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Flood Review July 2007

Yelford

An investigation into the causes and flood risk management options

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Executive Summary

Following the flooding of July 2007, which affected 6 properties in Yelford, we have investigated options to improve the level of flood protection. This study aims to outline the extent of the recent floods, record the damage and document the response. Opportunities for any improvements that could reduce flood risk for local residents and businesses will be investigated.

The keys findings are that an unusually wet May and June with rainfall up to 195% of the long term average combined with an exceptional level of rainfall on 19 and 20 July created unprecedented levels of flow in the Brighthampton Cut and the wider land drainage system. Water levels and flows exceeded the capacity of culverts and bridges forcing flood water over and/or around the structures, into roads and residential areas. This caused widespread flooding across the catchment which was worsened by surface water flooding in places.

The classification of the Brighthampton Cut is an ordinary watercourse (see glossary), throughout the majority of the village. We do not have powers or funding to carry out works on ordinary watercourses and are therefore unable to spend funds on monitoring river flows and levels to provide a flood warning system for this area.

There are no mills or sluices that we are aware of that could affect the flooding of July 2007. However, the Brighthampton Cut passes under the main road in culvert, the capacity and condition of this culvert contributed to the flooding of properties in July 2007. Oxfordshire County Council (O.C.C.) Highways Department have inspected this culvert and have confirmed that there is structural damage which necessitates its replacement. However, it should be noted that had the culvert not been damaged, it would not have had the capacity to convey the volume of water during the July flood event. We are working with O.C.C Highways Department to agree and approve works to replace this structure with a greater capacity which will reduce flood risk locally.

A number of positive recommendations are made with the objective of reducing the consequences of future flooding. The key recommendations of the review are:

- we will continue to work with O.C.C Highways Department so that the Brighthampton Cut culvert can be replaced with a greater capacity to reduce flood risk to the village
- increased awareness of riparian rights and responsibilities of watercourses responsibilities to ensure adequate maintenance and passage of flows
- we will continue to work with West Oxfordshire District Council (W.O.D.C) to prevent inappropriate development in the flood plain
- increased flood resistance and resilience of properties at risk from flooding via flood prevention products and construction techniques
- we will work with communities to produce local flood plans so they are better prepared for future flooding and better able to respond.

David McKnight Flood Risk Engineer

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1 Background

Introduction

Following the floods of July 2007, we have undertaken this flood review to understand the meteorological conditions that contributed to the flooding, the mechanism of flooding and the number of properties effected in order to identify works to reduce flood risk and its impacts. The reviews will also identify responsibilities for flooding, and provide guidance on other flood risk management tools such as flood warning, flood resistant construction, flood resilience. The review has been written in consultation with the West Oxfordshire District Council (W.O.D.C.).

Yelford is a small village in West Oxfordshire, it is located approximately 4 km south of Witney in West Oxfordshire District. The Brighthampton Cut (ordinary watercourse) enters the village from the north under the main road. The Brighthampton Cut becomes a main river (see glossary) just upstream of the main road in Yelford. It then flows in a south easterly direction and discharges into the River Thames approximately 1 km upstream from Newbridge.

2 The Problem

Flooding mechanism & history

Meteorology

May and June 2007 were unseasonably wet months across the UK with many areas receiving rainfall above the long term average (LTA) for the period 1961-1990. The Thames Region received 109mm of rainfall in May and 88mm in June (195% and 160% of the long term average respectively).

The unsettled weather continued into July 2007 as low pressure dominated across the UK. This was due to the abnormal southerly position of the Polar Jet Stream, a narrow band of fast moving air in the upper atmosphere which steers weather systems from west to east across the Atlantic. The jet stream is usually further north during the summer period, allowing high pressure to form across the UK more frequently.

In July the Thames catchment received 121mm compared to the long term annual average rainfall amount of 49mm (247% of the long term average), as illustrated in Figure 1. The Brize Norton rain gauge recorded 127 mm in 20 hours.

Figure 1: Rainfall totals compared to the long term average (LTA) (1961-90)

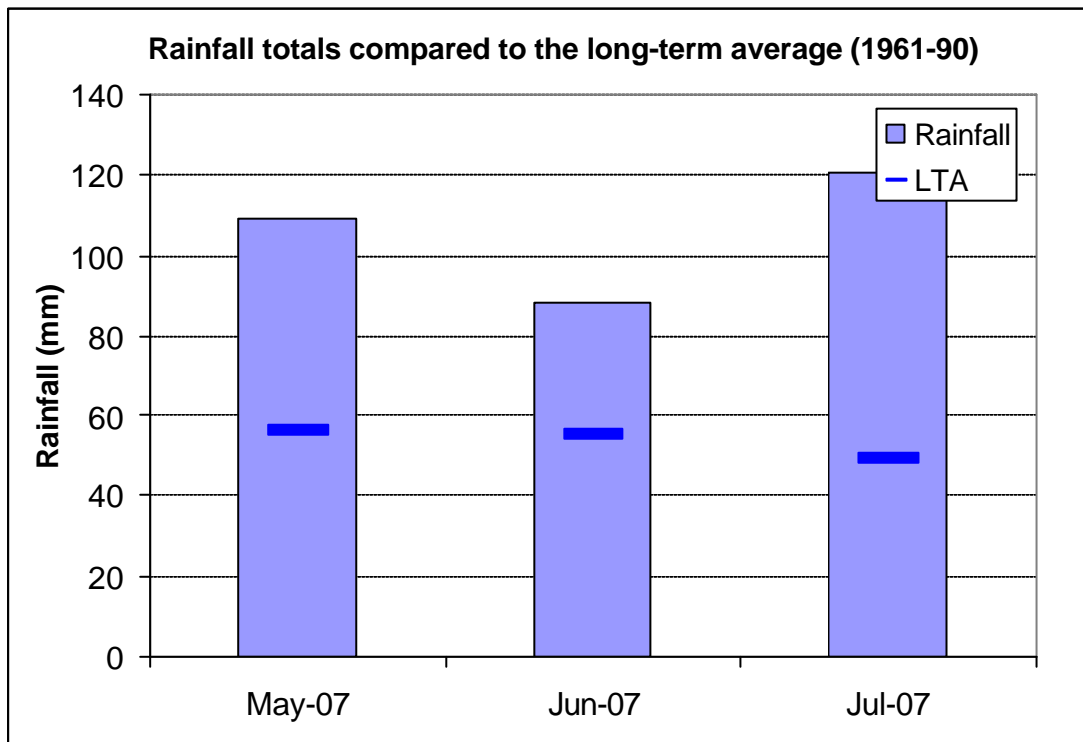


Table 1: Rainfall totals compared to the long term average (LTA) (1961-90)

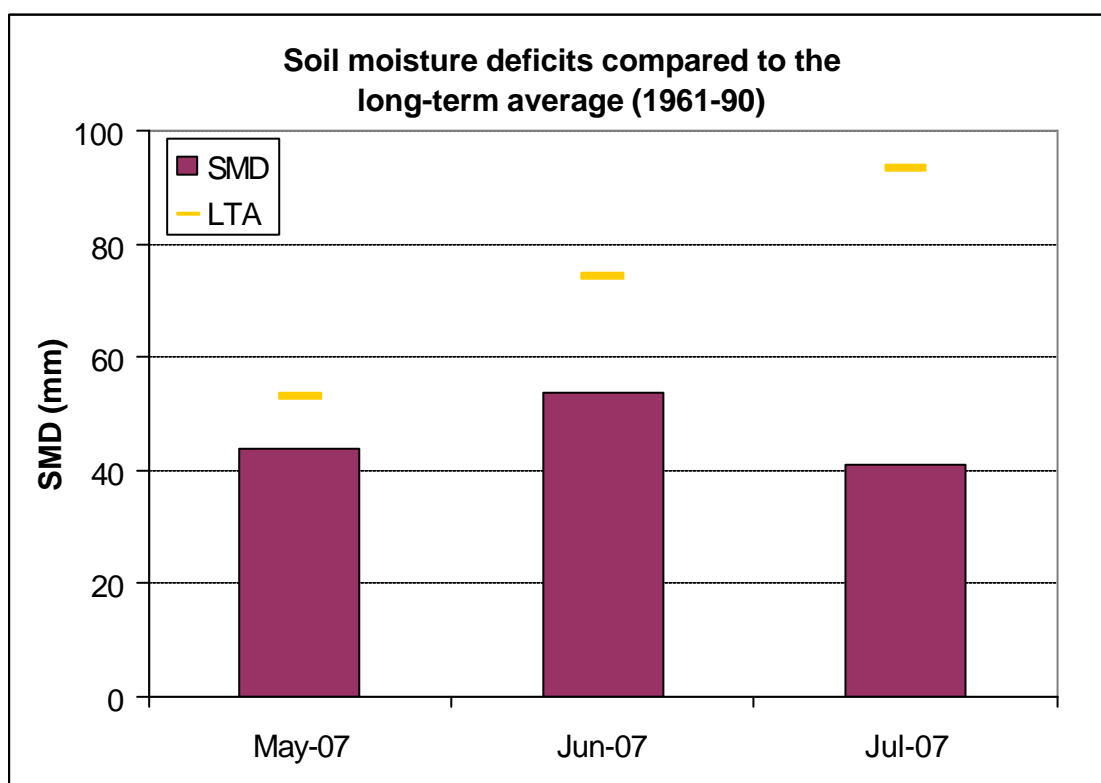
Month	Total rainfall for Thames Region (mm)	Long Term Average (1961-1990) (mm)	2007 rainfall as % of LTA
May 2007	109	56	195
June 2007	88	55	160
July 2007	121	49	247

Hydrology

Soil Moisture Deficit (SMD) is a measure of the saturation of the soil. Low SMD means that the soil is wetter than usual, and SMD above the LTA means that it is dryer than usual. The SMD in May and June 2007 are compared with long term averages for 1961-90 in Figure 3. Extended periods of wet weather across much of the Thames Region resulted in lower than average SMD leading up to the July 2007 event. This means that less rainfall was needed for the soils to become fully saturated, increasing the potential for greater runoff into rivers.

The extremely high rainfall totals and intensities coupled with the low soil moisture deficits for the time of year caused flows (i.e. the volume of water in the river) at many locations to increase rapidly. By the end of July 2007 average monthly river flows at many sites were the highest on record for July.

Figure 2: Soil moisture deficits (SMD) compared to the long term average (LTA) (1961-90)



The combination of exceptional rainfall and low soil moisture deficit resulted in extremely high flow and levels in watercourses in the region.

Flood history

There have been a number of major floods in the River Thames catchment since records began, most notably in November 1894, March 1947, October/November 2000 and January 2003. All occurred during the winter months and affected the upper Thames tributaries as well as the Thames itself.

Historically, summer floods on the Thames and larger tributaries are less common. However it is interesting to note that the highest levels at Thames locks upstream of Oxford since records began in the 1880s were generally recorded in the flood of June 1903. Also, the July 1968 floods caused severe flooding in the lower Thames tributaries and the highest flows on record in the neighbouring lower Severn catchment.

Table 2 gives a summary of the main historic flood events that have affected similar areas to those in the July 2007 event. It is by no means a comprehensive record of every flood in the Thames catchment.

Table 2: Historic flood events

Date	Description
November 1894	Catchment-wide flooding in the Thames catchment. Highest levels downstream of Oxford since records began. Numbers of properties affected unknown.
June 1903	Flooding on the upper Thames. Highest levels locks upstream of the Cherwell since records began. Numbers of properties affected unknown.
March 1947	Basin-wide flooding in the Thames, including the Lee catchment (over 10,000 properties affected).
July 1968	Flooding in the mid to lower Thames and severe flooding in the Mole and Wey catchments (about 10,000 properties affected).
November 1974	Flooding in the lower Thames and its tributaries including Addlestone Bourne, Blackwater, Beam, Loddon, Emm Brook.
Easter 1998	Flooding in the Cherwell catchment – Approximately 1000 properties affected.
October/November 2000	Catchment wide flooding in the Thames. Approximately 1100 properties affected.
January 2003	Catchment wide flooding in the Thames. Over 500 properties affected.

Examination of the rainfall data and runoff characteristics from the July flood event has enabled an estimation of the flood return period in excess of 1 in 100 years (1% annual probability of occurrence).

Flood mechanism/source of flooding

The flooding in July was from several sources: rivers (fluvial), surface water (pluvial) and sewers. It is very difficult to distinguish the exact source of flooding due to the complex connection between rivers and drainage systems.

The smaller the area these systems serve the more rapidly they will respond: the larger the area they drain, it will take a longer time for the majority of the rainfall to reach any point. Flooding will often occur in a time sequence that reflects this e.g. first we see a puddle in the garden, then overflowing drains, ditches overflow, small river floods then finally large rivers flood.

Yelford is located near the top of the Brighthampton Cut, just above the main river section. (see figure 3 in Appendix B). The source of the primary watercourse (Brighthampton Cut), is located

approximately 1.5 km upstream at Boys Wood to the north of Yelford. Due to its location at the top of the catchment and for the above reason it is likely to be fast-reacting after rainfall. Any area with a rainfall catchment of less than 3 km² were not considered in our first National Flood Map outlines, this is why our published flood plain extent does not extend into the village. (See figure 3 in Appendix B).

The flooding of roads, roadside drains and gullies immediately after the exceptionally heavy rainfall from mid morning to late afternoon on Friday 20 July occurred due to insufficient capacity to cope with the volume of water. Many of the main roads connecting the villages were impassable by Friday afternoon. The ditches, streams and larger watercourses were already rising due to the runoff from fields and built development surface water drainage systems. The above land drainage and sheet flow discharged into the larger watercourses including the Brighthampton Cut whilst the intense rainfall was falling on Friday 20. Flood flows entering the culvert under the main road exceeded the capacity of the culvert and the excess water flowed backed up, causing flooding to properties. In some locations, high river levels prevented the discharge of surface water sewers and drains, which surcharged and caused flooding, or added to flooding from watercourses.

The local watercourses cover a large area with local variations in runoff rates, structures and catchment response to the rainfall, thus the timing of the various main rivers bursting their banks varied from location to location.

It is understood that the July flood event effected 6 properties out of a total of 9 properties in Yelford.

Planning controls and floodplain development

Current planning guidance contained in Planning Policy Statement 25 (PPS25 – published December 2006) states that flooding is a material planning consideration and explains how flood risk should be considered at all stages of the planning and development process. It places the onus on the developer to assess flood risk for a particular site and its impact on adjacent sites. It allows the planning authority to adopt the precautionary principle when determining planning applications within the floodplain.

We are a statutory consultee in the town and country planning process. We have provided local planning authorities with maps identifying the flood plains to guide development away from these areas.

Prior to PPS25, planning authorities were not obliged to incorporate our comments or advice into their final decision, this may in certain circumstances have resulted in development going ahead against our recommendations.

Under the 'Flooding Direction' issued in conjunction with PPS25, where a local planning authority is minded to approve a planning application for major development yet we have objected to it on flood risk grounds, the application must be referred to the appropriate Government Office to consider, on behalf of the Secretary of State, whether it should be called in for determination.

We will object to any inappropriate development within the floodplain that may result in:

- increased resident population in the floodplain;
- a loss of floodplain storage capacity;
- impede flood flows routes;
- result in increased flood risk elsewhere.

We are not aware of any recently approved or proposed developments in the vicinity that may affect flood risk to Yelford. We continue to work with WODC to ensure that flood risk is considered at every stage in the planning process.

We are also working with WODC to produce their strategic flood risk assessment (SFRA). The purpose of an SFRA is to identify areas within a development plan that are at risk of flooding and to avoid these areas for land allocations using the risk based approach as advised in PPS25.

Flood warning

Flood warnings are issued on a best endeavour basis and aim to simultaneously warn homeowners, businesses, emergency services and local authorities of the threat of flooding. Flood warnings can be sent via telephone, fax, text or email.

Flood warnings apply to flooding caused by main rivers and streams, not to flooding from other sources, such as sewer, surface water flooding, burst water mains and impounding, etc.

We can only provide a flood warning service to those at risk from flooding where we are able to monitor river levels. We are currently unable to offer a flood warning service to the residents in Yelford.

3 Management of flood risk

Catchment Flood Management Plan (CFMP)

Catchment Flood Management Plans (CFMP's) provide an overview for managing the long-term flood risk over the next 50 to 100 years.

A reliance on flood defence is no longer sustainable and we are moving towards managing the risks of flooding. This can be achieved by putting in place a range of flood risk management policies that can react to change.

Yelford lies within the undeveloped natural flood plain catchment area as defined by the CFMP. The approach to flood risk management in these areas is about working with the natural characteristics of the catchments. The aim is to manage flood risk by taking opportunities to maximise the potential of the flood plain to retain water. Specifically the messages are:

- The flood plain is our most important asset in managing flood risk
- Maximising the capacity of the flood plain to retain water in these areas can have many advantages for people and the natural environment
- Managed flooding of some areas of the natural flood plain will reduce the risk to some communities
- We will do all that we can to prevent inappropriate development which reduces the capacity of the flood plain to retain water. Future maintenance work on river channels should aim to increase the capacity of the flood plain.

Third party structures & maintenance

We are not aware of any mills or sluices that could effect the flooding of July. However, the Brighthampton Cut passes under the main road through the village in culvert.

Maintenance regime

All rivers, streams and ditches forming the natural drainage system fall into 2 categories. They are: main river and ordinary watercourses. We are the operating authority for all main rivers. W.O.D.C. are the operating authority for ordinary watercourses and have similar powers to us. Oxfordshire County Council Highways Department are responsible for the maintenance of structures that they own, this will generally include road culverts, bridges, gullies and some ditches.

The maintenance of all watercourses is legally the responsibility of the owner of the river (riparian owner). Many households own very small sections of the various watercourses and in many cases are unaware of their responsibilities. W.O.D.C. are currently working through a programme of minor flood defence work which involves identifying ditch and ordinary watercourse landowners and asking them to undertake maintenance work if required.

We would support riparian owners wishing to undertake maintenance of watercourses, subject to them gaining our consent where this is required. Our support could include guidance and advice on various aspects of maintenance. Further information and advice relating to the need to gain our consent can be obtained from our National Customer Contact Centre on: 08708 506 506.

Details of the rights and responsibilities of riparian landowners are provided on the our website:

<http://www.environment-agency.gov.uk/subjects/flood/362926/>

The same information is also available on request from us in a hard copy booklet entitled 'Living on the Edge'.

We have permissive powers to carry out maintenance on any river that is classed as main river. Our maintenance role is scheduled on the basis of flood risk priority and recourses. The primary main river that causes flood risk to Yelford is the Brighthampton Cut. The Brighthampton Cut is maintained from the main road in Yelford down to the confluence with the Elm Bank Ditch (approximately 1000 metres downstream), see figure 3 in Appendix A for the main river limit.

We do not give a risk score to each watercourse, instead we categorise the flood risk management system in which it sits. The main rivers locally sit within the Brighthampton Cut System, which has been categorised as a medium risk system from April 2008. This is because of the total number of properties within the flood plain is medium with little risk to life. Every year we aim to undertake work in all high risk systems and some medium risk systems. This means that at present we can justify our annual clearance of vegetation and obstruction removal. The timing of this annual clearance is for the end of November or the beginning of December. The maintenance programme also includes a de-silt on this reach.

Our assessment of the channels through this area is that whilst increased maintenance could lead to reductions in the water levels during very minor flood events it would not have helped during the floods in July due to the scale of the flooding and volume of water involved.

Intervention options

Our aim is to reduce flood risk. For defended areas at flood risk we will inspect, maintain and improve flood risk management assets, on main rivers and the coast on the basis of risk (i.e. the likelihood and consequences of failure). In undefended areas we build and maintain assets where it is considered to be an appropriate use of our flood risk management resources and meets our risk-based criteria. The classification of the Elm Bank Ditch upstream of the village is ordinary watercourse, we do not have powers or funding to carry out works on ordinary watercourses.

Under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws 1981, the prior written consent of the Environment Agency is required for any proposed works or structures in, under, over or within 8 metres of the top of bank of a main river. Culverting, alterations to culverts, diverting or infilling of any watercourse requires our prior written consent under the terms of the Land Drainage Act 1991 or Water resources Act 1991.

Oxfordshire County Council Highways Department have inspected the Brighthampton Cut culvert and have confirmed that there is structural damage which requires attention. It should be noted that an un-damaged culvert would not have had the capacity to convey the volume of water during the July flood event. We are working with O.C.C Highways Department to agree the scope of replacement works and to approve their proposal to construct a new culvert with approximately 3 times the current culvert capacity. These works should allow greater flood flows to pass through the structure without backing up and flooding houses in the vicinity.

Historic works

There are currently no flood alleviation schemes in place for Yelford.

Flood resilience

Flood resilience refers to measures that reduce the amount of damage caused by water entering properties. There are a wide range changes that can be made to a property and any changes would be very specific to each property in order to ensure that they are suitable.

At present our policy is not to provide financial assistance with any protection to individual properties, however the Department for Environment Food and Rural Affairs (DEFRA) are currently funding a pilot grant scheme to encourage flood resilience as part of the Making Space for Water strategy. The outcome of this study could influence the decision of householders in the future.

In Yelford and the surrounding areas it is unlikely that flood defences can be provided for the majority of homes at risk of flooding. Individual flood defences and flood resilience measures are therefore recommended.

Flood resilience measures should be based on advice from either the Royal Institute of Chartered Surveyors (RICS) or the Flood Protection Association. For further information please see the National Flood Forum website at: www.floodforum.org.uk

In general if such measures are installed as part of repairs after the recent floods then insurance companies will expect the householder or business to meet the extra costs themselves. Possible measures include:

- Raised cupboards & electrical circuits
- Water resistant door frames
- Non-return valves on drainage pipes
- Water resistant plaster
- Air brick covers
- Tanking (waterproofing internal walls).

We have noted that for some of the historic properties that have been affected by flooding, those with traditional materials such as lime based renders and plaster have proved to be more resilient than more modern gypsum based products.

Flood defence products for individual properties are also widely available and we support the BSI Kitemark standard which signifies that the product has been rigorously tested. See 'References' for links to further information.

Community flood plans

Following the July flooding we are working with affected communities to produce their own flood plans. We can assist by providing flooding advice, supplying maps and other relevant information. They can also be adapted to include other emergency situations, thus increasing the resilience of a community. The community flood plan contains information on:

- setting up emergency management teams
- flood event procedures
- communications – useful numbers, local media, Environment Agency
- flood Maps including vulnerable properties & residents
- key community skills & equipment
- emergency accommodation.

4 Conclusions & recommendations

The floods of July 2007 were an exceptional event, particularly in terms of the rainfall and the catchment response. The widespread flooding experienced was caused by the volume of water and inability of the overloaded drainage systems including, drains, ditches, streams and rivers to convey the flood water.

We worked with our professional partners throughout the flood event to warn where possible and assist residents and businesses. Unfortunately, we are unable to offer a flood warning system to the residents of Yelford as we can only provide a flood warning service where we are able to monitor river levels.

The classification of the Brighthampton Cut is ordinary watercourse for the majority of the village, we do not have powers or funding to carry out flood defence works, install river level or flow monitoring sites or undertake maintenance work.

The main physical structures that affect flood flows are road culverts, bridges and built development. These structures can hold back river flows and constrain the flood plain, increasing flood risk if they became blocked with debris. The poor condition of the Brighthampton Cut culvert under the main road would have contributed to the timings and possibly the magnitude of the flooding locally.

Increased channel maintenance would not have significantly reduced the level of flooding experienced in July due to the volume of flood water. Increases in channel capacity would provide limited reduction in flood risk because the extra volume in the channel only equates to a very small proportion of the volume of water in the flood plain. However, increased channel maintenance would assist in flood risk reduction for smaller floods.

An important element of flood risk management is to address the consequences of flooding. Communities should work together with parish councils to produce community flood plans. We have provided templates to help, the plans will:

- identify the risks to the community and take action to reduce them
- identify vulnerable people in the community and develop plans to assist/protect them
- identify resources in the community available to assist during an emergency
- provide key contact details for the Emergency Management Team, key community recourses, the Emergency Services and local authorities.

In order to reduce the impact of any future floods there are several actions that should be taken forward as a matter of priority:

- we will work with Oxfordshire County Council Highways Department to agree and approve proposals for the replacement and enlargement of the Brighthampton Cut culvert
- we will work with riparian owners to increase awareness of riparian rights and responsibilities on watercourses and local land drainage system)
- being prepared - both at community (community flood plans) and householder level
- our continued role in the planning process – objecting to inappropriate development in the flood plain
- increased flood resistance and resilience for homes and businesses.

Appendix A - Maps

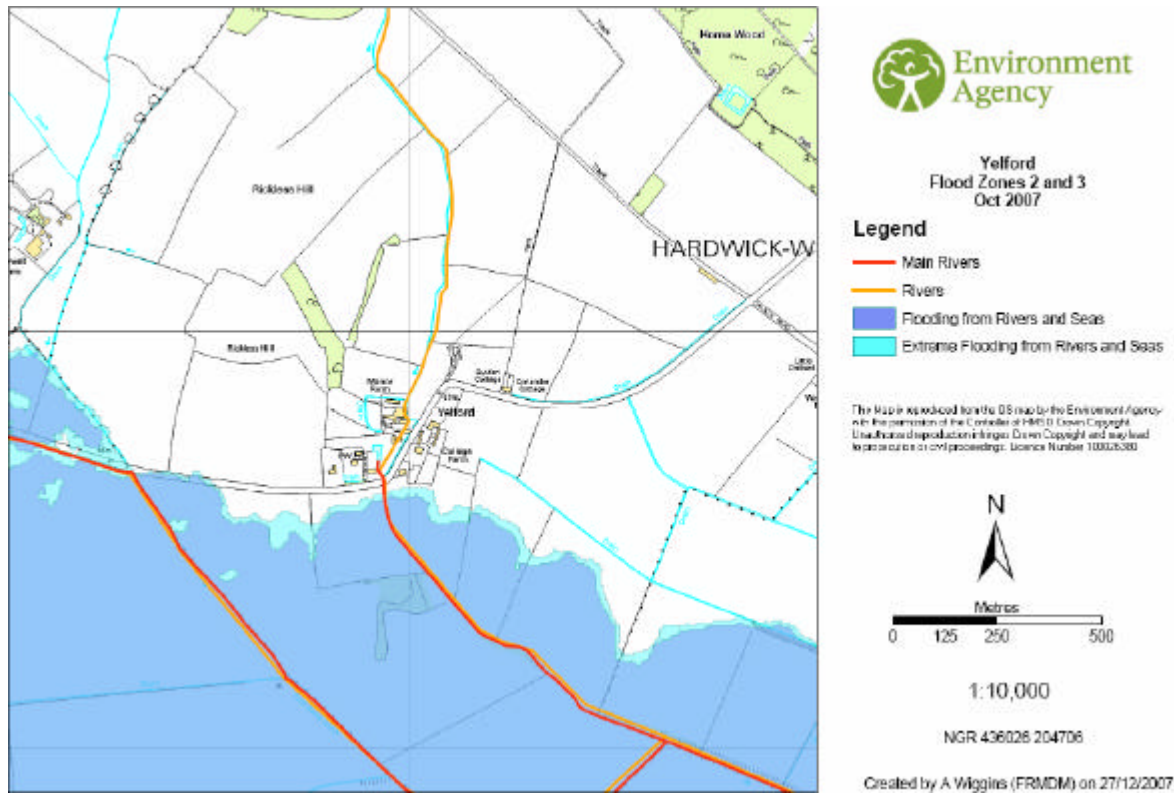


Figure 3 – Yelford –Flood Zone 3 (1% annual probability of occurrence) and FZ2 (0.1% annual probability of occurrence)

Glossary of terms

Cost Benefit Analysis

In order to receive funding for a flood defence scheme an analysis must be made of the costs and benefits. The costs include the design, construction and maintenance over a 100 year period. This is compared against the benefits – i.e. the reduction in damage caused by flooding of properties in financial terms. The higher the ratio of cost to benefit the more likely the scheme is to gain funding due to the national prioritisation of flood risk capital funding.

Critical Ordinary Watercourse

These are ordinary watercourses which have been identified by DEFRA as being strategically important and are to be enmained.

Culvert

A closed conduit for the conveyance of water, e.g. a pipe underneath a road.

Enmained

Procedure in which the Environment Agency assumes powers to legally change the classification of an Ordinary Watercourse to a Main River in order to maintain exercise its Permissive powers for maintenance, flood warning and flood alleviation works.

Flood plain

A flood plain is an area of land over which river or sea water flows or is stored in times of flood. A flood plain can extend beyond the land immediately adjacent to a watercourse. (Living on the edge)

Flood Zone

Flood Zones are the Environment Agency's nationally agreed geographical layers of information that define the extend of flood risk. They are split into Flood Zone 1, 2 and 3.

Flood Zone 2 is flooding from rivers without defences at a 1% (1 in 100) chance of happening each year. It is the natural flood plain area that could be affected in the event of flooding from rivers.

Flood Zone 3 is the outline of a flood extent in an extreme flood with a 0.1% (1 in 1000) chance of happening each year.

Flood storage area

A flood storage area is a part of the flood plain that allows flood waters to be temporarily stored. The purpose of such an area is generally to retard larger floods from reaching a main watercourse for a designed flood return period.

Fluvial Flooding

Flooding where the source is river water.

Land Drainage Scheme

Post World War II the emphasis in river engineering was on increasing the farming capacity of the UK. This was achieved through land drainage schemes that increased the quality of farmland by maximising the drainage of water.

Main rivers

Main rivers are defined under the Water Recourses Act 1991, they are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. A main river is defined as a watercourse shown as such on a main river map, and can include any structure or appliance for controlling or regulating the flow of water in, into or out of the main river. The Environment Agency's powers to carry out flood defence works apply to main rivers only. Main rivers are designated by the Department for Environment, Food and Rural Affairs in England (DEFRA) and by the Welsh Assembly Government. (Living on the edge)

National Flood and Coastal Defence Database (NFCDD)

The National Flood and Coastal Defence Database is a central store for Flood Risk Management related data. It aims to allow rapid access to national data, stored and maintained in a consistent manner.

Ordinary watercourse

An ordinary watercourse as defined under the Land Drainage Act 1991 is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than public sewer) and passage through which water flows which does not form part of a main river. On ordinary watercourses, the local authority and, where relevant, Internal Drainage Boards (IDB) have similar permissive powers as the Environment Agency has on main rivers. (Living on the edge)

Pluvial Flooding

Flooding where the source is surface water.

Priority Score

The national scoring system that is used by the Environment Agency and DEFRA to prioritise the capital funding of flood defence schemes.

Professional Partners

Professional partners are organisations we work with. Specifically, the emergency services, local authorities, health bodies, utilities, transport bodies and other Government agencies.

Riparian Owner

The owner of the river in terms of property. The usual situation is for the landowner of each bank to own up to the centreline of the river. There are responsibilities and rights associated with owning the river – principally that of maintenance of the watercourse and associated structures.

Trash Screen

A grill or grate that is installed on a culvert or other limited opening on a river to collect debris and prevent blockages.

List of abbreviations

AOD	Above Ordinance Datum
BSI	British Standards Institute
CFMP	Catchment Flood Management Plan
COW	Critical Ordinary Watercourse
DEFRA	Department for Environment, Food & Rural Affairs in England
FSA	Flood Storage Area
GMT	Greenwich Mean Time
NFCDD	National Flood and Coastal Defence Database
LTA	Long Term Average
PPS25	Planning Policy Statement 25
RICS	Royal Institute for Chartered Surveyors
SMD	Soil Moisture Deficit

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