often exacerbated by deficiencies in the local surface water drainage system, but these can usually be remedied by relatively minor works once they have been exposed by a flooding event. Local flooding can also be caused by temporary blockages or obstructions in a drainage system, especially one that has been extensively culverted. Such flooding can therefore be virtually random in its occurrence, although the prevalence of blockages at a particular location would suggest a systematic problem, justifying action to modify the drainage system at that location in order to resolve it.

In recent years some urban watercourses considered to be particularly at risk from such blockages have been designated "Critical Ordinary Watercourses" (COWs). COWs have been designated in their respective areas by Local Authorities and Internal Drainage Boards, as well as by the Environment Agency. Where a COW is at present separated from the Main River system by a length of non-Main River the intervening watercourse will also be enmained. Information regarding Main Rivers and COWs within Lewes District has been provided by the EA and is Included in Appendix B.

In inland areas, all local surface water drainage systems discharge to a major stream or river. Except where pumps have been installed, this discharge is by gravity. If the receiving stream or river is in flood, especially where that watercourse is contained within raised floodwalls or banks - as in Lewes town - the flow in the local drainage system can no longer drain to the river and is impounded behind the defence line for the duration of the flood. This is known as "flood locking". This can result in secondary flooding within the defended area, even though the defences may not have been breached or overtopped. Fortunately, this secondary flooding is almost always much less severe or widespread than primary flooding from the main river would have been.

In coastal areas, a similar phenomenon occurs during times of high tide. A backing up effect is produced in the major stream as a result of being unable to discharge by gravity into the sea. This is known as “tide locking”.

The occurrence of secondary flooding depends on the coincidence of heavy rain over the local drainage catchment with "flood locking" or “tidal locking” of its outfall. Due to the complex coincidence of events required to produce this type of flooding, its probability of occurrence is difficult to quantify and it falls within the category of "residual risk".

Functional Floodplains and Washlands

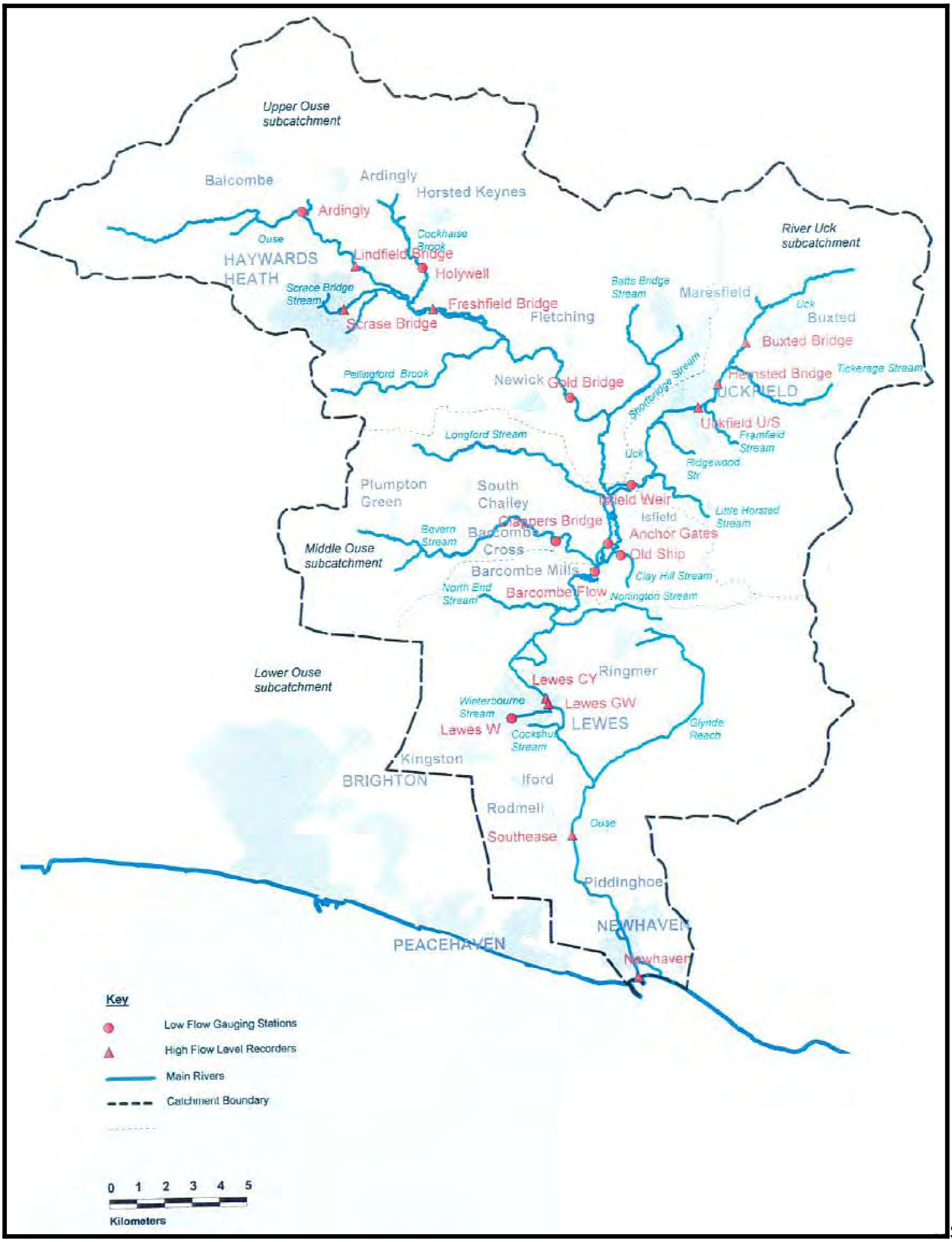
Functional floodplains form the basis for Flood Zone 3b in PPS25 and are defined as areas where flooding, whether controlled or uncontrolled, can be expected to occur with an annual frequency of 5% (once in twenty years) or greater.

For the purposes of this study, it was deemed adequate to designate functional floodplain areas in Lewes District by using the results obtained from the hydraulic modelling of the undefended 1 in 25 year return period event. This slight departure from PPS25 was approved by the Environment Agency and Lewes District Council taking into consideration that the expected difference in terms of estimated water levels with the 1 in 20 year scenario would be relatively insignificant.

OVERVIEW OF FLOOD ALLEVIATION SCHEMES

Construction Date	Defence Schemes	Standard of Protection
1953-1979	<u>River Ouse Tidal River Walls Improvement Scheme</u> Carried out in 8 stages between Newhaven and Barcombe Mills. Range of measures including embankments, walls and brick parapets through Lewes, closing off tidal tributaries, reconstruction of sluices and drainage structures.	10% annual probability
1960, 1974, 1985	<u>Winterbourne Improvement Scheme</u> 1960 - Replacement of the 500m Southover High Street and St Pancras Road culvert, installation of weed screens from Bell Lane to Garden Street. 1974 - Tidal outfall installed 1985 - Replacement of the 460m culvert beneath cattle market and railway station, channel realignment and enlargement, small flood storage areas created.	2% annual probability
1971	<u>Barcombe reservoir</u> The reservoir occupies about two thirds of the floodplain above Barcombe Mills. Southern Water carried out channel improvements to compensate for this.	
1978-1981	<u>Uckfield Flood Relief Scheme</u> River capacity improved between Hempstead Mill and Isfield gauging station, including new twin box-culvert beneath Uckfield Mill.	2% annual probability (Urban) 10% annual probability (Rural)
1989 and 1990 2002/03	<u>Scrase Bridge Stream/West Common Stream Improvements</u> Environment Agency and Mid-Sussex Council improved defences, channel and culvert capacities for Scrase Bridge Stream. West Common Stream bypass culvert installed.	Approximately 3% annual probability 2% annual probability
2004-05	<u>Malling Brooks</u> Flood embankment and flood gate installed to protect Malling Brooks area. Scheme designed to protect 237 residential and 50 commercial properties.	0.5% annual probability
2005	<u>Plumpton culvert</u> Carries Bevern Stream under station road; East Sussex County Council replaced the old culvert with a box culvert approximately twice its original size.	
2005	<u>Winterbourne Stream outfall</u> Stabilisation works in and around 35 metre section of wall adjacent to and north of Winterbourne Stream outfall. Old concrete wall replaced with new timber capped steel sheet piling. New toe profiles in the river and reprofiling and stabilisation of river bank.	2% annual probability

OUSE SUBCATCHMENTS AND GAUGING STATIONS SUMMARY



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Source: Sussex Ouse Flood Management Strategy

Environment Agency's Gauging Stations within Lewes District

Watercourse & Station ID	Gauging Station And OS grid ref.	Gauged Area (Km^2)	Type of Recording	Start of Record
Ouse	BARCOMBE (FISHLADDER) TQ4342714794	395.7	Flow	1981
Ouse	BARCOMBE ULTRASONIC TQ4381015010	395.7	Flow	1999
Ouse 41005	GOLD BRIDGE TQ4234816112	180.91	Flow	1960
Winterbourne Stream 41037	LEWES WINTERBOURNE TQ4032709582	17.3	Flow	1966
Clayhill Stream 41021	OLD SHIP TQ4481515357	7.1	Flow	1955
Spring	PLUMPTON GOTE FARM TQ3479413787	N/A	Flow	2001
Ouse	ANCHOR GATES TQ4418915943	N/A	Water Level	2000
Ouse	BARCOMBE DOWNSTREAM TQ4330314880	N/A	Water Level	1992
Ouse	LEWES CORP YARD TQ4168510595	N/A	Water Level	2000
Ouse	NEWHAVEN TIDAL TQ4511600027	N/A	Water Level	1990
BEVERN STREAM 41020	CLAPPERS BRIDGE TQ42351611	34.62	Water Level and Flow	1969
Ouse	FRESHFIELD BRIDGE	N/A	Water Level	N/A
Ouse	SOUTHEASE TQ42780534	N/A	Water Level	N/A

LIST OF MAIN RIVERS AND WATERCOURSES IN LEWES DISTRICT

Reference	Watercourse Name	Status	Type
J601	River Ouse Tidal Reaches	main river	tidal
J602	Island Loop. Newhaven	main river	fluvial
J603	Glynde Reach	main river	fluvial/tidal
J604	The Cockshut	main river	fluvial
J605	Bulldog Sewer & Green Man Spur	main river	fluvial
J606	Hamsey Cut	main river	tidal
J607	Northend Stream	main river	fluvial
J608	Pike's Bridge Stream Tidal	main river	tidal
J609	Newhaven Mill Creek	main river	tidal
J610	Winterbourne Stream	main river	fluvial
J611	Norlington Stream	main river	tidal
J612	Denton Sewer	main river	tidal
J613	South Heighton Sewer	main river	fluvial
J614	Malling Brooks	main river	fluvial
J615	Newhaven Sewer	main river	fluvial
J627	Tide Mills Sewer	ordinary watercourse	fluvial
J630	Piddinghoe No. 1 Sewer	ordinary watercourse	fluvial
J631	Piddinghoe No.2 Sewer	ordinary watercourse	fluvial
J632	Southease South Sewer	ordinary watercourse	fluvial
J633	Southease Middle Sewer	ordinary watercourse	fluvial
J634	Southease North Sewer	ordinary watercourse	fluvial
J635	Celery Sewer	ordinary watercourse	fluvial
J636	North End Sewer	ordinary watercourse	fluvial
J637	Kingston Sewer	ordinary watercourse	fluvial
J638	Rodmell Sewer	ordinary watercourse	fluvial
J639	Pool Bar Sewer	ordinary watercourse	fluvial
J640	Rise Farm Sewer	ordinary watercourse	fluvial
J641	Cockshut Stream	ordinary watercourse	fluvial
J643	Papermill Cut	ordinary watercourse	fluvial
J644	Chalkpit Cut	ordinary watercourse	fluvial
J645	Pellbrook Cut	ordinary watercourse	fluvial
J646	Ranscombe Sewer	ordinary watercourse	fluvial
J648	Ripe Sewer	ordinary watercourse	fluvial
J650	Laughton Place Sewer	ordinary watercourse	fluvial
J651	Langtye Sewer	ordinary watercourse	fluvial
J652	Broyle Place Sewer	ordinary watercourse	fluvial
J654	Glyndebourne Sewer	ordinary watercourse	fluvial
J657	Rise Farm Sewer East	ordinary watercourse	fluvial
J658	Headlee Sewer	ordinary watercourse	fluvial
J659	Ham Sewer	ordinary watercourse	fluvial
J660	Ranscombe Spur	ordinary watercourse	fluvial
J661	Swale Brook	ordinary watercourse	fluvial
J662	West Firle Stream	ordinary watercourse	fluvial
J663	Willow Shaw Sewer	ordinary watercourse	fluvial
J664	Neville Brook	ordinary watercourse	fluvial
J665	Stoneham Sewer	ordinary watercourse	fluvial
J666	New Barn Sewer	ordinary watercourse	fluvial
J701	River Ouse Middle Reaches	main river	fluvial
J702	Iron River	main river	fluvial

Reference	Watercourse Name	Status	Type
J703	Bevern Bridge Or Grantham Stream	main river	fluvial
J704	Plumpton Mill Stream	main river	fluvial
J705	Longford Stream	main river	fluvial
J706	Shortbridge Stream	main river	fluvial
J726	Clay Hill Stream	ordinary watercourse	fluvial
J727	Plashett Park Stream	ordinary watercourse	fluvial
J801	River Ouse Upper Reaches	main river	fluvial
J802	Pellingford Brook	main river	fluvial
J810	Canal Cut Freshfield	main river	fluvial
J901	River Uck	main river	fluvial
J902	Isfield Mill Stream	main river	fluvial
K501	Cuckmere River (Tidal)	main river	fluvial
K526	Freshwater Stream	ordinary watercourse	fluvial
L201	River Adur East Branch	main river	fluvial

PPS25 GUIDANCE TABLES

(Source: Planning Policy Statement 25 - PPS25)

Table B.1 Recommended contingency allowances for net sea level rise

Administrative Region	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, East Midlands, London, SE England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Notes:

1. For deriving sea levels up to 2025, the 4mm/yr, 3mm/yr and 2.5mm/yr rates (covering the three groups of administrative Regions respectively), should be applied back to the 1990 base sea level year. From 2026 to 2055, the increase in sea level in this period is derived by adding the number of years on from 2025 (to 2055), multiplied by the respective rate shown in the table. Subsequent time periods 2056-2085 and 2086-2115 are treated similarly.
2. Refer to Defra FCDPAG3 *Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006, for details of the derivation of this table. In particular, Annex A1 of this Note shows examples of how to calculate sea level rise.
3. Vertical movement of the land is incorporated in the table and does not need to be calculated separately.

Table B.2 Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Notes:

1. Refer to *Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006*, for details of the derivation of this table.
2. For deriving peak rainfall, for example, between 2025-2055 multiply the rainfall measurement (in mm/hour) by 10 per cent and between 2055-2085 multiply the rainfall measurement by 20 per cent. So, if there is a 10mm/hour event, for the 2025-2055 period this would equate to 11mm/hour; and for the 2055/2085 period, this would equate to 12mm/hour. Other parameters in Table B.2 are treated similarly.

Table D.1: Flood Zones

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

FRA requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.

Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 3a High Probability

Definition

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.

The highly vulnerable uses in Table D.2 should not be permitted in this zone.

The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Zone 3a High Probability *(continued)*

Policy aims

In this zone, developers and local authorities should seek opportunities to:

i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
ii. relocate existing development to land in zones with a lower probability of flooding; and
iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition

This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:

– remain operational and safe for users in times of flood;
– result in no net loss of floodplain storage;
– not impede water flows; and
– not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
ii. relocate existing development to land with a lower probability of flooding.

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.[19]
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste.[20] • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).

[19] DETR Circular 04/00 – para. 18: *Planning controls for hazardous substances*. www.communities.gov.uk/index.asp?id=1144377

[20] See *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* for definition. www.communities.gov.uk/index.asp?id=1500757

Table D.2: contd.

Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan.**

Notes:

1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)[21] and also on the need of some uses to keep functioning during flooding.

2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Table D.3[22]: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception Test required	✔	✔
	Zone 3a	Exception Test required	✔	✗	Exception Test required	✔
	Zone 3b 'Functional Floodplain'	Exception Test required	✔	✗	✗	✗

Key:

✔ Development is appropriate

✗ Development should not be permitted

FD2320 SAFE ACCESS AND EXIT LOOKUP TABLE

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00				Danger for some	Danger for some	Danger for some	Danger for most	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all
0.10				Danger for some	Danger for some	Danger for most	Danger for most	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all
0.25				Danger for some	Danger for most	Danger for most	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all	Danger for all
0.50				Danger for most	Danger for most	Danger for most	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all	Danger for all
1.00			Danger for some	Danger for most	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
1.50			Danger for some	Danger for most	Danger for most	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
2.00		Danger for some	Danger for some	Danger for most	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
2.50		Danger for some	Danger for some	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
3.00		Danger for some	Danger for some	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
3.50		Danger for some	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
4.00		Danger for some	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
4.50	Danger for some	Danger for some	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all
5.00	Danger for some	Danger for some	Danger for most	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all	Danger for all

Key:

- Danger for some
- Danger for most
- Danger for all

SUSTAINABLE DRAINAGE SYSTEMS (SUDS) - OPTIONS

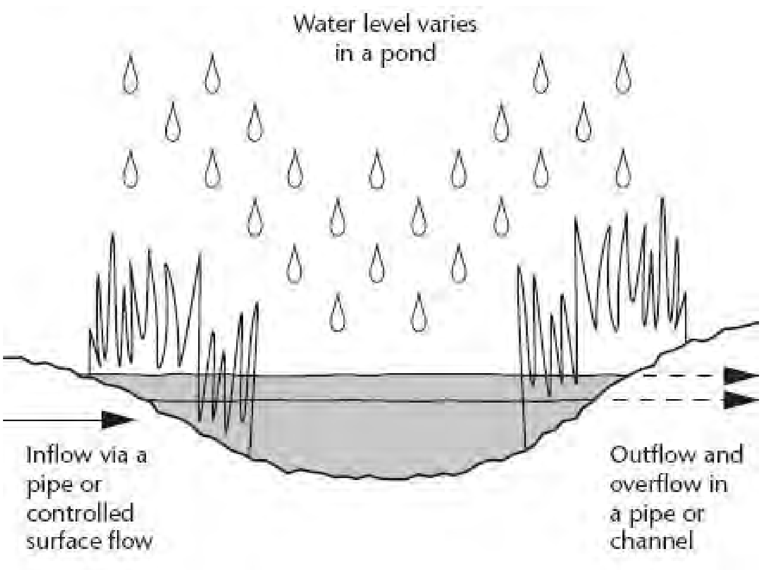
The various sustainable drainage systems that could be applied effectively in various areas of Lewes District Council are as described below.

It must be noted that a detailed site investigation is essential to establish the most appropriate techniques to be applied.

Ponds and Wetlands: Can be designed to accommodate considerable variations in water levels during storms, thereby enhancing flood-storage capacity. These would create habitats attractive to wildlife and thus enhance the environmental and visual amenity value of the area. Ponds and wetlands can be fed by swales, filter drains or piped systems which are also SUDS. This option is often restricted by the amount of land available for development.

Photograph 1: Typical Example of Retention Pond

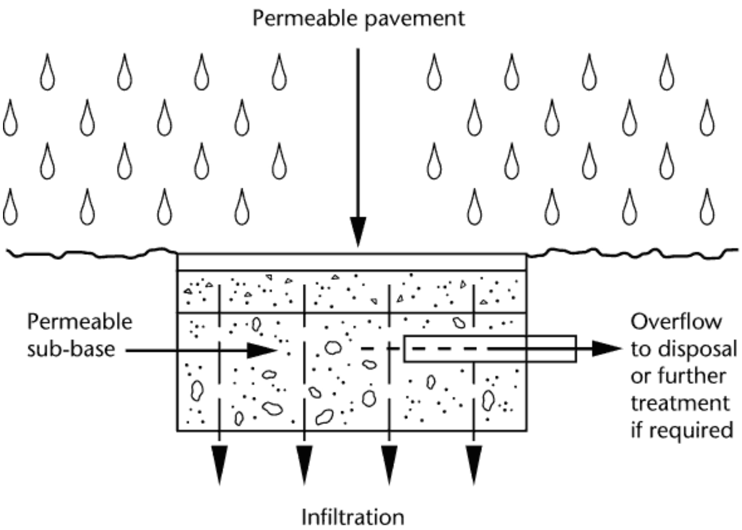
Figure 2: Retention Pond Schematic



Permeable Pavement: Reduces the need for surface water drains and off-site sewers can be reduced or eliminated where run-off is encouraged to permeate through a porous pavement, such as permeable concrete blocks, crushed stone and porous asphalt. Pollutant removal occurs either within the surfacing or sub-base material itself, or by the filtering action of the reservoir or subsoil.

Photograph 2: Typical example of Permeable Pavement

Figure 3: Permeable Paving Schematic

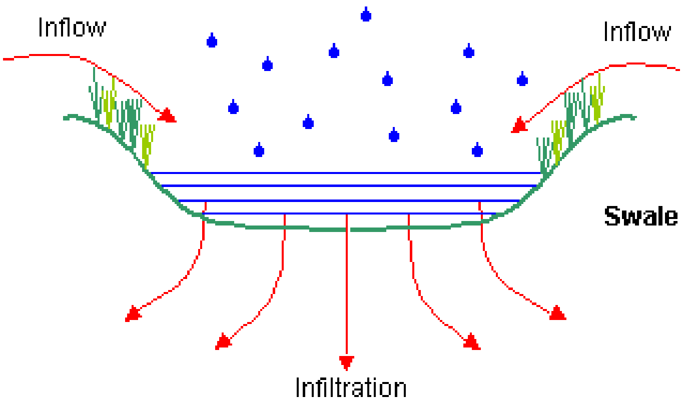


Swales and Basins: These can be created as features within the landscaped areas of proposed development sites. They provide temporary storage for storm water, reduce peak flows to receiving waters, and facilitate the filtration of pollutants as well as allowing water infiltration directly into the ground.

Swales and basins are often installed as part of a drainage network connecting to a pond or wetland, prior to discharge to a natural watercourse. These are often used alongside secondary roads to replace conventional kerbs.

Photograph 3: Typical example of Swale

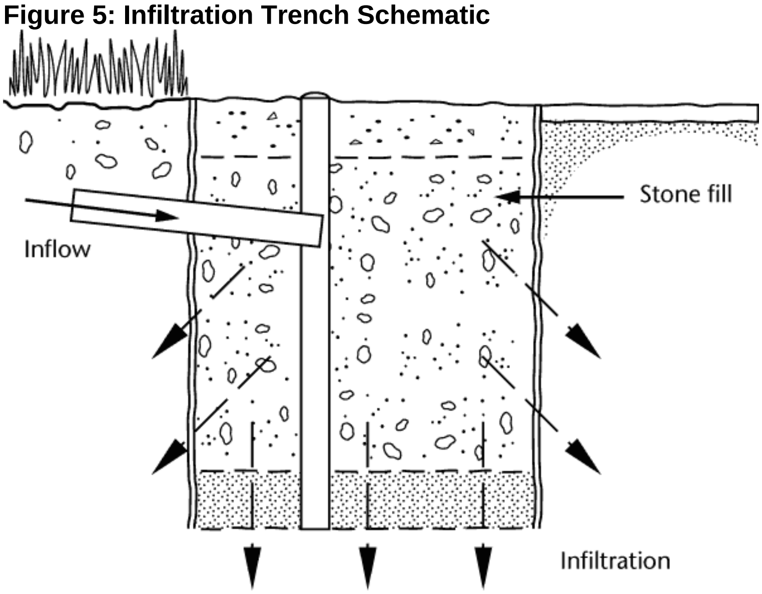
Figure 4: Swale Schematic



Infiltration Trenches and filter drains: Infiltration trenches comprise stone-filled reservoirs to which run-off is diverted, and from which water gradually infiltrates into the ground. Filter drains are similar structures through which a perforated pipe runs. This facilitates the storage, filtering and some infiltration of water passing from the source to the discharge point. Pollutants are removed by absorption, filtering and microbial decomposition in the surrounding soil. These are widely used by highway authorities.

Photograph 4: Typical example of Infiltration Trench

Figure 5: Infiltration Trench Schematic

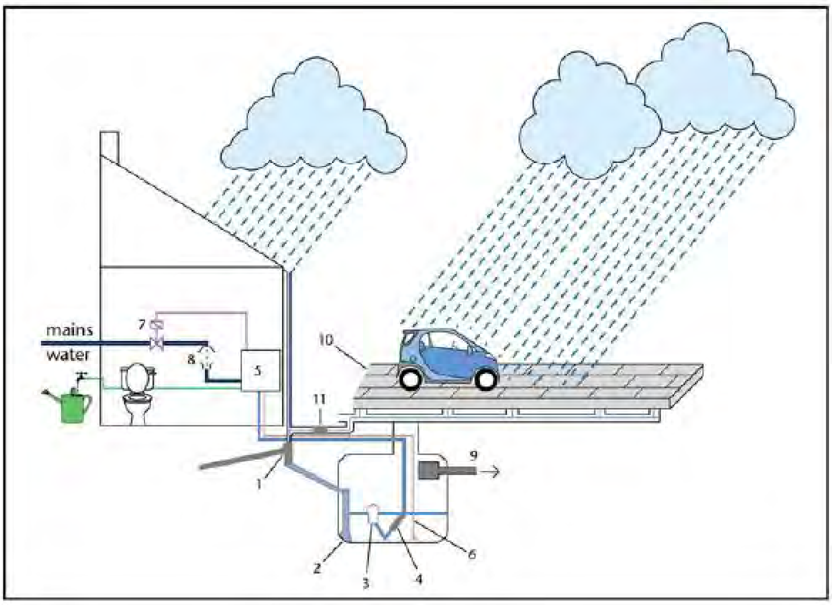


Green Roofs and Rain Water Reuse: Green roofs can reduce the peak flow and the total volumes discharged and improve water quality. Additionally, they can improve insulation and increase the lifespan of the roof.

Rainwater reuse (or harvesting) involves the collection of the rainwater on site and its use as a substitute for mains water, for example in watering a garden or for flushing toilets. These could be applied to any proposed development but would probably be more feasible in multi-storey residential blocks.

Photograph 5: Typical Example of Green Roof

Figure 6: Rain water Harvesting Schematic

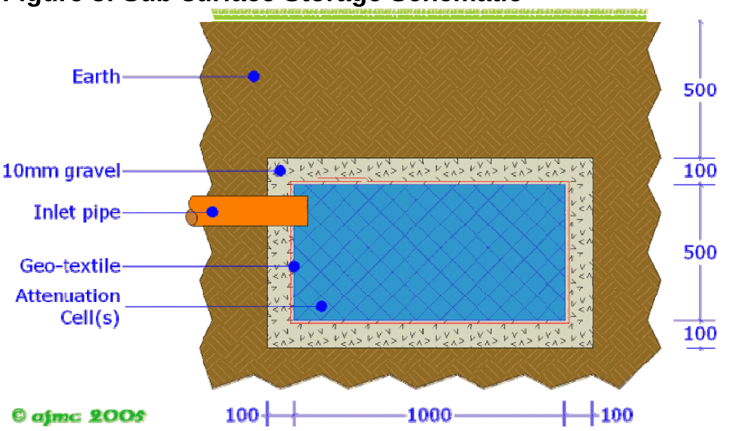


1 Filter
2 Smoothing inlet
3 Suction filter
4 Pump
5 Control unit
6 Water level monitor
7 automatic change over
8 AA air gap
9 Overflow trap
10 Permeable pavement
11 Oil trap

Sub-Surface Storage: The sub-surface storage systems work by replacing soil with plastic storage units and by doing so increasing the voids ratio from around 30% to 95% thus maximising the capacity to store flow. These systems allow the use of the land for recreational purposes and secondary roads. This technique is normally incorporated when the area available for mitigation is restricted.

Figure 7: Typical application of Sub-surface storage techniques

Figure 8: Sub-surface Storage Schematic



The following table provides a comparison of the cost/benefit offered by the different attenuation systems considered for development sites.

Table 12: Cost/Benefit Analysis of various SUDS Techniques

Attenuation System	Cost Implication	Benefits
Ponds and Wetlands	Large areas of land-take required	Easy to build and maintain. Major environmental benefits
Permeable Pavement	More expensive than normal pavement	No land-take for drainage. No need for surface water drains
Swales and Basins	Minor land-take required. Economical	Replace conventional kerbs. Reduces costs. Provides a rural aspect
Infiltration Trenches and filter drains	Minor land-take required. Economical	Environmentally friendly. Use of natural materials
Green Roofs and Rain Water Reuse	Relatively new and therefore rather costly	Residential/ commercial water savings. Less flow to watercourses. Water available during summer
Sub-surface Storage	Relatively expensive	Maximises land-use for development