

Wokingham Borough Council
Preliminary Flood Risk Assessment

June 2011

Halcrow Group Limited

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Wokingham Borough Council

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Preliminary assessment report spreadsheet for Wokingham

PFRA Checklist

1 Executive Summary

- 1.1.1.1 This document reports on the Preliminary Flood Risk Assessment (PFRA) carried out for Wokingham Borough. It has been produced to satisfy Wokingham Borough Council's responsibility, as a Lead Local Flood Authority (LLFA), to undertake a PFRA as required by law under the UK Flood Risk Regulations and the European Floods Directive, Directive 2007/60/EC.
- 1.1.1.2 Under the Flood Risk Regulations, LLFAs are responsible for compiling data on flood risk from local sources of flooding, which includes surface runoff, groundwater and ordinary watercourses (including lakes and ponds). LLFAs should only consider flooding from rivers or reservoirs if it is thought to affect flooding from a local source.
- 1.1.1.3 The PFRA is a high level screening exercise based on readily available data. It provides an assessment of past flood risk based on historical data sourced from Wokingham Borough Council, the Environment Agency, Thames Water, and local Parish Councils, Town Councils and Residents Associations. Four historical events were identified within Wokingham for inclusion in the PFRA spreadsheet. These occurred in 1993, 2000, 2003 and 2007.
- 1.1.1.4 An assessment of future flood risk is provided based on modelling data from the Flood Map for Surface Water and Areas Susceptible to Groundwater Flooding, with analysis of consequences based on the National Receptor Database data. This data provided by the Environment Agency has been used to complete the PFRA spreadsheet.
- 1.1.1.5 The Flood Risk Regulations and EU Floods Directive require submission of defined flood risk areas. The criteria for defining these areas was determined by Defra and the Welsh Assembly, as being areas where at least 30,000 people within a 3km by 3km area are affected by flooding. Indicative flood risk areas were calculated by the Environment Agency and sent to the LLFAs for review of possible amendment, based on their own local information and knowledge. No flood risk areas have been identified for Wokingham Borough for submission to the European Union.

2 Introduction

2.1 Scope of the report

2.1.1.1 This document reports on the Preliminary Flood Risk Assessment (PFRA) carried out for Wokingham Borough. It has been produced to satisfy Wokingham Borough Council's responsibility, as a Lead Local Flood Authority (LLFA), to undertake a PFRA as required by law under the UK Flood Risk Regulations (FRR) 2009, which came into force on 10 December 2009. The Flood Risk Regulations were introduced to implement the European Floods Directive (2007/60/EC) which requires member states to map key areas at risk of flooding (flood risk areas) and their associated hazard and draw up flood risk management plans to take adequate and coordinated measures to reduce flood risk, focussing on prevention, protection and preparedness.

2.1.1.2 Under the Flood Risk Regulations, LLFAs are responsible for compiling data on flood risk from local sources of flooding, which includes surface runoff, groundwater and ordinary watercourses (including lakes and ponds). LLFAs should only consider flooding from rivers or reservoirs if it is thought to affect flooding from a local source. The Environment Agency is responsible for compiling data on flood risk from main rivers and reservoirs. These roles correspond with the Environment Agency's traditional responsibilities for fluvial flood risk and the new responsibilities of LLFAs for local flood risk in accordance with the Flood and Water Management Act 2010. The table below provides a summary of the tasks for LLFAs under the UK Flood Risk Regulations, and the corresponding deadlines.

FRR chapter ref	Flood Risk Regulations 2009 tasks for LLFAs	Deadline
Part 2	LLFAs to undertake PFRAs on local flood risk within their administrative boundaries.	<i>22 June 2011</i>
	LLFAs or groups of LLFAs to confirm or to propose alternative Flood Risk Areas from indicative flood risk areas already identified in national datasets.	<i>22 June 2011</i>
Part 3	LLFAs to prepare Flood Hazard and Flood Risk Maps for the flood risk areas and in relation to local flood risk.	<i>22 June 2013</i>
Part 4	LLFAs to prepare Flood Risk Management Plans of the identified flood risk areas.	<i>22 June 2015</i>

Table 2-1: Stages of the Flood Risk Regulations

This PFRA report provides a summary of Part 2 of the Flood Risk Regulations 2009: the undertaking of the PFRA and the identification of flood risk areas. This addresses the first requirement of the EU Floods Directive of identifying flood risk areas and producing preliminary reports by 2011.

- 2.1.1.3 The PFRA deliverables consist of the Preliminary Assessment Report, the PFRA spreadsheet completed with the flood data for the LLFA's administrative area, and a GIS file identifying significant flood risk areas (if applicable). These are submitted to the Environment Agency for review, and to be collated into the UK's submission to the European Union.

This PFRA report has been prepared for Wokingham Borough, in accordance with the Environment Agency's PFRA Final Guidance document (December 2010) and updated appendices (March 2011), which provide the final guidance on the structure and content of PFRAs.

2.2 Aims and Objectives

- 2.2.1.1 The key objectives for the PFRA are summarised as follows:

- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means of future and ongoing stakeholder engagement;
- Describe arrangements for ongoing collection, assessment and storage of flood risk data and information;
- Summarise the methodology adopted for the PFRA with respect to data sources, availability and review procedures;
- Assess historic flood events within the study area from local sources of flooding, and the consequences and impacts of these events;
- Assess the potential harmful consequences of future flood events within the study area;
- Review the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide an explanation and justification for any amendments required to the Flood Risk Areas;
- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements;
- Provide advice on the next steps required to ensure that Wokingham Borough Council complies with its role as the LLFA.

2.3 The Study Area

- 2.3.1.1 The study area is defined as the Wokingham Borough administrative area (see *Figure 2-1*). Wokingham Borough is a Unitary Authority in Berkshire in South East England. The area of

the Borough is 17,892 hectares and it has a population of 150,229 (2001 Census). Wokingham Borough is generally rural in character, with farmlands to the north, east and southwest of the borough. The main settlements in the Borough are marked in *Figure 2-1*.

- 2.3.1.2 The study area lies within the Thames river basin district and has several main rivers including the River Thames and its tributary the Foudry Brook, and the River Loddon and its tributaries the Twyford Brook, Emm Brook, Barkham Brook and the River Blackwater. There are seven major reservoirs (over 25,000 m³ of water) including Bearwood Lake, Black Swan Lake at Dinton Pastures, Longmoor Lake, Maiden Erleigh Lake, Queensmere, Southlake and Whiteknights Lake. These features, which are excluded from the PFRA analysis, are marked in *Figure 2-1*. There are no canals in the Borough.

3 LLFA Responsibilities

3.1 Lead Local Flood Authorities

3.1.1.1 The concept of a LLFA was introduced in the Flood and Water Management Act 2010, as being a Unitary Council or, if there is no Unitary Council, the County Council. The Flood and Water Management Act was brought into UK Law to improve flood risk management and support continuity of water supply. A key feature of the Act is the implementation of recommendations from the Pitt Review into the summer 2007 flooding, thus increasing the emphasis on other sources of flooding than fluvial and tidal, in particular surface water which featured heavily in the 2007 flooding. The Act makes LLFAs responsible for local flood risk (as defined in *Chapter 2*) and gives them a number of powers and responsibilities in respect to this. The Flood Risk Regulations built upon this by assigning the preparation of PFRA to the LLFAs.

3.2 Responsibilities

3.2.1.1 In addition to their responsibilities under the Flood Risk Regulations (see *Chapter 2*), the key responsibilities for LLFAs under the Flood and Water Management Act are:

- **Leadership and Partnership:** LLFAs are required to take the lead in managing local flood risk. However, other organisations hold valuable local knowledge and expertise so LLFAs are encouraged to work in partnership with them, or in some cases agree to delegate authority, in order to make full use of all capabilities and local experience. Borough councils, internal drainage boards, highways authorities and water companies are identified as risk management authorities, together with the Environment Agency. The LLFA is encouraged to bring together all relevant bodies to help manage flood risk in its area, and is also empowered to require information from others needed for their flood and coastal erosion risk management functions.
- **Local Strategy for Flood Risk Management:** The LLFA must develop, maintain, apply and monitor a strategy for managing local flood risk in its area. The strategy must specify the risk management authorities in their area and the functions they exercise, and the objectives for managing flood risk with details of the measures proposed to achieve those objectives. The strategy must be consistent with the national flood and coastal erosion risk management strategy for England.
- **Investigating flood incidents:** When flooding occurs in its area, the LLFA must, where necessary or appropriate, investigate which risk management authorities have relevant flood risk management functions and whether they are exercising these functions. The LLFA should publish the results of its investigation and notify any relevant risk management authorities.

- **Asset Register:** The LLFA has a duty to maintain a register of structures or features which are likely to have a significant effect on flood risk in its area, including information about ownership and state of repair. The register must be available for inspection at all times and must be in accordance with any regulations which the Secretary of State may make.
- **Designation Powers:** LLFAs, Borough councils, internal drainage boards and the Environment Agency are given powers to designate structures and features that are relied upon for flooding or coastal erosion management in order to avoid or control removal/alteration of these by third party owners without consent.
- **Works Powers:** An amendment to the Land Drainage Act 1991 is included to give LLFAs powers to do works to manage flood risk from surface runoff or groundwater, or if there is no district council, from ordinary watercourses including lakes and ponds.
- **SUDS Approving Body:** The Act establishes LLFAs as the SUDS Approving Body. Developers will be required to have their drainage proposal approved by the Approving Body before they can commence construction. Furthermore, the right of new developments to connect to the public sewerage system will be conditional on approval. The SUDS Approving Body will also be responsible for adopting and maintaining SUDS which serve more than one property, apart from those on public roads which are the responsibility of Highways authorities.

3.3 Governance and partnership arrangements

3.3.1.1 Under the Flood Risk Regulations, the PFRA is a collaborative report with inputs, of different levels, from a number of different authorities. The Environment Agency takes an overview role in coordinating the contributions for the European Parliament, both their own information on main rivers and reservoir flooding, and the local flood risk information from the LLFAs. The Environment Agency communicate with Wokingham Borough Council as the LLFA in order to provided much of the data for analysis, guidance to LLFAs for compiling their PFRA's, and they will review the PFRA's prior to submission to the European Union. Wokingham Borough Council in turn communicates with other relevant organisations within its area. Several of the parish and town councils of Wokingham Borough have provided invaluable help in submitting information on past flooding in their areas. Information has been received from: Barkham Parish Council, Earley Town Council, Loddon Valley Residents Association, Shinfield Parish Council, Sonning Parish Council, Saint Nicholas Hurst Parish Council, Swallowfield Parish Council, Twyford Parish Council, Wokingham Town Council and Woodley Town Council. Information has also been received from Thames Water in regard to flooding from sewers. A further source of information is the Wokingham Strategic Flood Risk Assessment (SFRA); the existing SFRA was carried out by Jacobs in July 2007 and an updated version is being written

concurrently with this PFRA. Information was also requested from the Highways Agency and Network Rail, but unfortunately it was not available in time to inform this PFRA.

3.4 Communication to the public

3.4.1.1 Under the requirements of the EU Floods Directive, all assessments, maps and plans prepared shall be made available to the public. The Flood Risk Regulations determine that LLFAs' PFRA reports will be published by the Environment Agency, by 22 December 2011, along with the Environment Agency's own reports and the preliminary assessment maps they compile for each river basin district. However, to demonstrate ownership, the Environment Agency are encouraging LLFAs to make their PFRA available through their own websites. A chart relating the PFRA process to the various parties is shown in **Figure 2-2**.

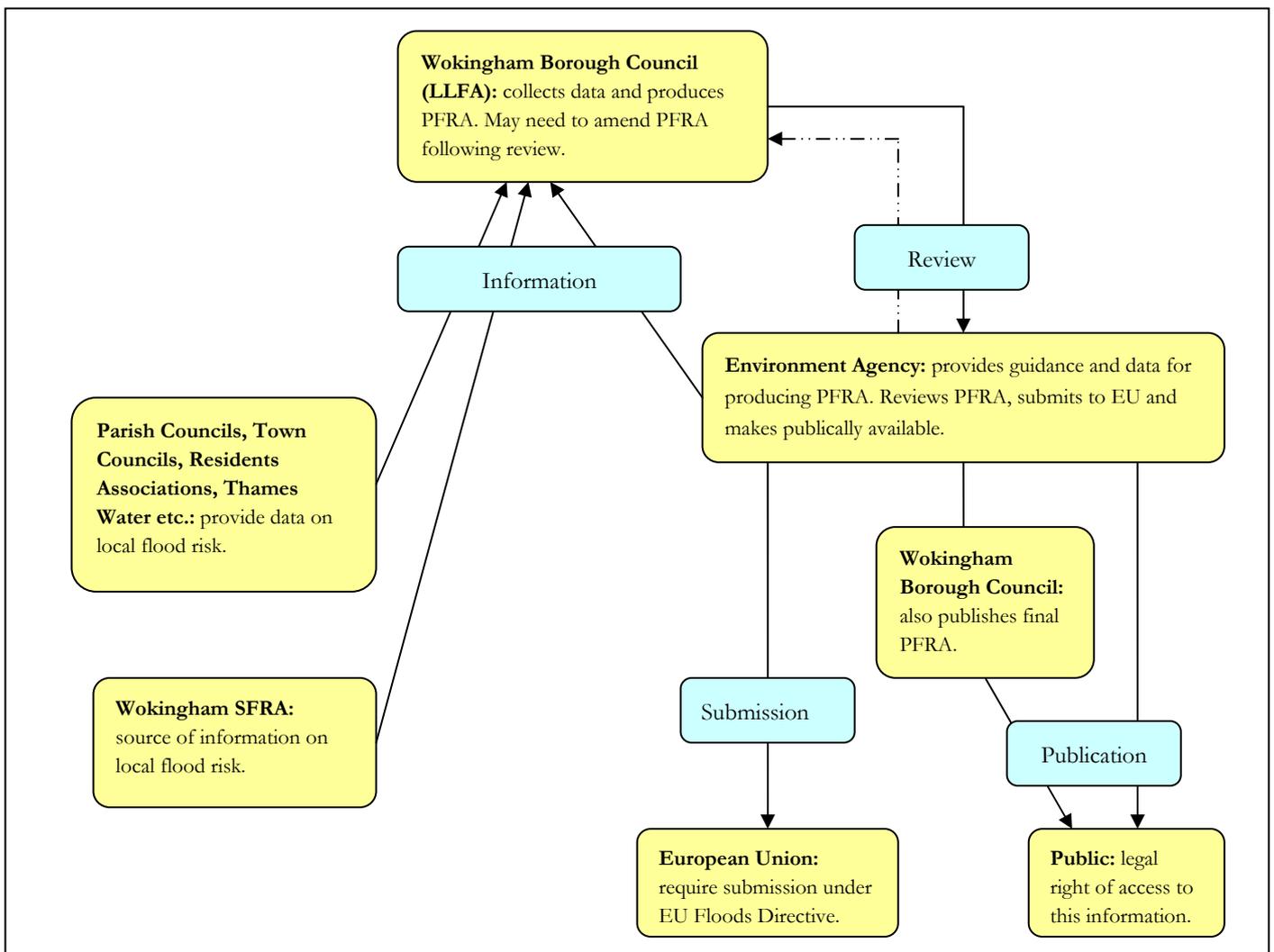


Figure 2-2: Wokingham Borough PFRA process

4 Methodology and Data Review

4.1 Data Collection

4.1.1.1 The PFRA is a high level screening exercise based on readily available data. Three main types of data are relevant for the PFRA:

- *Historical Flooding:* Information on past flooding in the Borough has been obtained from historical records held by the Borough Council, Parish and Town Councils, Thames Water and the Environment Agency. The main issue is that, to date, there has been no requirement for comprehensive collection of all flood incidents from local sources of flooding. It is therefore very much subject to the adhoc nature of public reporting and variable standards of record keeping. The situation is improving, particularly with the introduction of standard record keeping for PFRA's. The Council currently logs information received from residents during a flooding event; after 22 December it is anticipated that this will be the role of the Borough Council's Flood Risk Manager. Under the Flood and Water Management Act the Borough Council has a duty to investigate the source of flooding events.
- *Available Modelling Data:* In order to assist the LLFAs with their PFRA's, the Environment Agency have supplied a set of maps from national modelling projects, which provide estimates of future flood risk.
- *Data Available for Assessing Flood Risk:* To assess the effect of the various flood data, the Environment Agency have supplied various specially created maps including features such as property points, land classifications etc.

4.1.1.2 The data collected is listed in **Table 4-1**.

Data	Description	Obtained from	Quality assurance and data limitations	Licensing/Restrictions
Historical data from the SFRA by Jacobs (July 2007)	Relates to three main flood events within the borough, 1993, 2000 and 2007.	Supplied on CD by Wokingham Borough Council	The 1993 and 2007 events are provided as GIS spot locations of flooding. Associated attribute information is limited and it is based on incidents reported to the Council by the public therefore it is not a comprehensive list of all incidents which have occurred. The information for 2000 was only available as a table of statistics for each parish in the Borough. Due to the variability of data it is difficult to get a clear idea of the relative susceptibility to flooding, although it is assumed that those parishes most affected were most likely to have records.	No licensing restrictions.
Historical groundwater flooding incidents	Spreadsheet of groundwater incident spot locations, with associated attributes including description of the incident, date, grid reference and notes on geology.	Supplied by email from Environment Agency	The main issue is that this is based on incidents reported to the Environment Agency by the public therefore it is not a comprehensive list of all incidents which have occurred. Generally the associated attribute data is informative although there is some uncertainty in regard to the quoted date, i.e. whether it is the date of occurrence or date of reporting – as groundwater flooding typically lasts for some time.	Licensed to Wokingham Borough Council.
Thames Water sewer flooding	Excel spreadsheet summarising number of incidents within a post code area.	Supplied by email from Thames Water	Due to the Thames Water confidentiality requirements information could only be supplied as the number of flooding incidents by the first part of the post code, which covers too large an area to usefully assess for this PFRA.	Licensed to Wokingham Borough Council.
Historical data from the Parish/Town Councils/Residents	Historical information collected for the PFRA and updated SFRA. Received from: Barkham Parish Council, Earley Town Council, Loddon	Supplied by email from Wokingham Borough Council	Very variable standards of data provided ranging from mapped houses and flow paths with accompanying reports, to fairly detailed descriptions	No licensing restrictions.

Data	Description	Obtained from	Quality assurance and data limitations	Licensing/Restrictions
Associations	Valley Residents Association, Shinfield Parish Council, Sonning Parish Council, Saint Nicholas Hurst Parish Council, Swallowfield Parish Council, Twyford Parish Council, Wokingham Town Council and Woodley Town Council		of incidents and locations, to simple brief notes on flood prone areas. It is based on incidents reported to the Councils/Residents Association by the public therefore it is not a comprehensive list of all incidents which have occurred. Furthermore, responses were not received from all the Parish Councils in the Borough.	
The 'Chronology of British Hydrological Events' database	Record of incidents of flooding occurring up to 1935.	Online database kept by the British Hydrological Society	A search of the 'Chronology of British Hydrological Events' database was made, as this often has useful anecdotal information relating to floods a long time ago. However, no (non main river) incidents were identified.	No licensing restrictions.
Areas Susceptible to Surface Water Flooding (AStSWF)	Flood extents from the Environment Agency's initial surface water modelling project which looked at a 1 in 200 annual probability rainfall event and maps areas which are 'less', 'intermediate' and 'more' likely to be susceptible to surface water flooding – for example the 'more' band indicates areas which are likely to flood first, flood deepest, and/or flood for relatively frequent, less extreme events.	Data Share website	The mapping is comprehensive (i.e. no missed areas), however due to being national scale is fairly coarse and takes no account of buildings, soil type or drainage systems.	Licensed to Wokingham Borough Council. Due to modelling resolution should not be used with more detailed background maps than 1:50k. Should be displayed in shades of purple.
Flood Map for Surface Water (FMfSW)	Flood extents from the Environment Agency's second generation surface water modelling which takes account of buildings and make some allowance for the effects of infiltration and sewerage. This considers both a 1 in 30 and 1 in 200 annual probability rainfall event and maps areas of 'shallow' (between 0.1m and 0.3m depth) and 'deep' (greater than 0.3m depth)	Data Share website	The mapping is comprehensive (i.e. no missed areas), and takes some account of buildings, infiltration and drainage, although due to its national scale the assumptions are very generalised.	Licensed to Wokingham Borough Council. May be used with background maps of 1:10k. Should be displayed in shades of purple.

Data	Description	Obtained from	Quality assurance and data limitations	Licensing/Restrictions
	flooding for each scenario.			
Areas Susceptible to Groundwater Flood Map	Maps showing areas where groundwater flooding may be an issue.	Data Share website	The mapping is comprehensive (i.e. no missed areas), but very coarse as is based on assigning attributes to 1km grid squares and does not include indication of flooding probability.	Licensed to Wokingham Borough Council. Should be displayed in shades of orange/brown
Main rivers	Map of main river centre lines – ordinary watercourses can therefore be identified as all watercourses not included on this map.	Data Share website	This is the Environment Agency’s formal map of main rivers, which are principal rivers or locally significant watercourses as defined by Section 93 of the Water Resources Act, 1991.	Licensed to Wokingham Borough Council.
National Receptor Database (NRD).	Consists of a set of GIS layers including Property points; Roads network; Railway network; Agricultural land classification (grades land according to quality); Policy designations (e.g. woodland and environmentally sensitive areas); International designations (e.g. Special Areas of Conservation, Special Protection Areas, Sites of Special Scientific Interest and Ramsar sites); National designations; Local designations (local nature reserves etc); Parks and gardens of special historic interest; Scheduled Ancient Monuments; Listed buildings; Country parks; Nature trails; Super Output Areas (areas for statistical reporting); Utilities (includes premises with radioactive substances; authorities licensed for waste storage, treatment or disposal.	Updated version (November 2010) supplied on Data Share website	High quality as data has been specifically edited for uses such as PFRAs.	Licensed to Wokingham Borough Council.
The “places above flood risk thresholds” (or “blue squares) map	Maps of 1km grid squares which indicate flood risk above a specified threshold (these are coloured blue)	Supplied on CD by Environment Agency	The mapping is comprehensive (i.e. no missed areas), but very coarse as is based on assigning attributes to 1km grid squares but is of adequate resolution for the	Licensed to Wokingham Borough Council.

Data	Description	Obtained from	Quality assurance and data limitations	Licensing/Restrictions
			PFRA.	
The “cluster areas” map	Clusters of five or more ‘places above flood risk thresholds’ within a 3x3km (9km ²) grid square which are touching, as specified by Defra.	Supplied on CD by Environment Agency	The mapping is comprehensive (i.e. no missed areas), but very coarse as is based on assigning attributes to 1km grid squares but is of adequate resolution for the PFRA.	Licensed to Wokingham Borough Council.
The “indicative flood risk areas” map	Cluster areas which exceed the 30,000 people at risk threshold specified by Defra.	Supplied on CD by Environment Agency	The mapping is comprehensive (i.e. no missed areas), but very coarse as is based on assigning attributes to 1km grid squares but is of adequate resolution for the PFRA.	Licensed to Wokingham Borough Council.

Table 4-1: Available data

4.2 Data Review Methodology

- 4.2.1.1 As much of the new historical data provided by the Parish/Town Councils/ Residents Association was provided as text or data tables, the first task was to transfer this data to GIS format. The quality of historical data is variable which meant that some difficulty was encountered in mapping the data. For example the locations of incidents were often referenced only in terms of street names so if the street stretched a long distance there could be considerable uncertainty in where to plot the point. Therefore the locations shown on the map should only be taken as approximate indicators.
- 4.2.1.2 Attributes were assigned to each plotted incident based on the fields which the Parish/Town Councils had been asked to fill in. These fields were in turn based on the PFRA draft guidance for GIS layers, simplified down to just those which the Councils were likely to be able to answer. In some cases the Parish/Town Councils had filled in each field and the information could be translated directly to the GIS attribute fields. Where fields were only partially filled in, or information was provided simply as summary texts, the attribute fields were filled in as well as could be deduced from the provided information.
- 4.2.1.3 All of the historical data (including the remaining data from the SFRA, which was already in GIS format) was then reviewed to filter out incidents which were not relevant to this PFRA, i.e. any incidents relating to fluvial flooding from main rivers (there were no reservoir incidents). The relevant incidents are described in **Chapter 5**.
- 4.2.1.4 The next stage of the procedure was to review future flood risk based on the Environment Agency modelling maps. In particular, it was necessary to decide the 'locally agreed surface water information'. This is because there are two possible surface water maps (from the two national maps, AStSWF and FMfSW, - there has been no detailed local modelling carried out for the Wokingham area) so either one, or possibly a combination of the two if each is found to perform better in specific areas, must be chosen.
- 4.2.1.5 The final stage was to assess the Environment Agency's indicative flood risk areas and decide whether the information collected necessitated any amendment to them or whether they could be confirmed as the final flood risk areas for submission to the European Union.

5 Past flood risk

5.1 Overview of past flood events

5.1.1.1 The data from the events above, along with records of other incidents as noted in **Section 3.1**, has been summarised in **Table 5-1** (this table has not been included for publication as some of the details are confidential) and are shown in **Figure 5-1**. The vast majority of incidents are provided as spot locations, however, some information on flow paths is provided for the 2007 event in Swallowfield; this is indicated in **Figure 5-2** (again not included for publication due to the level of detail).

5.2 Surface water flooding

5.2.1.1 The majority of historical incidents collected for this PFRA relate to surface water flooding, which occurs where rainfall is unable to infiltrate into the ground and/or exceeds the capacity of the local drainage system. This is particularly the case for flooding which occurred during the events in 1993 and 2007. The GIS data for the 1993 event shows incidents categorised into foul, highway drainage, land drainage (countryside runoff) and surface drainage (urban runoff) flooding. It also indicates locations of restricted toilet use, however this has not been included in the PFRA as it does not constitute flooding, although it does indicate where sewer capacity is potentially full so it would be expected that flooding is a risk. The GIS data for the 2007 event does not specify flooding source but they are most likely to be surface runoff since all locations are outside the main river flood zones and the event was caused by unprecedented rainfall which fell between 17 and 29 July 2007 – with at one point almost a month’s average rainfall within just a few hours. Approximately 300 properties within the Borough suffered flooding, and of those around 140 properties were flooded internally. Analysis of the spot locations shows that some are near ordinary watercourses so in these cases the precise cause of flooding is uncertain. A flooding event is also known to have occurred in January 2003 which was similar to the 2000 and 2007 events, but unfortunately there is little direct information from this event.

5.3 Ordinary watercourse flooding

5.3.1.1 As noted above, the limited information available for the historical flooding records made it difficult to differentiate between surface runoff and ordinary watercourse flooding. In some cases the information provided noted that the flooding was fluvial and so it could be attributed to ordinary watercourses if it was some distance from a main river.

5.4 Groundwater flooding

5.4.1.1 Direct information on groundwater flooding is sparse, although a few incidents have been recorded by the Environment Agency. Information from the Borough Council records includes

a table of statistics on flooding during Autumn 2000. This may have had a groundwater component since it followed persistent rainfall during October and November which corresponds to typical conditions likely to cause a gradual rise in the water table, leading to groundwater flooding where it reaches the surface. It is also known that other areas of the country, such as Hampshire, experienced considerable groundwater flooding at this time. Unfortunately, insufficient information is available to conclude whether any, some or most of the incidents in Wokingham Borough's table were groundwater. However, a few of the Environment Agency incidents appear to correlate with this period, and their descriptions support the suggestion that Wokingham Borough suffered at least some limited groundwater flooding during this period (particularly one which records flooding of very lengthy duration which is typically indicative of groundwater flooding).

5.5 Consequences of historical flooding

- 5.5.1.1 Analysis of the flood events experienced in Wokingham Borough shows that they have had a number of locally important adverse consequences, including flooding of buildings, including some listed buildings, flooding of parks and agricultural land, and flooding of roads which in several cases caused lack of access. Swallowfield in particular was notable in the analysis due to the extensive flooding experienced in 2007 (plus additional incidents in other years) due to the drainage arrangements.

For the purpose of this PFRA, the four flooding events which occurred in 1993, 2000, 2003 and 2007 are considered to be significant. Two of these, the 2000 and 2007 events, were part of flooding which occurred across much of the country. The 1993 event was of a similar scale to the other two events within the Borough of Wokingham. Whilst little direct evidence is available for the 2003 event, it is reported as having affected many of the same locations as 2000 and 2007. These four historical events have therefore been reported in the PFRA spreadsheet. All three incidents were experienced at numerous locations across the whole Borough.

It should be noted that the numbers of affected properties quoted in the spreadsheet may not be a complete picture as only those incidents reported to the Council are included. Information on human, economic, environmental and cultural consequences were estimated through comparison of the reported flooding locations with GIS mapping data to determine the receptors affected.

6 Future flood risk

6.1 Surface water flood risk

- 6.1.1.1 As there are two alternative surface water maps (the AStSWF and FMfSW), it is important that the PFRA partners agree on which information best represents surface water flood risk in Wokingham Borough. In practice, the main difference between the flood areas predicted by the two maps is that the AStSWF tend to be much wider, amalgamated areas. This is most likely to be due to the lack of allowance for infiltration or sewerage resulting in greater volumes of water. Generally the FMfSW are considered to perform better, with more realistic water volumes and taking account of buildings. The main exception is in very flat areas with low sewer capacity where its assumptions may lead it to underestimate flooding, so in these areas, the AStSWF may be a better choice. The topography of Wokingham includes some hills of medium size compared to the rest of the country so it is expected that the FMfSW would be the preferred map.
- 6.1.1.2 A detailed analysis of both the AStSWF and FMfSW maps was carried out for the SFRA, comparing each with historical incident locations. The maps were also discussed at a meeting held with the Borough Council and Environment Agency, where the Council's drainage expert analysed the maps at several locations across the Borough based on his own experience of flooding incidents. It was agreed that, whilst both maps normally performed reasonably well in predicting flooding in the locations where flooding has been observed in reality, the FMfSW was slightly better. The AStSWF was generally felt to suggest much broader areas of flooding than was considered likely in reality. Therefore, it was agreed that for Wokingham Borough the FMfSW is the preferred map to use for predicting future flood risk from surface water. The map is shown in *Figure 6-1*.

The Flood Map for Surface Water has been selected as the locally agreed surface water information.

Statistics relating to the flood risk to receptors from surface water flooding have been provided by the Environment Agency for filling in the PFRA spreadsheet.

6.2 Groundwater flood risk

- 6.2.1.1 For the assessment of future groundwater flood risk, the Environment Agency has provided assistance to LLFAs by providing maps of Areas Susceptible to Groundwater Flooding. The susceptibility is indicated based on 1km grid squares. Each grid square is attributed with an estimate of the proportion of its area which is susceptible to groundwater flooding by

considering where geological and hydrogeological conditions suggest that groundwater might emerge. The aquifer source of flooding is also indicated as being either consolidated such as chalk, sandstone etc. which is termed 'clearwater', or from superficial deposits. However, it is important to note that while this indicates areas where groundwater flooding may occur, it does not give an indication of the likelihood of that flooding occurring.

6.2.1.2 The two aspects of the maps of areas susceptible to groundwater flooding are shown in **Figures 6-2 and 6-3**.

6.2.1.3 Based on these maps it can be seen that much of the Borough has some susceptibility to groundwater flooding but the most susceptible areas tend to be along the paths of the rivers. In this case, high groundwater levels are likely to coincide with high river levels, both because the groundwater feeds the river and because rainfall events which increase groundwater levels are also likely to have increased runoff to the river. It is expected that groundwater flooding is most likely to feature as a component exacerbating the depth of fluvial flooding and increasing the time floodwaters persist on the land. Groundwater by itself is less likely to be noticeable, except possibly in a few depressions further from the river which fluvial overtopping does not reach or in people's basements. It may also be an indirect cause of flooding if it infiltrates the sewer system which would reduce capacity.

6.2.1.4 The recommendation for the Areas Susceptible to Groundwater Flooding maps is that unless the area identified as susceptible to groundwater flooding is also identified as at risk from surface water flooding, it is unlikely that the location would experience groundwater flooding of any appreciable depth and hence the consequences are unlikely to be classed as significant.

6.3 Ordinary watercourses

6.3.1.1 As yet, no data has been specifically produced focussing on ordinary watercourses. However, the surface water modelling does provide some indication of the risk since runoff tends to naturally converge on the streams and rivers which are normally the topographically lowest places within the study area.

6.4 Local Drainage Capacity

At this time, there is little information on drainage capacity. However, the Borough Council is currently undertaking mapping of manholes, gullies and highway drains, so it is anticipated that more information will be available for the next cycle of the PFRA. There is known to be issues with the drainage system in the Swallowfield area, as evidenced by the 2007 flooding.

6.5 Climate change

6.5.1 The Evidence

- 6.5.1.1 There is clear scientific evidence that global climate change is happening now. It cannot be ignored.
- 6.5.1.2 Over the past century, more of our winter rain fell in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation, however the broad trends are in line with projections from climate models.
- 6.5.1.3 Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.
- 6.5.1.4 There is more uncertainty about the effects of climate change at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

6.5.2 Key Projections for Thames River Basin District

- 6.5.2.1 If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:
- Winter precipitation increases of around 15% (very likely to be between 2 and 32%)
 - Precipitation on the wettest day in winter up by around 15% (very unlikely to be more than 31%)
 - Peak river flows in a typical catchment likely to increase between 8 and 18%

6.5.3 Implications for Flood Risk

- 6.5.3.1 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.
- 6.5.3.2 Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers.

- 6.5.3.3 Rising river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.
- 6.5.3.4 There is a risk of flooding from groundwater-bearing chalk aquifers across the Borough. Recharge may increase in wetter winters, or decrease in drier summers.

6.5.4 Adapting to Change

- 6.5.4.1 It is possible to prepare and adapt for climate change by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits.
- 6.5.4.2 The Council will consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that the vulnerability to flooding in the Borough is not increased.

6.6 Long term developments

- 6.6.1.1 It is possible that long term developments might affect the occurrence and significance of flooding. Current planning policy aims to prevent new development from increasing flood risk.
- 6.6.1.2 Planning Policy Statement 25 (PPS25) on development and flood risk aims to "ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."
- 6.6.1.3 Any exceptions (e.g. where the benefits of the development outweigh the risks from flooding) would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

7 Identification of Flood Risk Areas

7.1 *Indicative Flood Risk Areas*

7.1.1.1 To provide a starting point for the determination of flood risk areas, the Environment Agency provided a national dataset of indicative flood risk areas for surface water runoff. These are based on the national surface water modelling described in **Chapter 6**, primarily the FMfSW although the AStSWF is taken into account. Within Wokingham Borough, there are no indicative flood risk areas.

7.2 *Review of Indicative Flood Risk Areas*

- 7.2.1.1 The indicative flood risk areas maps are necessarily relatively coarse and based on very generalised assumptions. It is imperative that LLFAs review the maps to assess their reasonableness in their own area, based on local information and experience.
- 7.2.1.2 The historical flood risk information (there is no local modelling information for Wokingham) was assessed to see if there were any major or frequent flooding incidents that may have affected large numbers of people, which the national surface water modelling did not reproduce. However, whilst Wokingham Borough has suffered flood events which were locally significant (see **Chapter 5**) none of these incidents were comparable with the national significance level set by Defra and the Welsh Assembly, where at least 30,000 people within a 3km by 3km area are affected.

7.3 *Final Flood Risk Areas*

No flood risk areas have been identified for Wokingham Borough for submission to the European Union.

8 Next steps

8.1 Preparation of flood hazard and flood risk maps, and flood risk management plans

8.1.1.1 The final two stages of the EU Floods Directives (preparing flood hazard and flood risk maps, and flood risk management plans, see **Table 2-1**) are required for areas which a PFRA identifies as a flood risk area. Since this PFRA has not identified any flood risk areas for Wokingham Borough that conform to the definition by Defra, the final two stages will not be required.

8.2 Future PFRAs

8.2.1.1 PFRAs are required by the EU Floods Directive and the UK Flood Risk Regulations to undergo revision on a cyclical process every 6 years. The next PFRA will have to be completed before 22 June 2017.

8.2.1.2 One of the key differences between this PFRA and the next, is that the reporting requirements for historical floods will become more stringent, with several additional fields required to be completed for all floods occurring after 22 December 2011. The current information required is: the name of the location, a grid reference, a summary description based on available information, and some estimation of significant consequences. In future, LLFAs will be required to provide in addition to these: the start date of flooding, days duration, probability of occurrence, main source of flood water, main mechanism of flooding, and main characteristic of flooding (further description of these fields is included in the PFRA spreadsheet).

8.2.1.3 Wokingham Borough needs to prepare now to collect information on floods from December this year so that the additional fields required can be completed. For example the proposed Borough Council Flood Risk Manager will need to ensure that the council records log this information for all incidents reported to them by the public or their own drainage engineers, and any incidents they investigate as part of the Borough Council's LLFA duties. The required fields will also need to be disseminated to the Town/Parish Councils and Loddon Valley Residents Association to ensure any information they collect includes the necessary details.

8.3 Data Collection and Management

8.3.1.1 In order to fulfil its responsibilities as a LLFA, Wokingham Borough Council is required to investigate and maintain a record of flood incidents within its administrative area, both for the PFRA, and as a wider part of its duties under the Flood and Water Management Act. Similar to the present PFRA, the input from Parish Councils, Town Councils and Residents Association will be invaluable and these organisations should be encouraged to continue engaging in the process.

- 8.3.1.2 In order to facilitate better comparison of events between the different areas, it is recommended that a more consistent method of recording be followed. For example, a standard spreadsheet format could be used. It is recommended that this be based upon the PFRA spreadsheet to make completing future PFRA's more efficient. Additional fields could also be incorporated, such as details on depth of flooding, amount of rainfall, damage caused, and consequent action taken to reduce future flooding.
- 8.3.1.3 Data management should be in accordance with the INSPIRE Directive (2007/2/EC), which was introduced to improve the quality, consistency and accessibility of spatial data sets and services for environmental data. The directive promotes data sharing to help users to find suitable information more easily and reduce duplication of effort in data collection and maintenance. The Inspire Directive is implemented in the UK through the Inspire Regulations 2009.
- 8.3.1.4 On publication of the final PFRA on the Council's website, it is recommended that it be accompanied by encouragement to the public to submit information on flooding occurrences after 22 December 2011. This could either consist of contacting their respective town or parish council, or an online form (as discussed above) where the information can be sent directly to the Council.

9 References

- European Union Floods Directive 2007/60/EC, European Commission, November 2007, http://ec.europa.eu/environment/water/flood_risk/index.htm
- The Flood Risk Regulations 2009, Statutory Instrument No. 3042, <http://www.legislation.gov.uk/ukxi/2009/3042/contents/made>
- PFRA Final Guidance, Environment Agency, December 2010 and updated Annexes, March 2011 <http://www.environment-agency.gov.uk/research/planning/125459.aspx>
- Selecting and reviewing Flood Risk Areas for local sources of flooding Guidance to Lead Local Flood Authorities, Defra and Welsh Assembly Government, 2010, <http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf>
- Wokingham Borough Council Strategic Flood Risk Assessment, Jacobs, July 2007, <http://wokingham.gov.uk/environment/planning/new-planning/planningguidance/sfra/>
- Wokingham Borough Council Strategic Flood Risk Assessment, Halcrow (estimated publication date 2011)