Slough Local Development Framework

Strategic Flood Risk Assessment

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1.0 Introduction

1.1 The Borough Council has undertaken the initial stages of its Strategic Flood Risk Assessment to identify the variations in flood risk from the main sources of flooding within Slough. The purpose of the Strategic Flood Risk Assessment is to:

* inform the Sustainability Appraisal so that flood risk is taken into account when assessing options
* ensure that the allocation of land within the Local Development Framework, from the Core Strategy through to the Site Allocations, are made on the basis of an appropriately detailed assessment of flood risk as set out in the sequential test of Planning Policy Statement 25: Development and Flood Risk;
* ensure the formulation of appropriate development control policies for managing flood risk in Slough; and
* identify the level of detail required for site specific Flood Risk Assessments.

1.2 This Strategic Flood Risk Assessment does not reproduce all the guidance from PPS25 Development and Flood Risk and thus that document, together with the Companion Practice Guide, should be read in conjunction with this Strategic Flood Risk Assessment.

1.3 The Council uses the term ‘strategic’ with caution as this implies that the assessment has looked strategically at all the relevant watercourses and their catchments. Water does not respect local authority boundaries. However, the Council has worked closely with the Environment Agency (which is the principal flood risk management operating authority in England and Wales, empowered under the Water Resources Act 1991 to manage flood risk arising from designated “main” rivers and the sea) on the strategic fluvial flooding element of this Strategic Flood Risk Assessment.

1.4 The starting point for the flood risk study was the British Geological Survey map for the Slough area, to identify the bedrock, superficial deposits and man made disturbance across the Borough.

1.5 Information from the Environment Agency and from within the Council was then compiled and mapped on layers as follows:

* Environment Agency’s Flood Zone Maps which include the more detailed hydraulic modelling for the Lower Thames (including the Jubilee River) and the Lower Colne main rivers, critical ordinary watercourses and significant ordinary watercourses together with the natural catchment boundaries as estimated by the Council
* nodal data from the Environment Agency’s models of the Lower Thames and Lower Colne catchments
* Environment Agency’s map showing 1 in 20 year flood extent in the Colnbrook and Poyle area
* Environment Agency’s map showing Areas Benefiting from Defences in the Colnbrook and Poyle area
* Environment Agency’s historical areas of fluvial flooding
* groundwater source protection zones
* historic areas of flooding from groundwater and sewers
* significant culverts and surface water sewers and their respective catchment boundaries
* significant foul sewers and associated pumping stations together with catchment boundaries
* known restrictions to surface flow of fluvial flooding, whether specifically for flood defence or not (eg railway and motorway embankments)

1.6 A composite view of the major flooding sources/factors in Slough has been produced to highlight the key issues which have been identified in this Flood Risk Assessment.

1.7 This SFRA is part of an iterative process and will evolve and be refined over time as further modelling from the Environment Agency and other additional information becomes available.

2.0 Topography

2.1 Slough is situated on two terraces, the upper terrace and the river terrace. The land slopes from north to south, and west to east. The Borough is cut by a number of minor watercourse valleys; the Thames River valley runs along the southern boundary and the Lower Colne valley through the Colnbrook and Poyle area.

2.2 There are a number of watercourses in Slough or adjacent to Slough. Many of these are classified as main river or critical operating watercourses and therefore are the responsibility of the Environment Agency to maintain and improve. These include the following watercourses, plus their tributaries: Jubilee River, Huntercombe Lane Stream, Two Mile Brook (Chalvey Brook), Salt Hill Stream, The Myrke, Datchet Common Brook, Colne Brook, Wraysbury River, Poyle Channel, County Ditch, Hawthorn Ditch and the new Albany Park ditch.

2.3 There are numerous watercourses/ ditches which have not been designated as main river or critical ordinary watercourses; the local authority has permissive powers to maintain these ordinary watercourses.

3.0 Component Parts of Slough Flood Risk Assessment

Geology and Groundwater

3.1 Although Slough is a small, compact area extending seven miles east to west and three miles north to south, the underlying geology is both complex and varied. The bedrock is comprised of varying thicknesses of chalk, Reading Beds (composed of silt, clay, and gravels, which is semi-permeable), and London Clay (impermeable), overlain by River Terrace Deposits which are comprised of gravels and brick earth.

3.2 However, this bedrock is not constant across the borough, lying as it does on the Windsor incline. In some areas, such as Haymill, the River Terrace Deposits lie almost directly on an outcrop of chalk, where the London Clay and Reading Beds have been completely worn away.
3.3 In the area of Langley and Colnbrook/Poyle, the river terrace deposits are underlain by London Clay, which in turn are underlain by Reading Beds and then by the Upper Chalk. In the rest of the Borough, the London Clay layer has been eroded, leaving the Reading Beds below the river terrace deposits.

3.4 The superficial deposits are also varying across Slough. Across the northern part of the Borough, there is a swathe of river terrace gravels with a couple of 'pockets' of exposed London Beds which is impermeable. South of this, there is a swathe of brick earth which is less permeable than the gravels but as permeable as the London Beds underlying it. Further south, there is a mixture of river terrace gravels as well as a few areas of where the river terrace deposits are clayey or thin over London Clay.

3.5 The boundaries between the various areas of bedrock and superficial deposits as shown on the British Geological Survey maps are by no means precise, and the survey maps are updated as new information becomes available.

**Groundwater**

3.6 Understanding the complex geology of Slough is crucial as it has a direct bearing on groundwater and hence has implications for flooding and for the disposal of surface water. As the geology varies across Slough, so too does groundwater and the propensity for groundwater flooding; similarly, appropriate measures for dealing with surface water drainage vary depending on the ground conditions.

3.7 Traditionally, Slough has promoted the use of soakaway disposal for drainage of private areas where the ground conditions permit (eg reasonably porous soils and/or low groundwater levels). However, this is more difficult as the density of development increases and sites of varying ground conditions come forward for development.

3.8 In the area of the lower terrace, the groundwater level is influenced by the permeability of the bedrock in conjunction with the River Thames, and is therefore relatively high, between one to two metres below the surface. It is also high where the impermeable clay is close to the surface, forming a perched watertable.

3.9 Where the groundwater level is high, infiltration via soakaways is not possible as there is an insufficient thickness of unsaturated ground. Similarly, as the permeability of the underlying ground decreases (due to clayey soils), the area required for infiltration increases. There is also the risk that, where there is a perched watertable, using soakaways can create a spring line, or groundwater flooding, further to the south; this is a particular issue in the Wexham area.

3.10 Therefore, an understanding of the geology and groundwater conditions of a site is essential in order to design a suitable surface water drainage system which will provide an effective means of disposal without detriment to other areas.

**Groundwater Source Protection Zones**

3.11 The Environment Agency defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. Much of Slough (with the exception of the eastern edge of Langley and Colnbrook and Poyle, as well as the southwestern part of Cippenham) falls within either inner or outer...
Source Protection Zones. The zones act as a risk screening tool for the major aquifers storing and producing the groundwater.

3.12 The GlaxoSmithKline source protection zones are modelled for the Lower Greensand which are some 300 metres underground; the site also draws groundwater from the River Terrace Deposits, but currently for evaporative cooling purposes only.

3.13 Slough Estates abstracts groundwater from the Chalk and Lower Greensand aquifers as a ‘private supply’. The related source protection zone extends generally northwards from the north-western end of the trading estate and is protective of the Chalk abstraction.

3.14 The manner in which these groundwater source protection zones are interpreted has a bearing on the design of surface water drainage systems for development sites within these zones. In addition, any change in the use of an aquifer could have significant implications for drainage systems within these zones.

Historical Fluvial Flooding in Slough

3.15 The Environment Agency produces an Historical Flood Map which shows the extent of known flooding from the 1947 flood. Only a small part of Slough (in the area of Chalvey, the Myrke and Langley) was affected.

3.16 An area in Wexham around Dawes Moor Close flooded in the late 1980’s/early 1990’s as a result of flooding from Datchet Common Brook and an apparent overland flow from the Horton Brook.

3.17 Huntercombe Lane has been subject to flooding on numerous occasions due to lack of capacity in Huntercombe Lane Stream.

3.18 More recently, the floods in the autumn of 2000 and 2003/2003 affected the Colnbrook and Poyle areas, in particular the area to the south of the County Ditch. The Colne Brook overtopped its banks, and flowed into the lake system on the north side of the Colnbrook Bypass; both Lakeside Road and the Colnbrook Bypass were overtopped, a water flowed into the watercourse running to the east of Pippins Park, and then into the County Ditch. With the Colne Brook in full flow, the County Ditch backed up, flooding numerous residential properties south of the Ditch. Surface water runoff from a former landfill site resulted in flooding in Galleymead Road industrial estate.

3.19 The Environment Agency had carried out flood alleviation measures (construction of a channel to the east of the Colne Brook, linking into the County Ditch) in the early 1990s; however, these measures did not adequately deal with the volume of water in the County Ditch. A further Colnbrook Flood Alleviation Scheme was implemented in 2005 which involved the creation of a new flood channel through Albany Park, rejoining the Colne Brook south of Cottagesbrooke Close. Other works involved the widening of the County Ditch, clearance along the Colne Brook, and raising the banks of Colnbrook West Lake.

3.20 In the Manor Park area, flooding has been recorded since the estate was built in the 1930’s as a result of water spilling from the balancing reservoir situated to the north within South Bucks, as well as surface water runoff due to the soil being saturated/extent of hard surfacing. Despite improvement to the reservoir, its capacity is limited and paving of gardens has exacerbated flooding in this area. Obstruction of the flood flow path widens the area of flooding from that predicted by the Environment Agency Flood Zones.
Flood Zone Maps

3.21 The Council has used the Environment Agency’s Flood Zone Map, June 2007, which show the natural floodplain without taking account of defences. The flood zones for the watercourses other than the Lower Thames and Lower Colne have been produced from National Generalised Modelling which used flow data and a Digital Terrain Model (a digital representation of the ground topography) to create flood outlines for all catchments, with a size of 3km$^2$ or greater, in England and Wales.

3.22 Detailed hydraulic modelling has been carried out by the Environment Agency for both the Lower Thames and the Lower Colne. The modelling of the Lower Thames includes levels and extents for the 5% (20 year), 1% (100 year) and 1% (100 year + 20%) (climate change) flood events.

3.23 The Environment Agency will be replacing the current Flood Zone 3 for the Lower Thames with a revised undefended outline in late 2007.

3.24 The Environment Agency will also be producing an Area Benefiting from Defences outline up to the 1 in 100 year event for the Lower Thames. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding with a 1% (1 in 100) chance in any given year, and will be shown as a hatched area on the Flood Map. An area of land may benefit from the presence of a flood defence even if the defence is overtopped, if the presence of the defence means that the flood water would not extend as far were the defence not there. The study will remodel the Lower Thames to take into account road and rail embankments, raised defences, and the Jubilee River, taking into account its enhanced capacity since the remedial works on the river banks were completed in 2006.

3.25 The Agency has already produced an Area Benefiting from Defences outline for the Lower Colne; this shows the area to the west of the Colne Brook between the Colnbrook Bypass and the Vicarage Way residential development as benefiting from defences. Thus development along Mill Street and St. Thomas’ Walk are shown as within the Area Benefiting from Defences. In addition, much of the land between the Poyle Channel and the Old Bath Road, east of Poyle Road and west of the railway line, together with the northwestern half of Poyle Industrial Estate also fall within the Area Benefiting from Defences. Interestingly, the extent of the 1 in 100 year flood plain has been extended on this map to include the Drift Way area and the area north and south of the High Street to the west of the Colne Brook. The Council will be discussing this mapping with the Environment Agency to clarify the rationale for these changes.

3.26 The Flood Maps show areas within Zone 2 and 3 which are defined as follows:

* Zone 2: Land assessed as having an annual probability of flooding of 0.1% (1 in 1000) or greater from rivers (Flood Zone 2)

* Zone 3: Land assessed as having an annual probability of flooding of 1% (1 in 100) or greater from rivers, ignoring the presence of defences
3.27 Land outside Zones 2 and 3 is classified as Zone 1, assessed as having an annual probability of flooding of less than 0.1% (1 in 1000 year).

3.28 Zone 3 is divided into two categories referred to as Zone 3a and Zone 3b. Zone 3a comprises land assessed as having a 1 in 100 year or greater annual probability of river flooding (>1%) whilst Zone 3b comprises land where water has to flow or be stored in times of flood; assessed as having an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood. However, the Environment Agency has defined Zone 3b for the Colnbrook and Poyle area only; the Council has a few queries with respect to this map which it is pursuing with the Environment Agency. Outside of this area, there are no defined areas of Zone 3b, and the Council is unable to map such areas without information relating to the extent of the various catchments, together with levels. The Council had requested information relating to levels from the 1 in 100 and 1 in 1000 year flood maps. However, the Environment Agency has advised that the modelling methods used to produce the Flood Zones data were developed and tested for the production of flood extents only, and thus the level data is not made available by the Environment Agency.

3.29 Within Slough, the majority of the land falls within Zone 1.

3.30 Areas falling within Zone 2 and 3 are associated with the watercourses running north/south through the Borough including Huntercombe Lane Stream, Two Mile Brook (Chalvey Brook), Salt Hill Stream, Datchet Common Brook, Horton Brook, Tanhouse Stream, Colne Brook, Wraysbury River, and the Poyle Channel.

Refinement of Flood Zones

3.31 Last year, the Council had raised concerns with the Environment Agency regarding the accuracy of the Flood Zones for the following watercourses in Slough: Huntercombe Lane Stream, Two Mile Brook (Chalvey Brook), Salt Hill Stream, Datchet Common Brook, and the Horton Brook (north of Withy Bridge).

3.32 The Environment Agency undertook Flood Zone Improvements to Huntercome Lane Stream and Two Mile Brook using LiDAR data (ground elevation) for the area covering these watercourses. The revised Flood Zones for these watercourses have been published on the June 2007 Flood Zone map. However, a Detailed Flood Risk Study to remodel Salt Hill Stream and Datchet Common Brook would require detailed flood mapping using local catchment information; this will not be carried out until 2009, subject to funding, and the revised flood outlines will not be available until late 2009/2010.

3.33 With respect to the Horton Brook north of Withy Bridge, the Flood Maps reveal potential flooding in the Langley area which the Council believes is overstated given the presence of the Slough Arm of the Grand Union Canal and the railway embankment. However, if flooding in the Langley area were indeed over-estimated, there would be other areas at risk which have not been identified and hence there is a need for further study of the catchment further north. Of particular concern is whether there is any potential for the Horton Brook to 'jump' catchments in the area north of Dawes Moor Close and join the Datchet Common Brook catchment to the west. It is thought that this is what may well have happened in the late 1980's/early 1990's when flooding occurred in Wexham. However, no commitment with respect to a detailed flood risk study of the Horton Brook has been given by the Environment Agency at this stage.
3.34 It is considered that the June 2007 Flood Zone Map reflects more accurately the areas at risk of flooding though, as identified above, the Council considers that further refinement is still required. However, without knowing how the Environment Agency has defined the catchments for the various watercourses, it is difficult to judge whether the extent of flooding as shown on the Flood Zone Maps is reasonable. For example, the area of Manor Park has experienced minor flooding events which have spread further than the 1 in 100 year event Flood Zone would suggest. The spread of flood waters is due to obstructions such as garden fences and walls, sheds, etc. which are not taken into account by the Environment Agency’s model. The Council will continue to work with the Environment Agency in defining the Flood Zones more accurately to ensure that land allocations in the DPD for the next 20 years are made on the basis of an appropriately detailed assessment of flood risk as set out in the sequential test of PPS25.

**Surface Water Sewers**

3.35 These are owned and managed by Thames Water. Although Thames Water has not provided any detailed information, the Council is in the fortunate position of having considerable knowledge of the surface (and foul sewers) within the Borough.

3.36 Prior to 1974, the Council had a strategy which involved creating balancing, together with an integrated system of watercourses and sewers; unfortunately, following the formation of the water companies, this system was never completed.

3.37 Historically, there has been a tendency for Thames Water to permit an unrestricted discharge of surface water runoff into the public sewer with little attempt to introduce source controls and attenuation measures. This approach is not sustainable as it increases the risk of flooding downstream and reduces the capacity in Thames Water’s existing sewer system.

3.38 Discharging to sewer, even with attenuation, places greater pressure on the surface water sewers in Slough. Surface water flooding occurs where there is surcharging of underground drainage systems, particularly where groundwater levels are high, the ground is saturated thereby preventing infiltration, and there are significant volumes of surface water run-off. Increased impermeable surfacing in new developments increases surface water runoff if there is not sufficient storage and attenuation. On the domestic scale, the increased use of hard surfacing in front gardens to accommodate parking of cars and hard landscaping in back gardens add significantly to the problem of increased rates of surface water runoff. It should be noted that the density of the built area in Slough (eg total roof area) is approximately 13%, which is similar to the figure for Greater London.

3.39 This Strategic Flood Risk Assessment has identified concerns regarding the ability of the surface water sewers in the Slough Estates area as well as in the town centre (where the majority of the surface water sewers serving the town centre discharge into the Myrke) to accommodate any significant increase in flows. As part of the Flood Risk Assessment for the Slough Trading Estate Masterplan, detailed means of source controls and attenuation for surface water drainage on all development sites will need to be addressed. Similarly, when the Simplified Planning Zone for Slough Estates is replaced by a Local Development Order, it is essential that there be stringent requirements for surface water drainage.

3.40 In the recent storm event in July 2007, surface water flooding occurred in the Stoke Road and Burnham Lane area as a result of large volumes of surface flow from areas to the
north in South Bucks. The Council has already identified the need to work in partnership with Buckinghamshire County Council, the highway authority for South Bucks, to address these problems.

3.41 Within areas which have experienced surface water flooding, it is imperative to ensure that future developments provide sufficient balancing/attenuation on site to achieve greenfield runoff rates, though this is not always straightforward given high groundwater levels and unfavourable ground conditions (in terms of permeability and contamination), as well as being located within inner or outer source protection zones.

3.42 On small development sites (much less than a hectare), the resulting discharge can be too low to control effectively. Ideally, combined drainage schemes would be the answer, but Thames Water does not take responsibility for such schemes, and the Borough Council is not a drainage authority.

3.43 Surface water flooding such as experienced in Slough is localized and can be addressed as part of the design process and therefore should not influence the allocation of land for future development. However, appropriate development control policies setting out the requirements for the disposal of surface water will be required for all developments in Slough, whether or not the site falls within an existing problem area. In addition, these policies will need to consider the possibility of restricting the density of development in some key areas where the underlying ground conditions restrict the options available for designing the surface drainage system.

Foul water sewers

3.44 The foul sewers are also owned and maintained by Thames Water. There are known problems of sewer flooding but this is limited in geographical area and is generally associated with storm events when the sewer system is surcharged with surface water in excess of its capacity rather than sewerage overload. This problem is exacerbated by factors such as illegal domestic connections of roof/surface water drainage to foul sewers, as well as a number of surface water sewer overflows in the Slough Trading Estate area.

3.45 In storm events, there are pinch points at two pumping stations which have resulted in the foul sewers surcharging in low spots within Ditton Park and Winvale. The development of the site south of Castleview Road will place an additional load on these sewers, adding to the capacity problems with the pumping stations.

3.46 However, it is not considered that deficiency in capacity within the sewers would prevent development within Slough as there are means by which Thames Water could alleviate the problem such as by providing storage for storm events.

3.47 The Council is seeking to work with Thames Water to identify infrastructure provision required to accommodate future development in the Borough, together with information on the timing of any required improvements. This work will inform the formulation of development control policies in the next stage of the Local Development Framework.

Groundwater Flooding

3.48 Groundwater flooding occurs when water accumulates in areas as a result of high water table and substantial groundwater flow through permeable ground from surrounding land or from a spring line.
3.49 Groundwater flows can be altered, as has occurred in the Colnbrook and Poyle area by the filling of sites excavated for sand and gravel, (and particularly those which are sealed, such as the land east of Sutton Lane), the construction of the Queen Mother and Wraysbury reservoirs, and development such as Thames Water’s Iver South Sludge Treatment Works, as groundwater flows through these sites have been partially or totally blocked, thereby increasing the rate of flow of groundwater in the remaining ‘gaps’.

3.50 The Council is aware of groundwater flooding in areas of Colnbrook (in particular around Popes Close) as well as in the Cocksherd Wood area of Britwell.

3.51 Appropriate development control policies will be required to ensure that future development does not exacerbate this problem. Furthermore, close consultation will be required with adjoining local planning authorities to ensure that developments within their boundaries do not adversely affect groundwater flows into or out of Slough.

3.52 The Environment Agency has now assumed a strategic overview for monitoring groundwater flooding and will be improving the collation of records and improve the assessment and monitoring of problems associated with groundwater flooding. They are considering how best to incorporate risk information (from both existing and new development) into their existing flood risk mapping strategy in order to improve awareness and understanding. Consideration is being given to whether a national database is appropriate given that groundwater flooding is specific to some areas of England.

Highway Drainage

3.53 The Council is responsible for the provision and maintenance of highway drainage. It is considered that the capacity of the system is sufficient, though, as much of the highway drainage is connected to either surface water sewers or watercourses, flooding on the highway does occur in places. It is considered that where this does occur, it is a reflection of the incapacity of the surface water sewers/water courses rather than a failure of the highway drainage itself. In some areas, soakaways have been constructed which provide disposal. These have a finite capacity and it is important that no other areas drain onto the highway.

Reservoirs

3.54 This study has not taken into account the risk of flooding from the Queen Mother or Wraysbury Reservoirs as it is considered that the risk of failure is extremely low and is therefore not an issue to constrain the location of development. The integrity and safety of reservoirs is the responsibility of the Department of Environment, Food and Rural Affairs; as reservoirs are part of the national critical infrastructure, no detailed information is available due to security reasons.

3.55 There has been public concern following the failure of Thames Water’s feed pipe from the River Thames to the Queen Mother reservoir which resulted in a number of houses in the Horton area being flooded. There are other feed pipes in the Colnbrook and Poyle area; however, for a number of reasons, it is considered that the chances of another such failure are relatively remote, and therefore should not constrain the location of development.

3.56 Similarly, the study hasn’t taken account of flooding from the failure of the Stoke Park or Haymill reservoirs because of the very low risk of failure.
3.57 Detailed modeling of the Lower Thames has taken into account the potential impact of climate change over the next 50 years. The anticipated 1% AEP (100 year) flood affected area in 2056 resembles the current 0.1% AEP (1000 year) flood outline.

4.0 **Summary of Key Issues Relating to Flooding in Slough**

4.1 The key issues arising from this flood risk assessment can be summarized as follows:

* the varied and complex nature of the underlying geology in Slough;
* the restrictions on surface water drainage systems appropriate in Slough due to the underlying geology, and hence groundwater levels, land contamination, and groundwater source protection zones;
* presence of numerous watercourses which run north/south through the Borough, as well as the Jubilee River and River Thames to the south combined with a lack of knowledge relating to their catchments and hence the potential area at risk of flooding;
* level of maintenance by the Environment Agency with respect to main rivers;
* level of maintenance and capacity issues in the surface water sewer system;
* capacity of the foul sewer system due to surcharging by surface water in storm events;
* groundwater flooding in a few areas due to perched water tables and high groundwater levels;
* lack of ownership and hence maintenance of attenuation scheme greater than 30 years.

5.0 **Further Information Required to Refine the Slough Flood Risk Assessment**

5.1 Considerable work has been carried out to compile information on the various factors which influence flooding from various sources, not purely fluvial, in Slough. As stated previously, this is an iterative process and further information will be incorporated as it becomes available. It will be essential to work closely with the Environment Agency as well as Thames Water in order to ensure that the Site Allocations and Development Control Policies DPD fully address the risk of flooding in accordance with PPS25.6.

5.2 Additional information required which has been identified in this Flood Risk Assessment includes the following:

* information on levels from the 1 in 100 and 1 in 1000 year flood maps together with catchment boundaries so that the location and extent of flooding can be further assessed and refined;
* detailed flood risk study of Salt Hill stream, Datchet Common Brook and the Horton Brook north of Withy Bridge; and
* areas defined as functional floodplain outside of the Colnbrook and Poyle area;

5.3 The above information will be essential in order for the Council to identify areas of existing and potential flow balancing as well as predicted flow paths of floods where existing and new development could cause a significant increase in the area of flood risk.
6.0 Specific Issues to be Considered as part of Flood Risk Assessments in Slough

6.1 Site specific flood risk assessments will need to follow the guidance as laid out in PPS 25 as well as the companion practice guide. In addition, the Slough Flood Risk Assessment has emphasized the fact that the underlying geology in Slough varies significantly and therefore FRAs for any development site in Slough will need to take into account the following:

a. Ground conditions: The prevailing ground conditions of the development site and their implications for the design of the surface water drainage system needs to be provided. This should include whether the site is contaminated in such a manner that would further constrain the surface water drainage system as infiltration/soakaways may not be appropriate in such situations.

b. Groundwater levels: Information on groundwater levels over a period of several years is required as the levels vary; reliance on too short a period, especially during a dry spell, would result in artificially low levels.

7.0 Development Control Policies

7.1 The Site Allocations and Development Control Policies DPD will need to contain policies which reflect the guidance in PPS25. In addition, for a compact, densely built up area such as Slough, policies will be required to ensure that the increasing density of new development does not intensify the problems of flooding from all sources.

7.2 Given the underlying geology, and the pattern and density of development in Slough, and the interlinkages amongst natural water, surface water and foul sewer, a flood risk assessment looking at all sources of flooding should be required for all developments involving 100m² of more floorspace or one or more residential dwellings.

7.3 The assessment would need to contain sufficient information relating to the proposed drainage scheme for the site at the application stage. This should identify the key characteristics of the site and set out an appropriate sustainable drainage system for balancing and attenuating surface water to achieve greenfield runoff rates.

7.4 Sustainable drainage systems (referred to as SUDS) include a number of engineered measures to manage surface water drainage including:

* Source control measures including rainwater recycling and drainage

* Infiltration devices to allow water to soak into the ground, that can include individual soakaways and communal facilities;

* Filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns;
* Filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed; and

* Basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding.

7.5 In Slough, there is insufficient space to incorporate measures such as swales, basins and ponds. And, as has been highlighted in the Assessment, the use of soakaways and permeable underground storage is not always appropriate in Slough due to the impermeability of the soil, contamination of the land, and the level of groundwater.

7.6 Therefore, it is essential that the design of the surface water drainage system is considered in the very initial stages of a development to ensure that adequate space is made available to accommodate appropriate attenuation measures.

7.7 Best practice measures must be implemented to mitigate any potential increase in the loading of existing drainage systems. Sufficient information will be required to demonstrate that the proposed measures are appropriate for the specific development site, given varying ground conditions across the Borough, and will not give rise to problems elsewhere, eg possible creation of spring lines downgrade from infiltration measures. Information should include:

* proposed drainage works including pipe network, invert and cover levels, storage and infiltration details, control device, and rate of discharge
* hydraulic calculations showing:
  -- system simulated for a range of storm durations for the 100 year plus 20% event
  -- for the critical storm, water, ground and invert levels within the whole system
  -- maximum storage within the system and discharge from the control
  -- soakage tests for attenuation gained by infiltration should be carried out to BRE Digest 365, though this will provide an indication of immediate ground conditions only and will not identify whether infiltration could result in problems elsewhere

7.8 Following further refinement of the Flood Zone maps, there may be a need to formulate policies for specific areas in Slough where flood flow paths need to be improved.
PART II

Strategic Flood Risk Assessment and the Core Strategy

8.0 Key Findings of the SFRA

8.1 The Strategic Flood Risk Assessment has taken account of the following key issues that affect the Borough:

* the varied and complex nature of the underlying geology in Slough;
* the restrictions on surface water drainage systems appropriate in Slough due to the underlying geology, and hence groundwater levels, land contamination, and groundwater source protection zones;
* presence of numerous watercourses which run north/south through the Borough, as well as the Jubilee River and River Thames to the south combined with a lack of knowledge relating to their catchments and hence the potential area at risk of flooding;
* level of maintenance by the Environment Agency with respect to main rivers;
* level of maintenance and capacity issues in the surface water sewer system;
* capacity in the foul sewer system due to surcharging by surface water in storm events;
* groundwater flooding in a few areas due to perched water tables and high groundwater levels;

8.2 The SFRA also highlighted the additional information required in order to refine the flood assessment to ensure that the subsequent Site Allocations and Development Control Policies DPD fully address the risk of flooding in accordance with PPS25.

9.0 Implications of Spatial Strategy contained in Slough’s LDF Core Strategy

9.1 Although additional information is required, the level of detail that is currently available is sufficient to assess the core strategy’s spatial strategy for development over the next 20 years.

Relocation of development within Zones 3a and 3b

9.2 The policy aims of PPS25 (Development and Flood Risk) state that existing development within Zones 3a (areas with a high probability of flooding) and 3b (the functional floodplain) should be relocated to land in zones with a lower probability of flooding. The Strategic Flood Risk Assessment has identified that there has not been any designation of Zone 3b in Slough other than in the Colnbrook/Poyle area. The Council considers that there are likely to be some dwellings located within the functional floodplain or Zone 3b, but it is premature to identify areas at this stage without additional information and consultation with the Environment Agency.

9.3 There are approximately 3,865 dwellings located within the valleys of the watercourses in Slough and which have been designated as Zone 3 by the Environment Agency. As shown in the Table below. This represents about 8.2% of the 47,000 dwellings in Slough.
### Watercourse Valley

<table>
<thead>
<tr>
<th>Watercourse Valley</th>
<th>Number of Dwellings within Zone 3 Greater than 1:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huntercombe Lane</td>
<td>530</td>
</tr>
<tr>
<td>Haymill</td>
<td>350</td>
</tr>
<tr>
<td>Salt Hill</td>
<td>1045</td>
</tr>
<tr>
<td>Datchet Common Brook</td>
<td>1000</td>
</tr>
<tr>
<td>Horton Brook</td>
<td>940</td>
</tr>
<tr>
<td><strong>Total Number</strong></td>
<td><strong>3865</strong></td>
</tr>
</tbody>
</table>

9.4 It is not physically possible in Slough to relocate the 3,865 existing dwellings in Zone 3, as the Borough is a small, densely developed area, where there is already considerable pressure on land to meet local housing need and the allocation in the South East Plan. The only means of relocating housing within Zone 3 to a lower risk flood area is through comprehensive redevelopment schemes involving the demolition of existing residential areas outside of Zone 3 and construction of new housing to replace the demolished dwellings as well as those dwellings within Zone 3; the social and financial cost of such an approach would significantly outweigh the benefits of removing the dwellings from Zone 3.

9.5 With respect to non-residential development within the various flood zones, the approximate percentage of the Existing Business Areas within Zone 3 is as follows:

<table>
<thead>
<tr>
<th>Existing Business Area</th>
<th>Percentage of Existing Business Area within Zone 3 Greater than 1:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>North side of Bath Road, Cippenham</td>
<td></td>
</tr>
<tr>
<td>North and south side of Bath Road, Burnham</td>
<td>20%</td>
</tr>
<tr>
<td>Slough Trading Estate</td>
<td></td>
</tr>
<tr>
<td>Chalvey</td>
<td>15%</td>
</tr>
<tr>
<td>North of Town Centre, west of Wexham Road</td>
<td></td>
</tr>
<tr>
<td>Between Wexham Road and Uxbridge Road</td>
<td>25%</td>
</tr>
<tr>
<td>North of Slough Arm of Grand Union Canal</td>
<td>30%</td>
</tr>
<tr>
<td>Langley Business Centre</td>
<td>20%</td>
</tr>
<tr>
<td>Parlaunt Road</td>
<td></td>
</tr>
<tr>
<td>Former Ford Iveco Site</td>
<td></td>
</tr>
<tr>
<td>Lakeside Road</td>
<td>5%</td>
</tr>
<tr>
<td>Galleymead Road and surrounding area</td>
<td></td>
</tr>
<tr>
<td>Poyle Industrial Estate</td>
<td>65%</td>
</tr>
</tbody>
</table>

9.6 The more detailed S105 flood map for the Lower Colne reveals that the last three areas are not within the 1 in 100 year flood envelope (Zone 3).
9.7 The relocation of the commercial development located within Zone 3 to sites elsewhere in the Borough outside of the Green Belt at a lower risk of flooding is not a viable option financially or physically.

9.8 With respect to the retail areas, part of Langley District Centre and most of the Chalvey neighbourhood centre are located in Zone 3; the remainder of the retail areas are within Zone 1. Again, the relocation of the retail areas in Chalvey and Langley to sites at a lower risk of flooding is not a viable option, financially or physically.

Core Strategy and Fluvial Flooding

9.9 The core strategy is based on concentrating high density residential development and intensive employment generating uses, and intensive trip generation uses in the Town Centre over the period up to 2026.

9.10 The Core Strategy seeks to provide a minimum of 5700 dwellings in the Borough over the next 20 years, of which a minimum of 3000 dwellings would be located in the town centre. The remainder would comprised of:

* urban extensions already granted permission in Cippenham, Wexham and south of Castleview Road (750);
* major sites in other urban areas (1350) and
* developments of fewer than 10 dwellings on small sites in existing residential neighbourhoods. (600)

9.11 The Flood Risk Study reveals that concentrating development in the town centre would avoid any potential areas of fluvial flooding as shown on the Environment Agency’s flood maps. The Salt Hill Stream catchment area runs to the west of the town centre whilst the Datchet Common Brook catchment runs to the east. The whole of the Town Centre area as defined in the Core Strategy falls within Zone 1.

9.12 The Core Strategy identifies both a 5 year and a 15 year supply of deliverable housing; many of the sites already have the benefit of planning permission and thus already have been subject to a Flood Risk Assessment.

9.13 The Site Allocations DPD will need to follow the sequential test in identifying further sites. For sites in Flood Zone 3 (which is possible due to the shortage of land), the Exemption Test will be required. The layout would need to be designed so as to locate housing on that part of the site at lowest probability of flooding. In order to comply with the Exceptions Test, any development would need to provide other benefits to the community which would outweigh the flood risk.

9.14 The Spatial Strategy of concentrating development in the town centre means that the amount of infilling in the residential areas is likely to reduce from 80 to 30 units a year. This should help to maintain the amount of undeveloped land in the suburbs.

9.15 The Core Strategy protects the Existing Business Areas to ensure the maintenance of a diverse employment base in Slough which can continue to provide a range of jobs for local residents. It also promotes the regeneration of these areas to provide premises which meet the needs of modern businesses. Under the sequential test, the regeneration of these areas is acceptable subject to there not being available land at a lower risk of
flooding; it is clear that in a compact, built up area such as Slough, that there are no alternative sites.

9.16 Similarly, the Core Strategy advocates the selective regeneration of district and neighbourhood centre to ensure they are able to meet local needs, provide variety and reduce the need for people to travel. Under the sequential test, redevelopment of the retail areas in Chalvey and Langley falling within Zone 3 is acceptable subject to there not being available land at a lower risk of flooding.

9.17 Protecting the retail areas and Existing Business Areas in Slough is considered a sustainable approach to flood risk as, in accordance with PPS25, such uses are compatible with Zone 3, subject to there being no land at a lower risk of flooding available.

Other Sources of Flooding

9.18 The study does reveal that surface water drainage for new development within the town centre will need to be designed in such a manner as to maximise attenuation/balancing on site and to minimise discharge to the surface water sewers as there are capacity issues with respect to the Myrke Stream. Any increase in impermeable area must be mitigated for, and peak run-off rates and volumes must not exceed that of the current development, up to a 1 in 100 year storm, with an allowance for climate change.

9.19 Further discussions with the Environment Agency are taking place in order to clarify appropriate sustainable drainage systems in the outer groundwater source protection zones which cover the whole of the town centre area.

9.20 As for the impact of concentrating development in the town centre on the foul sewers, the study reveals that there are capacity problems across the Borough (excluding Colnbrook and Poyle) but there are means by which these problems can be overcome. Further discussions will be held with Thames Water to assist in the formulation of appropriate development control policies with regard to the implementation of improvements to infrastructure.

9.21 Ground water flooding is not a risk in the town centre.

9.22 Outside of the town centre, sites identified for residential development in Appendix 2 which have not already been granted planning permission are not susceptible to groundwater flooding. These areas are also not constrained by surface or sewer flooding though there are capacity issues which need to be addressed by ensuring that all new development incorporates appropriate drainage schemes.

9.23 Given the underlying geology, and the pattern and density of development in Slough, and the interlinkages amongst natural water, surface water and foul sewer, a flood risk assessment looking at all sources of flooding and providing details of the proposed surface water drainage system should be required for all developments involving 100m2 of more floorspace.
10.0 Conclusions

10.1 The main conclusion to be drawn from the above analysis is that there are no significant flooding issues for the Core Strategy. The proposed Spatial Strategy of concentrating development in the town centre, combined with the selective regeneration of areas such as Slough Trading Estate, should not increase flood risks in the Borough. Any detailed surface water drainage issues can be resolved in the Development Control and Site Allocations DPD and at the planning application stage.