

LUTON BOROUGH COUNCIL

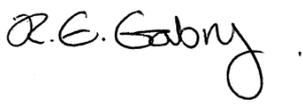
PRELIMINARY FLOOD RISK ASSESSMENT

JUNE 2011



Luton

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Executive Summary

Background

This report has been prepared by Capita Symonds Ltd for Luton Borough Council to meet their duties to manage local flood risk under the Flood and Water Management Act 2010 (the Act) and deliver the requirements of the Flood Risk Regulations (2009). Luton Borough Council is defined as a Lead Local Flood Authority (LLFA) under the Act. LLFAs are required under the Act to develop a strategy for local flood risk management.

This is being achieved in the first instance by carrying out a Preliminary Flood Risk Assessment (PFRA). This document and the supporting spreadsheet presents the findings of the PFRA for Luton. The PFRA process is aimed at providing a high level overview of flood risk from all sources within a local area, including consideration of **surface water, groundwater, ordinary watercourses and canals**. The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and Defra's Guidance on selecting Flood Risk Areas, both published in December 2010.

Review of Available Local Flood Risk Information

In order to develop a clear overall understanding of the flood risk across the Luton Borough Council area, flood risk data and records of historic flooding were collected from local and national sources including within the Borough, the Environment Agency, Thames Water, Anglian Water and emergency services.

Information relating to past flood events caused by flooding from local sources was collected and analysed. However, comprehensive details on flood extents and consequences of these events were largely unavailable. Based on the evidence that was collected, only four past flood events could be determined with any certainty to have had 'significant harmful consequences'. These events are summarised below.

- July / August 1980 - Various flood locations throughout Luton ranging from 200mm to 750mm deep. Consequences included flooding of more than 100 buildings including private houses, businesses and the rear part of the Town Hall (Grade II Listed Building)
- 4 July 2006 - Hail, lightning, flash floods and a twister hit the Luton area. Flooding cause damage to possessions, shops and buildings. Impacts included closure of Luton indoor market for half a day and flooding at the Luton and Dunstable Hospital.
- 25 to 28 May 2007 – The wettest day on record for Luton caused major travel disruptions by via surface water flooding of several main roads. Combined surface water and Main River flooding in Wardown Park caused cancellation of the Luton Carnival that cost the Council more than £300,000 and the loss of approximately 100,000 additional visitors to the area for the event.
- 20 July 2007 – Heavy rainfall caused several roads (including Airport Way) to be closed and people became stuck in their cars. The Lloyds TSB Bank in George Street experienced flooding up to 1m deep.

Review of Indicative Flood Risk Areas

The geographic area covered by Luton Borough Council was not identified as an 'Indicative Flood Risk Area' by the national assessment undertaken by the EA and Defra. Similarly, locally collected information does not suggest that Luton should be classified as a 'Flood Risk Area'. Therefore, no changes to the national assessment of Flood Risk Areas are proposed.

Glossary

Term	Definition
Aquifer	A source of groundwater comprising water bearing rock, sand or gravel capable of yielding significant quantities of water.
AMP	Asset Management Plan
Asset Management Plan	A plan for managing water and sewerage company (WaSC) infrastructure and other assets in order to deliver an agreed standard of service.
AStSWF	Areas Susceptible to Surface Water Flooding
Catchment Flood Management Plan	A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CFMP	Catchment Flood Management Plan
Civil Contingencies Act	This Act delivers a single framework for civil protection in the UK. As part of the Act, Local Resilience Forums must put into place emergency plans for a range of circumstances including flooding.
CLG	Government Department for Communities and Local Government
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Culvert	A channel or pipe that carries water below the level of the ground.
Defra	Department for Environment, Food and Rural Affairs
DEM	Digital Elevation Model
DG5 Register	A water-company held register of properties which have experienced sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DTM	Digital Terrain Model
EA	Environment Agency
Indicative Flood Risk Areas	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by Defra and WAG and the use of certain national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
FMfSW	Flood Map for Surface Water
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG.
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRR	Flood Risk Regulations
IDB	Internal Drainage Board
LDF	Local Development Framework
Lead Local Flood Authority	Local Authority responsible for taking the lead on local flood risk management
LiDAR	Light Detection and Ranging

Term	Definition
LLFA	Lead Local Flood Authority
Local Resilience Forum	A multi-agency forum, bringing together all the organisations that have a duty to cooperate under the Civil Contingencies Act, and those involved in responding to emergencies. They prepare emergency plans in a co-ordinated manner.
LPA	Local Planning Authority
LRF	Local Resilience Forum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs
Partner	A person or organisation with responsibility for the decision or actions that need to be taken.
PFRA	Preliminary Flood Risk Assessment
Pitt Review	Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.
Pluvial Flooding	Flooding from water flowing over the surface of the ground; often occurs when the soil is saturated and natural drainage channels or artificial drainage systems have insufficient capacity to cope with additional flow.
PPS25	Planning and Policy Statement 25: Development and Flood Risk
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Risk Management Authority	As defined by the Floods and Water Management Act
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems
Sustainable Drainage Systems	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Surface water	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
SWMP	Surface Water Management Plan
WaSC	Water and Sewerage Company

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1. Introduction

1.1 WHAT IS A PRELIMINARY FLOOD RISK ASSESSMENT?

- 1.1.1 A Preliminary Flood Risk Assessment (PFRA) is a high level screening exercise to identify areas of significant flood risk within a given study area. The PFRA process involves collecting information on past and future (potential) floods, assembling the information into a report and identifying Flood Risk Areas.
- 1.1.2 The Luton Borough Council PFRA provides a high level summary of significant flood risk, based on available and readily derivable information, describing both the probability and harmful consequences of past and future flooding. The development of new information is not required by the process, but new analysis of existing information may be needed.
- 1.1.3 This PFRA has been based on existing and readily available information and brings together information from a number of available sources such as the Environment Agency's national information (for example Flood Map for Surface Water) and existing local products such as Strategic Flood Risk Assessments (SFRAs) and Surface Water Management Plans (SWMPs).
- 1.1.4 The scope of the PFRA is to consider past flooding and potential future flooding from the sources of flooding **other than main rivers, the sea and reservoirs**. In particular this **includes surface runoff, groundwater and ordinary watercourses** and any interaction these have with other sources of flooding.
- 1.1.5 The key deliverables from the PFRA process are:
- PFRA Report - This document and associated appendices
 - PFRA Spreadsheet – A structured spreadsheet provided by the Environment Agency and populated with information relating to local flooding. It contains the following sections:
 - Annex 1: Records of past floods and their significant consequences
 - Annex 2: Records of future floods and their consequences
 - Annex 3: Records of Flood Risk Areas and their rationale
 - PFRA Checklist – A checklist completed by the Lead Local Flood Authority to ensure all aspects of the PFRA process have been covered (included as Appendix D of this document)
 - GIS layer of Flood Risk Area(s) – Only required where new Flood Risk Areas are proposed or indicative Flood Risk Areas are amended.

1.2 BACKGROUND

- 1.2.1 The primary driver behind the Preliminary Flood Risk Assessment is the Flood Risk Regulations 2009, which came into force on the 10th December 2009. The Regulations transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law in England and Wales and implement its provisions.
- 1.2.2 In particular the Regulations place duties on the Environment Agency and Local Lead Flood Authorities to prepare a number of documents including:
- Preliminary Flood Risk Assessments (to identify 'Flood Risk Areas')
 - Flood hazard and flood risk maps (for 'Flood Risk Areas' only)
 - Flood Risk Management Plans (for 'Flood Risk Areas' only)
- 1.2.3 The purpose of the Preliminary Flood Risk Assessment under the Regulations is to provide the evidence for identifying Flood Risk Areas. The report will also provide a useful reference point for all local flood risk management and inform local flood risk strategies.

1.3 OBJECTIVES

1.3.1 The key objectives of the PFRA are summarised as follows:

- Present information on past (historic) and future (potential) floods within the study area, allowing easy comparison and simple interpretation of information. and record it within the Preliminary Flood Risk Assessment Spreadsheet;
- Assemble the information into a Preliminary Flood Risk Assessment report;
- Review the Indicative Flood Risk Areas delineated by the Environment Agency and where necessary provide explanation and justification for any amendments required to the Indicative Flood Risk Areas;
- Provide a summary of the systems used for data sharing and storing and the provision for quality assurance, security and data licensing arrangements;
- Describe arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information;
- Identify relevant partner organisations involved in future assessment of flood risk; and summarise means for future and ongoing stakeholder engagement;
- Provide a useful reference point for all local flood risk management and inform future local strategies.

1.4 DESCRIPTION OF STUDY AREA

1.4.1 Luton is a large town located 30 miles north of London in southern Bedfordshire, bounded by the local authority areas of Central Bedfordshire to the north and west, Dacorum and St Albans to the south and North Hertfordshire to the east.

1.4.2 The River Lea originates in the Luton area from a natural spring at Leagrave in the north of the borough and includes the Houghton Brook and Lewsey Brook tributaries. Apart from the urban areas of Luton, Houghton Regis and Dunstable, the remaining parts of the catchment are predominantly used for arable farming on chalky soils on an unconfined chalk aquifer.

1.4.3 The topography of Luton generally slopes towards the River Lea which runs in a south easterly direction through the centre of the town. The highest elevations are in the north west and the lowest in the south east.

1.4.4 The geology of the study area consists of Chalk with the Lambeth Group along the north east and south west sides of the borough and Glaciofluvial Deposits along the river.

1.4.5 Thames Water is the sewerage undertakers within the Luton Borough Council area – but Anglian Water manages the areas of Dunstable and Houghton Regis immediately to the west with some interconnection with the Thames Water system in Luton.

2. LLFA Responsibilities

2.1 LEGISLATIVE BACKGROUND

- 2.1.1 The key drivers behind the Preliminary Flood Risk Assessment are two pieces of new legislation, the Flood Risk Regulations 2009 which came into force on the 10th December 2009, and the Flood & Water Management Act (FWMA) which gained Royal Assent on the 8th April 2010.
- 2.1.2 The Flood Risk Regulations 2009 was created to transpose the EC Floods Directive (Directive 2007/60/EC) into domestic law in England and Wales. The Floods Directive provides a framework to assess and manage flood risks in order to reduce adverse consequences for human health, the environment (including cultural heritage) and economic activity.
- 2.1.3 The Flood and Water Management Act 2010 makes specific provision for the recommendations made by Sir Michael Pitt in his independent review of the flooding experienced across much of England and Wales in 2007.
- 2.1.4 Under these pieces of legislation, all Unitary Authorities are designated 'Local Lead Flood Authorities' (LLFA) and have formally been allocated a number of key responsibilities with respect to local flood risk management.

2.2 LEADERSHIP & PARTNERSHIP

- 2.2.1 The Flood and Water Management Act 2010 defines the Lead Local Flood Authority (LLFA) for an area as the unitary authority for the area, in this case Luton Borough Council. As such, Luton Borough Council is responsible for leading local flood risk management including establishing effective partnerships with stakeholders such as the Environment Agency, Anglian Water and Thames Water, as well as others as required. This working arrangement has been formalised to ensure clear lines of communication, mutual co-operation and management through the provision of Level of Service via the Luton Surface Water Management Plan Memorandums of Understanding (MoU).
- 2.2.2 Luton has an active 'Flood Group'. It mainly comprises of Council Officers and representatives from the Environment Agency and Thames Water. The purpose of the Group is to ensure that flood risk is properly managed within Luton, by all those who have a responsibility for it.

2.3 STAKEHOLDER ENGAGEMENT

- 2.3.1 As part of the PFRA and parallel preparation of the SWMP for the area, Luton Borough Council has sought to engage stakeholders representing the following organisations and authorities.

- Environment Agency
- Anglian Water
- Thames Water
- Highways Agency
- Luton Airport
- Network Rail

- 2.3.2 Within Luton Borough Council, representatives from a number of departments and sectors have been engaged in the PFRA process including Climate Change Adaptation, Emergency Planning, Strategic Planning, Highways and Drainage.

2.4 PUBLIC ENGAGEMENT

- 2.4.1 Members of the public may also have valuable information to contribute to the PFRA, leading to a better understanding and improved management of local flood risk within the study area. Public engagement can significantly benefit local flood risk management including building trust, gaining access to additional local knowledge and increasing the chances of stakeholder acceptance of options and decisions proposed in future flood risk management strategies.
- 2.4.2 However, it is also important to ensure that future management options and actions are properly understood and costed before raising expectations of solutions which cannot reasonably be implemented.
- 2.4.3 It is recommended that Luton Borough Council follow the guidelines outlined in the Environment Agency's "Building Trust with Communities" which provides a useful process of how to communicate risk including the causes, probability and consequences to the general public and professional forums such as local resilience forums.

2.5 OTHER RESPONSIBILITIES

- 2.5.1 Aside from forging partnerships and coordinating and leading on local flood management, there are a number of other key responsibilities that have arisen for Local Lead Flood Authorities from the Flood & Water Management Act 2010, and the Flood Risk Regulations 2009. These responsibilities include:
- **Investigating flood incidents** – LLFAs have a duty to investigate and record details of significant flood events within their area. This duty includes identifying which authorities have flood risk management functions and what they have done or intend to do with respect to the incident, notifying risk management authorities where necessary and publishing the results of any investigations carried out.
 - **Asset Register** – LLFAs also have a duty to maintain a register of structures or features which are considered to have an effect on flood risk, including details of ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.
 - **SuDS Approving Body** – LLFAs are designated the SuDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SuDS) within their area that serve more than one property. This responsibility is anticipated to commence from April 2012.
 - **Flood risk management strategies** – LLFAs are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area. The local strategy will build upon information such as national risk assessments and will use consistent risk based approaches across different local authority areas and catchments.
 - **Works powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.
 - **Designation powers** – LLFAs, as well as district councils and the Environment Agency have powers to designate structures and features that affect flooding in order to safeguard assets that are relied upon for flood risk management.

3. Methodology and Data Review

3.1 DATA SOURCES & AVAILABILITY

3.1.1 Table 3.1 provides a summary of the data sources held by partner organisations and provides a description of the dataset and its availability at the time the PFRA was produced.

Table 3.1 Data Sources

Source	Dataset	Description
Environment Agency	Thames River Basin Management Plan	This plan deals with the pressures facing the water environment in this river basin district and the actions that will address them
	Thames Catchment Flood Management Plan and Luton Policy Unit	Summarises the scale and extent of flooding now and in the future, and set policies for managing flood risk within the catchment.
	River Lee – Modelling and Mapping reports and outputs	Detailed river modelling and related results for the upper Lee River.
	Environment Agency Flood Map (Flood Zones)	Shows extent of flooding from rivers with a catchment during a 1% AEP (1 in 100yr) flood and 0.1% AEP (1 in 1000yr) flood. Shows extent of flooding from the sea during 0.5% AEP (1 in 200yr) and 0.1% AEP (1 in 1000yr) flood events. Ignores the presence of defences.
	Areas Susceptible to Surface Water Flooding	A national outline of surface water flooding held by the EA and developed in response to the Pitt recommendations.
	Flood Map for Surface Water	A second generation of surface water flood mapping which was released at the end of 2010.
	Areas Susceptible to Groundwater Flooding	Mapping showing areas susceptible to groundwater flooding.
	Groundwater Flooding Incidents	Records of historic incidents of groundwater flooding as recorded by the Environment Agency.
	National Receptors Dataset	A nationally consistent dataset of social, economic, environmental and cultural receptors including residential properties, schools, hospitals, transport infrastructure and electricity substations.
	Historic Flood Outline	Attributed spatial flood extent data for flooding from all sources.
	Rainfall Data	Locations of rain gauges and rainfall data for period 2000-2010
	Flood Defences	Flood defences and structures in Luton
	Luton Flood Risk Management Strategy	Sustainable management of fluvial flood risk over the next 100years
	Luton Flood Risk Management Strategy - Strategic Environmental Assessment Report	
	Vale of St. Albans Numerical Groundwater Model Final Report (Feb 2010)	Groundwater modelling investigation, primarily developed to address specific abstraction related low flow issues

Source	Dataset	Description
Luton BC	Level 1 - Strategic Flood Risk Assessment (SFRA)	SFRAs contain useful information on historic flooding, including local sources of flooding from surface water and groundwater.
	Anecdotal information relating to local flood history and flood risk areas	Anecdotal information from council officers regarding areas known to be susceptible to flooding from excessive surface water, groundwater or flooding from ordinary watercourses.
	Water Cycle Strategy – Luton and South Bedfordshire: Phases 1 and 2	Details the water cycle related actions and infrastructure needed to facilitate planned growth in the Luton and South Bedfordshire Growth Area
	Surface Water Management Plan (In Progress)	At the time of preparing this assessment, the Surface Water Management Plan is in progress. Outputs from Phase 2 of the study (Risk Assessment) have been used to assess Future Flood Risk as detailed in Section 5.0.
Anglian / Thames Water	DG5 Records (Thames Only)	Register of properties flooded by the sewer system over the past 10 years to a four digit postcode accuracy.
	Drainage Assets (Both)	GIS dataset providing the georeferenced location of sewer pipes, pumping stations, manhole locations and discharge locations
Highways Agency	Drainage Assets	GIS dataset of drainage assets
	Highways network flood risk assessment	GIS layer showing network vulnerability to flooding (primarily the M1 in the Luton area)
Bedfordshire Fire Brigade	Flood Incidents	Spreadsheet converted to GIS layer of flood incidents April 2009 – October 2010
Luton Airport	Flood Risk Assessment	Asset performance report relating to surface water flood risk
British Geological Survey (BGS)	Geological Indicators of Flooding	This data characterises superficial deposits in terms of their likely susceptibility to flooding, either from coastal inundation or fluvial (inland) water flow.
	Susceptibility to Groundwater Flooding	Based on geological and hydrogeological information, this data can be used to identify areas where geological conditions could enable groundwater flooding to occur or where groundwater may come close to the surface

3.2 LIMITATIONS

Records of Past Floods

- 3.2.1 The most significant data gap across Luton Borough Council relates to records of past 'local' flooding incidents. This is a common issue across the UK as record keeping of past floods has historically focussed on flooding from rivers or the sea. Recording of past incidents of surface water, sewer, groundwater or ordinary watercourse flooding have been inconsistent.

3.2.2 Thames Water have provided post code-linked data (DG5 register) on records of sewer flooding, however more detailed data on the location and cause of sewer flooding is not currently available. Anglian Water had not supplied this equivalent data at the time of this assessment.

3.2.3 Some incidents have been digitised into GIS from anecdotal evidence provided by Luton Borough Council officers, however there is very little information on the probability, hazard or consequence of flooding.

Future Groundwater Flooding

3.2.4 Groundwater flooding is dependent on local variations in topography, geology and soils. The causes of groundwater flooding are generally understood however it is difficult to predict the actual location, timing and extent of groundwater flooding without comprehensive datasets.

3.2.5 There is a lack of reliable measured datasets to undertake flood frequency analysis and even with datasets this analysis is complicated due to the non-independence of groundwater level data. Surface water flooding incidents are sometimes mistaken for groundwater flooding incidents. An example of this is where surface water runoff infiltrates soils locally and then seeps from an embankment, giving the appearance of locally high groundwater levels.

Future Surface Water Flooding

3.2.6 The Environment Agency data sets 'Areas Susceptible to Surface Water Flooding' and second generation 'Flood Map for Surface Water' are national scale assessments suitable for broadly identifying surface water flood risk. The datasets are of a resolution suitable for the PFRA, however are limited in their use in addressing the next stages of the Flood Risk Regulations (2009) if they are required.

3.3 SECURITY, LICENSING AND USE RESTRICTIONS

3.3.1 A number of datasets used in the preparation of this PFRA are subject to licensing agreements and use restrictions.

3.3.2 The following national datasets provided by the Environment Agency are available to lead local flood authorities for local decision making:

- EA Flood Zone Map
- Areas Susceptible to Surface Water Flooding
- Flood Map for Surface Water
- National Receptor Database

3.3.3 A number of the data sources used are publicly available documents, such as:

- Strategic Flood Risk Assessment
- Water Cycle Strategy
- Climate Change Action Plan
- Catchment Flood Management Plan
- Surface Water Management Plan

3.3.4 The use of some of the datasets made available for this PFRA has been restricted. These include:

- All Highways Agency and BGS data
- Records of property flooding held by the Council and Thames Water
- Luton Airport Surface Water Flood Risk Assessment

3.3.5 All necessary precautions have been taken to ensure that all information given to third parties is treated as confidential. The information has not be used for anything other than the purpose stated in the agreement. No information has been copied, reproduced or reduced to writing, other than what is necessary for the purpose stated in the agreement.

3.4 QUALITY ASSURANCE

3.4.1 All data received was subject to quality assurance measures to monitor and record the quality and accuracy of the data and information. A data quality score was given to all the data which is a qualitative assessment based on the Data Quality System provided in the SWMP Technical Guidance (March 2010). This system is explained in Table 3.2.

Table 3.2 Data Quality System (SWMP Technical Guidance March 2010)

Data Quality Score	Description	Explanations	Example
1	Best available	No better available; not possible to improve in the near future	2D Pluvial Modelling Outputs
2	Data with known deficiencies	Best replaced as soon as new data is available	Historic Flood Records
3	Gross assumptions	Not invented but based on experience and judgement	Location, extent and depth of surface water flooding
4	Heroic assumptions	An educated guess	Impact of a historic flood event

3.4.2 The use of this system provides a basis for analysing and monitoring the quality of data that is being collected and used in the preparation of the PFRA. As mentioned in Section 3.2, some of the datasets collected for this PFRA were of poor quality, and this has been identified and recorded using this system.

4. Past Flood Risk

4.1 SUMMARY OF PAST FLOODS

4.1.1 Table 4.1 provides a summary of the flooding recorded in locations in Luton, which are known to be from surface water, sewer or groundwater sources. Records in Table 4.1 are based on more than one reported incidence of flooding on a particular day, however as identified in Section 3.2, it does not necessarily represent every flooding incident in the Luton area.

4.1.2 There is very little reliable information available on the consequences of each of the flood events in Table 4.1; therefore there is no certainty in being able to classify the majority of them as having "significant harmful consequences", as required by the Flood Risk Regulations. The locally determined definition of "significant harmful consequences" for Luton Borough Council is included in Section 4.2. Records with sufficient information to be classified as 'significant' are highlighted in ***bold italics*** and further information has been included in Annex 1 of the PFRA Spreadsheet.

Table 4.1 Past Floods and Consequences

Date	Main source of flooding	Description	Data Source	Significant harmful consequences?*
<i>July/August 1980</i>	<i>Surface Water</i>	<i>Various flood locations throughout Luton ranging from 200mm to 750mm deep. Locations are shown on Figure A-1. Consequences included flooding of more than 100 buildings including private houses, businesses and the rear part of the Town Hall (Grade II Listed Building)</i>	<i>LBC Council Officers</i>	<i>Yes (Grade II Listed Building and >12 properties flooded)</i>
Pre-2005	Main River	<ul style="list-style-type: none"> The Toddington Road area to the west of the railway near Leagrave Common flooded significantly in July 1959 (prior to installation of additional culverts under Toddington Road), June 1966, June and August 1984 and July 2005 The New Bedford Road, adjacent to Mill Stream to the south of Wardown Park in Luton, flooded significantly in November 1963, June and December 1966, June 1967, September 1968, June and August 1984, September and October 1987, May 1992 and September 1998; Other areas of Luton such as Runfold Avenue, Midhurst Gardens, Wardown Park and Villa Road also flooded during the larger events of June 1966, September 1968, June and August 1984 and May 1992 	Luton Flood Risk Management Strategy	Unknown (detailed information on events not available)
23/05/2005	Surface Water	Heavy rain caused part of the ceiling to collapse at St. Matthews junior school. School closed for one day.	LCLIP	No
28/06/2005	Main River – River Lea	Out of bank flow as a result of backing up due to a tight bend in the River Lea downstream of Midhurst Gardens. Flooding from Houghton Brook affected	SFRA	Unknown (detailed information on event not available)

Date	Main source of flooding	Description	Data Source	Significant harmful consequences?*
		internal areas of properties at The Hedgerow.		
04/09/2005	Main River / Surface Water	Lewsey Farm and Pastures Way under 600mm of water, 8.9mm rain fell over 3.3 hrs. Damage to housing, resident's cars and insurance pay-outs.	LCLIP	Unknown (detailed information on event not available)
04/07/2006	Surface Water	Hail, lightning, flash floods and a twister hit the Luton area. 27.3mm rain fell over 2hr period. Damage to possessions (£1000's worth of damage) damage to shops and buildings, closure of Luton indoor market for half a day, flooding at the L&D hospital	LCLIP	Yes (flooding of critical infrastructure)
01/03/2007	Groundwater	Underground spring affecting the street and local gardens	SFRA	Unknown (detailed information on event not available)
25/05/2007 to 28/05/2007	Surface Water	At the recording station in Luton, close to the Stockingstone Road roundabout on the A6, 99.5mm of rain fell during the downpour, of which 87.1mm fell on Sunday alone, making this the wettest individual day ever recorded in the town, and the wettest day anywhere in Bedfordshire since 1992. Major travel disruption with flooding on main routes in Luton transport network (including New Bedford Road) and in Wardown Park. Flooding caused cancellation of Luton Carnival costing the council over £300,000 and loss of more than 100,000 visitors to the area.	LCLIP / BBC	Yes (Flooded Wardown Park and New Bedford Road)
27/05/2007	Main River	Flooding from the River Lea resulted in minor out of bank flooding at the downstream end of Wardown Park (estimated to be between 2% AEP and 1% AEP rainfall event)	SFRA	Yes (Flooded Wardown Park)
20/07/2007	Groundwater	None available	SFRA	Unknown (detailed information on event not available)
20/07/2007	Surface Water	30mm rain over 45 minutes was recorded. Several roads flooded (inc Airport Way); people trapped in cars. Lloyds TSB in George St 1m water. Only 2 trains/h on the Bedford to Brighton line.	LCLIP	Yes (Airport Way flooded)
Various	Surface Water	A summary of known repeat problem locations created by Council Officers is shown in Figure A-1. Issues at each of these locations are generally related to minor road flooding or flooding of between 1 and 5 properties.	LBC Council Officers	No

* Refer Section 4.2 for definition of 'Significant Harmful Consequences'

4.1.3 The complete available record of known and recorded flooding incidents in Luton are shown on the following figures in Appendix A:

- A-1 Surface Water Flooding Incidents
- A-2 Main River / Fluvial Incidents
- A-3 Groundwater Flooding Incidents
- A-4 Sewer Flooding Incidents

4.2 SIGNIFICANT HARMFUL CONSEQUENCES

4.2.1 National guidance issued by Defra sets thresholds for defining areas where the flood is significant. However, no guidance has been issued for defining 'locally significant harmful consequences' and it is up to each LLFA to set its own definition. It has been suggested by the Environment Agency that the threshold should be an order of magnitude below the significance criteria for determining flood risk areas.

4.2.2 Following the Environment Agency advice, Luton Borough Council has defined 'locally significant harmful consequences' of flooding as:

- 1) caused internal flooding to twelve or more residential properties, or
- 2) flooded one or more items of critical infrastructure, or
- 3) flooded three or more business premises, or
- 4) caused a major transport link to be totally impassable or inaccessible, or
- 5) flooded one or more of the following nationally important heritage features:
 - Wauluds Bank Scheduled monument,
 - Parish Church of St Marys Grade I listed building,
 - Specified Grade II listed buildings (refer Appendix E for list),
 - Wardown Park Registered park and garden, or
- 6) flooded parts of Plaiters Lea or Town Centre Conservation Areas,

4.2.3 A full definition of the LBC 'locally significant harmful consequences' of flooding can be found in Appendix E.

4.2.4 Available data on historic flooding in Luton has been assembled into a standardised GIS data record as part of the project to assist with consistent and suitably detailed recording of future flooding incidents for the next cycle of the Flood Risk Regulations.

4.3 INTERACTIONS WITH OTHER FLOODING SOURCES

4.3.1 Flooding is often the result of water from more than one source, or water building up because another source (such as a river) has prevented it from discharging normally. Information about past flooding can often be from an unknown source (i.e. it is not clear where the water came from), or flooding as a result of interactions between sources (in which case more than one source may be recorded).

4.3.2 Where flood records within the study area are known to be from more than one flood source, this has been recorded in the Preliminary Flood Risk Assessment spreadsheet. Where the source of flooding is not known this has also been recorded.

5. Future Flood Risk

5.1 NATIONAL INFORMATION ON FUTURE FLOOD RISK

5.1.1 Information about future flood risk, or potential flooding, is usually produced by computer models. The Environment Agency has several national datasets showing risk of flooding from surface water, groundwater, main rivers and ordinary watercourses that are available to LLFAs (listed below). These four national datasets were reviewed along side relevant local flood risk information as part of this assessment to determine the most appropriate source of surface water flood risk information in the Luton Borough Council area. The outcome of this review is summarised below.

- Areas Susceptible to Surface Water Flooding (AStSWF) and Flood Map for Surface Water (FMfSW) - 'Intermediate' Assessment undertaken as part of the Surface Water Management Plan (SWMP) provides a high confidence source of future flood risk information (refer Section 5.2). The SWMP risk assessment will be used as the 'local information' as it forms a higher confidence representation of local conditions when compared to the two EA datasets.
- Areas Susceptible to Groundwater Flooding – The groundwater flood risk assessment undertaken as part of the SWMP has reviewed the British Geological Society (BGS) 'Susceptibility to Groundwater Flooding' dataset. The BGS data is of higher resolution than the EA dataset and will therefore be used as the 'local information' (refer Section 5.2).
- Flood Zone Map – This dataset shows predicted future flooding from Main Rivers. Data will be used to assess the influence of Main River flooding on future local surface water flooding.

5.1.2 None of the national EA datasets will be used as 'locally agreed surface water information'.

5.2 LOCALLY AGREED SURFACE WATER INFORMATION

Surface Water and Ordinary Watercourses

5.2.1 Luton Borough Council is in the process of completing a Surface Water Management Plan (SWMP). As part of this study, direct rainfall modelling has been undertaken to simulate surface water flooding in the study area.

5.2.2 Figures B-1 and B-2 included in Appendix B show the results from this modelling for the 1 in 100 year return period rainfall event. Figure B-1 shows the Maximum Flood Depth and Figure B-2 shows the Flood Hazard Rating and general Flow Direction. Figures B-3 and B-4 show the same outputs for the 1 in 200 year return period rainfall event.

5.2.3 For a full methodology, the reader is referred to the Surface Water Management Plan for Luton. A summary of the methodology and possible harmful consequences are shown in Table 5.1. Details of the consequences of future surface water and ordinary watercourse flooding are included in Annex 2 of the PFRA Spreadsheet.

5.2.4 The direct rainfall modelling undertaken for the SWMP represents an improvement on the existing national data sets (e.g. Flood Map for Surface Water) and has therefore been used as the primary dataset to determine the significance of flooding from surface water and ordinary watercourses.

Groundwater

5.2.5 To supplement the national dataset provided, LBC has purchased a licence to access the British Geological Society (BGS) 'Susceptibility to Groundwater Flooding' dataset.

5.2.6 While this product is not defined as a 'risk' map and does not have a probability of occurrence associated with it, it does provide the best available background information for groundwater flooding hazard in the Luton area. This dataset has been determined to be the most appropriate locally agreed information for groundwater flooding and is mapped in Figure B-5.

5.2.7 Potential consequences of future groundwater flooding are summarised in Table 5.1 and further details are included in Annex 2 of the PFRA Spreadsheet.

Table 5.1 Summary of Potential Future Flood Risk

Main source of flooding	Probability	Description	Data Source	Significant consequences?
Surface Water / Ordinary Watercourses	1 in 30	'Intermediate Assessment' in accordance with Defra SWMP Technical Guidance. Topography is derived from EA LIDAR around the urban areas (2m grid; original accuracy $\pm 0.15\text{m}$) and Photogrammetry data (5m grid; original accuracy $\pm 1.5\text{m}$), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges. 100mm upstand created for all buildings (above average ground level) to represent floor levels and preferential flow around buildings.	SWMP Direct rainfall modelling	Yes – More than 12 residential properties at risk of flooding for all modelled events
	1 in 75			
	1 in 100			
	1 in 100 (plus climate change)			
	1 in 200			
Groundwater	Not Applicable	Based on geological and hydrogeological information, this data can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.	BGS - Susceptibility to groundwater flooding	Yes – The town centre area of Luton is identified as having 'Very high' susceptibility to groundwater flooding.

5.2.8 Information on the probability and consequences of future sewer flooding, based on detailed modelling of the sewer network, is not available for this PFRA.

5.2.9 Assessment of flood risk originating from Main Rivers for the purposes of the PFRA process is being undertaken at a catchment wide scale by the Environment Agency. No further assessment of flooding from main rivers has been undertaken as part of the Luton Borough Council PFRA.

5.2.10 Detailed records of future floods and their potential consequences are included in Annex 2 of the PFRA Spreadsheet.

5.3 IMPACT OF CLIMATE CHANGE

The Evidence

5.3.1 There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

5.3.2 Over the past century around the UK we have seen sea level rise and more of our winter rain falling 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.

5.3.3 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.

- 5.3.4 We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty 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%.

Key Projections for Thames River Basin District

- 5.3.5 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%)
 - Relative sea level at Sheerness very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
 - Peak river flows in a typical catchment likely to increase between 8 and 18%

Implications for Flood Risk

- 5.3.6 Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.
- 5.3.7 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, so we need to be prepared for the unexpected.
- 5.3.8 Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses.
- 5.3.9 There is a risk of flooding from groundwater-bearing chalk and limestone aquifers across the district. Recharge may increase in wetter winters, or decrease in drier summers.
- 5.3.10 Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

Local Impacts of Climate Change

- 5.3.11 The pluvial modelling completed for the Surface Water Management Plan for Luton included a model scenario with an allowance for climate change over the next 100 years by increasing rainfall intensity by 30%. As noted in Section 5.2, the outputs from this SWMP study make up the 'Locally Agreed Surface Water Information'.

Adapting to Change

- 5.3.12 Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare 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.

5.3.13 Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

5.4 MAJOR DEVELOPMENTS

5.4.1 The Local Development Framework (LDF) Core Strategy for Luton and Southern Bedfordshire identifies two 'sustainable urban extension' areas and one employment area around the periphery of the Luton Borough Council area. While these potential development areas are not specifically within the Luton boundary, they will still influence surface water flooding within the Luton area. The potential development areas are identified as:

- North Luton Strategic Site Specific Allocation (Undeveloped area to north of Marsh Farm and Bramingham Park)
- North Houghton Regis Strategic Site Specific Allocation (Undeveloped area to north of Houghton Park and Houghton Regis)
- East of London Luton Airport (potential employment area)

5.4.2 In each instance an Area Action Plan will be produced to provide further guidance on how development should be brought forward.

5.4.3 These potential developments, along with planned regeneration of the Luton Town Centre area, offer the opportunity to reduce flood risk in 'critical drainage areas' identified in the Surface Water Management Plan, as well as the potential to exacerbate existing problems.

5.5 LONG TERM DEVELOPMENTS

5.5.1 It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

5.5.2 In England, 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."*

5.5.3 Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

6. Review of Indicative Flood Risk Areas

6.1 EXTENT OF FLOOD RISK AREAS

- 6.1.1 Review of the Indicative Flood Risk Areas provided by the Environment Agency (Appendix C) shows that Luton Borough does not fall within nor is directly associated with the nationally defined Indicative Flood Risk Areas.
- 6.1.2 Following review of Locally Agreed Surface Water Information using the 'Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding' Guidance (Defra / WAG, 2010) there is no evidence to suggested that Luton Borough should be considered as a Flood Risk Area.
- 6.1.3 No further action has been undertaken in relation to this aspect of the PFRA.

7. Identification of Flood Risk Areas

7.1 AMENDMENTS TO FLOOD RISK AREAS / NEW FLOOD RISK AREAS

7.1.1 Locally available flood risk information does not provide sufficient evidence to create a flood risk area using the Defra / WAG (2010) criteria or amend an indicative flood risk area boundary.

7.1.2 No further action has been undertaken in relation to this aspect of the PFRA and Annex 3 of the PFRA Spreadsheet has been left intentionally blank.

8. Next Steps

8.1 SCRUTINY & REVIEW

8.1.1 Before the PFRA can be formally issued, Luton Borough Council is required to review and approve the document in accordance with their own internal processes, such as consideration by Executive, Cabinet, Council or an overview and scrutiny committee. Table 8.1 sets out the scrutiny process for Luton Borough Council.

Table 8.1 Luton BC Review Process

Stage	Requirements
1	Preparation of the PFRA by Capita Symonds
2	Review by Luton BC representative
3	Preparation of <i>Summary Executive Report</i> by Luton BC representative
4	Submission of <i>Summary Executive Report</i> and <i>PFRA</i> to portfolio holder
5	Review by executive and approval or amendments proposed
6	Finalise PFRA and final executive approval
7	Issue of PFRA to the Environment Agency for review

8.2 DATA COLLECTION AND MANAGEMENT

8.2.1 As identified in Section 3.2, a number of data gaps have been identified that limit the capacity to accurately summarise the risk of flooding in Luton from 'local' sources.

8.2.2 Key activities that could assist with addressing these gaps prior to the next round of PFRAs in 2017:

- Investigation and recording of significant past flooding incidents (as discussed below);
- Refining of the direct rainfall modelling in critical drainage areas to improve the understanding of flood mechanisms and flood hazard, and therefore whether the consequences of future flooding in these areas should be classified as significant;
- Work in partnership with flood risk management organisations (e.g. Anglian Water, Thames Water and the Environment Agency) to refine and share information on main river flooding, groundwater flooding and sewer flooding;

8.3 INCIDENT RECORDING

8.3.1 Luton Borough Council proposes to implement a system for recording local flood incidents across the borough. Where notification is given by the public or by another body, regarding flooding these will be recorded in a database developed through the Surface Water Management Plan.

8.4 OTHER FRR REQUIREMENTS

8.4.1 As Luton Borough Council is not within a Flood Risk Area, the Flood Risk Regulations relating to Flood Risk and Hazard Mapping and preparation of the Flood Risk Management Plan are not applicable.

8.4.2 The next action undertaken by Luton Borough Council in response to the Flood Risk Regulations will be preparation of a revised PFRA in 2017.

8.5 LOCAL FLOOD RISK MANAGEMENT

8.5.1 In response to the Flood and Water Management Act, Luton Borough Council plans to continue development of its Surface Water Management Plan and use the subsequent outputs to inform and shape its Local Flood Risk Management Strategy.

9. References

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- Environment Agency (March 2011) Preliminary Flood Risk Assessment (PFRA) Annexes to the Final Guidance, Report GEHO1210BTHF-E-E
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- Environment Agency (2010) Luton Flood Risk Management Strategy
- Environment Agency (2010) Luton Flood Risk Management Strategy – Strategic Environmental Assessment Report
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- Environment Agency (2009) Thames Catchment Flood Management Plan
- Luton Borough Council and South Bedfordshire District Council (2008) Level 1 Strategic Flood Risk Assessment
- Luton and South Bedfordshire Joint Committee (2010) Water Cycle Strategy Phase 2 – Final Technical Report
- Luton Borough Council (2008) Local Climate Impacts Profile (Summary of Extreme Weather Events from 2004 to 2008)
- Luton Borough Council (2010) Climate Change Adaptation Action Plan
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[<http://www.shapeyourfuture.org.uk/>] Accessed on 11 May 2011.
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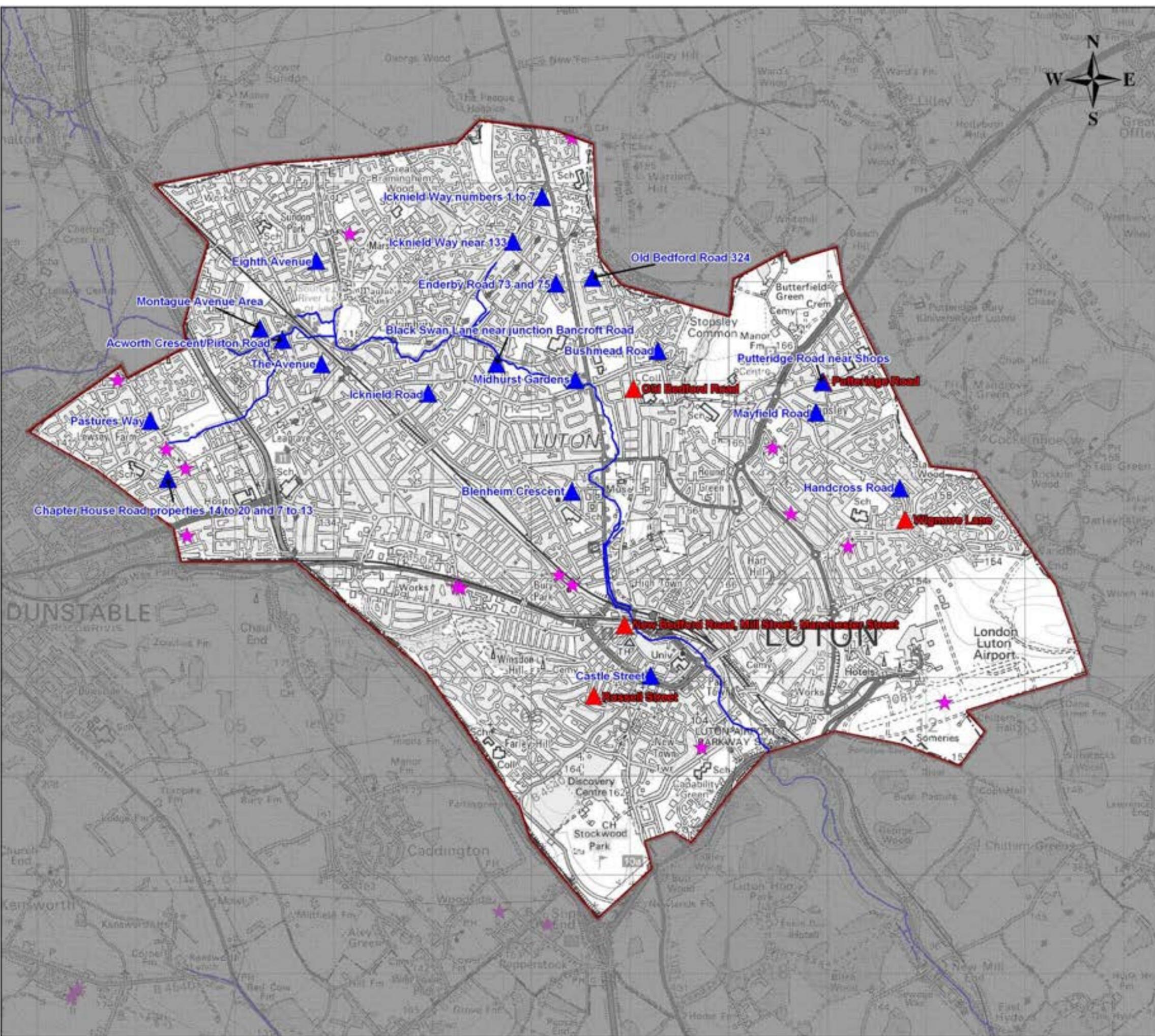
Appendix A Past Floods

Figure A-1 Surface Water Flooding Incidents

Figure A-2 Main River / Fluvial Flooding Incidents

Figure A-3 Groundwater Flooding Incidents

Figure A-4 Sewer Flooding Incidents



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- ▲ Luton Borough Council Highways Maintenance Known Flood Sites (Unresolved)
- ▲ Luton Borough Council Highways Maintenance July/ August 1980 Flood Incidents
- ★ Bedfordshire Fire Brigade Callouts for 'Weather Related Flooding' (April 2009 to October 2010)

Notes

Luton Borough Council
Luton
Preliminary Flood Risk Assessment

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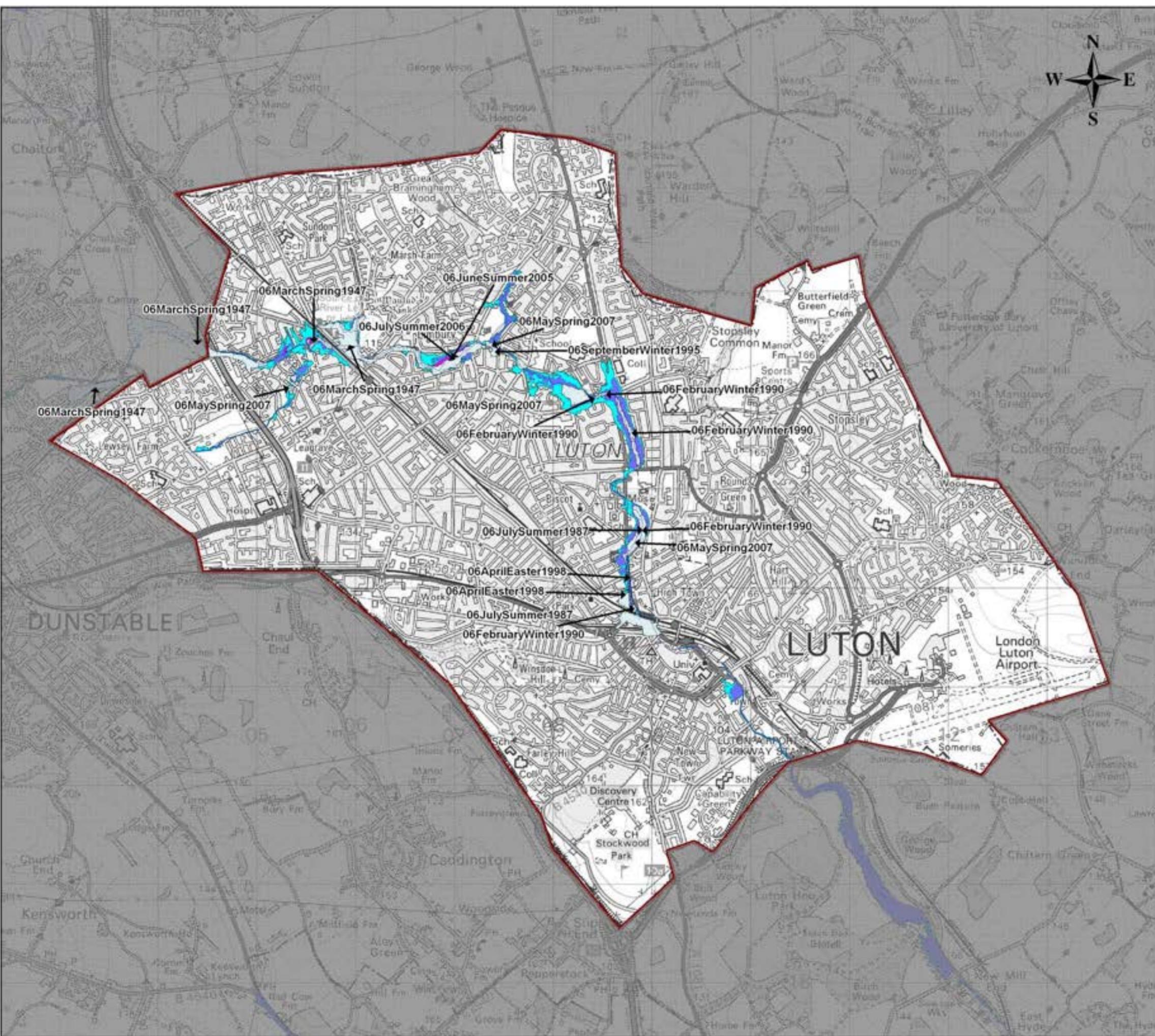
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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Summary Map of Past Floods
Surface Water Incidents

Consultant
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE A1



Legend

-  Luton Borough Council Boundary
-  Main River
-  Ordinary Watercourse
-  Environment Agency Historic Flood Map Known Flooding from Rivers
-  Environment Agency Historic Flood Extents
-  Environment Agency Flood Zone 3
-  Environment Agency Flood Zone 2

Notes

1. Environment Agency Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding.
2. Environment Agency Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.

Luton Borough Council
Luton

Preliminary Flood Risk Assessment

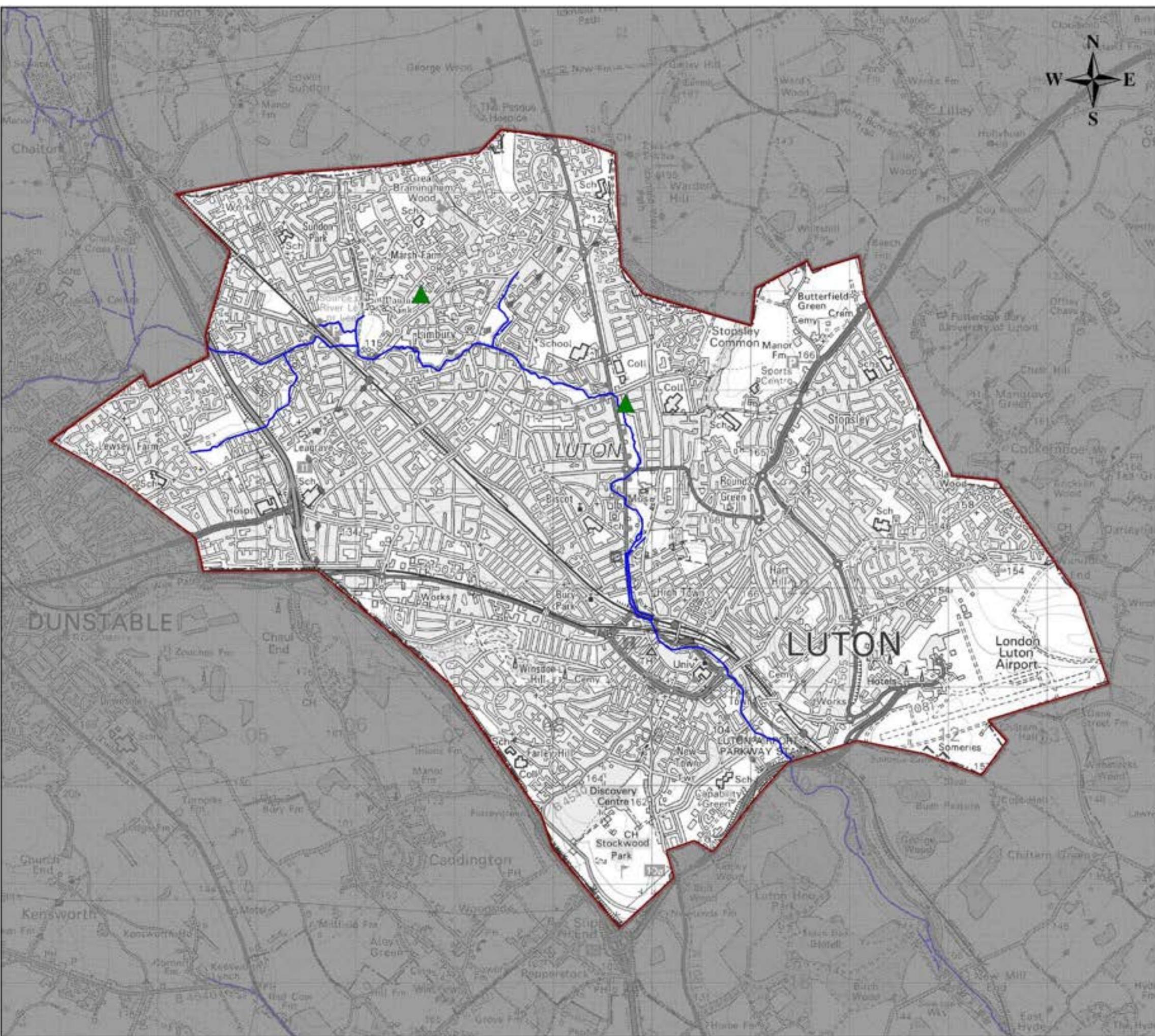
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Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**Summary Map of Past Floods
Main River/ Fluvial**

Consultant CAPITA SYMONDS Flood Risk Management	Capita Symonds Level Seven, 52 Grosvenor Gardens, Belgravia, London SW1W 0AU
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FIGURE A2



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- ▲ Environment Agency Groundwater Incident



Notes

Luton Borough Council
Luton
Preliminary Flood Risk Assessment

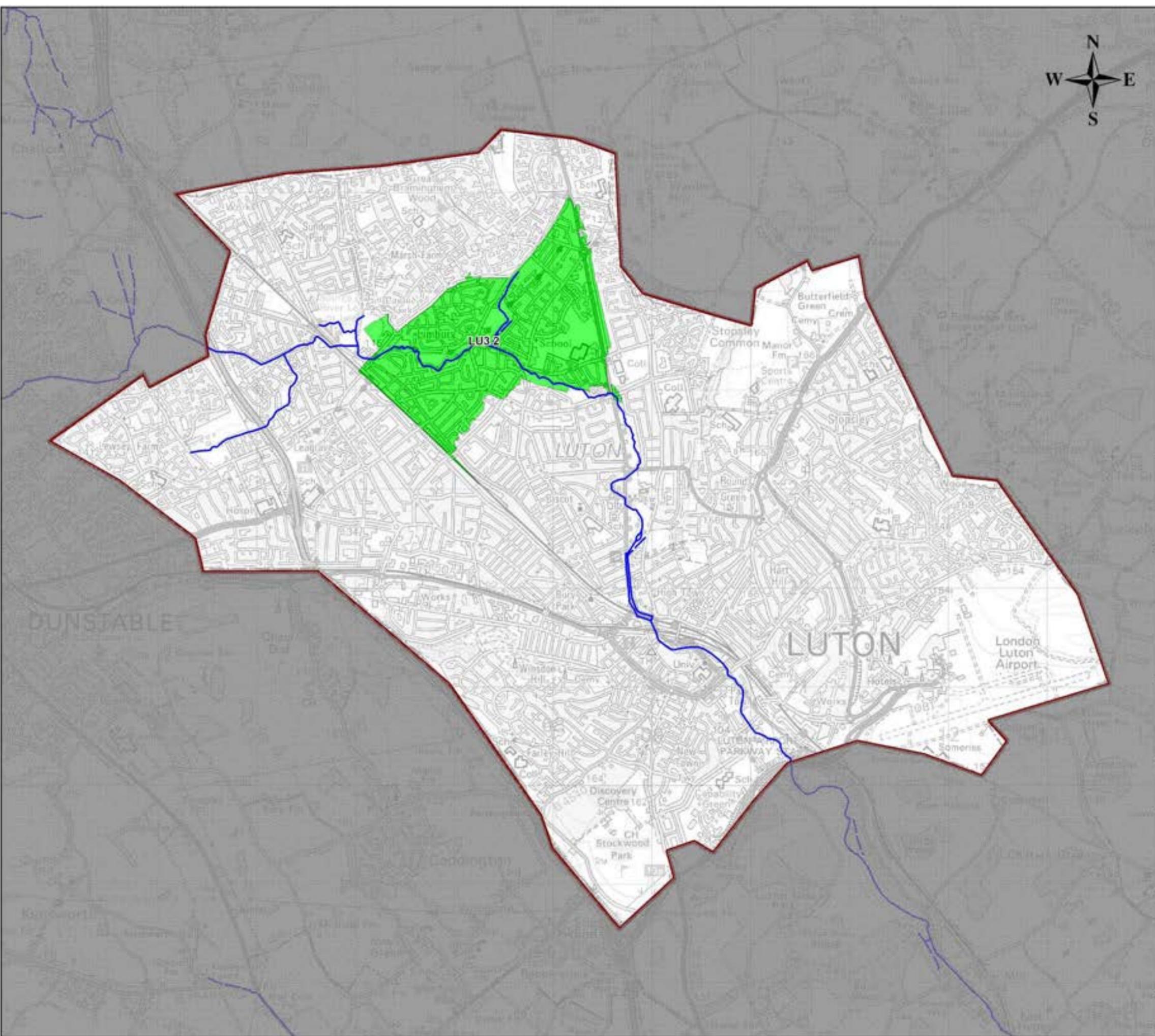
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Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**Summary Map of Past Floods
Groundwater Incidents**

Consultant CAPITA SYMONDS Flood Risk Management	Capita Symonds Level Seven, 52 Grosvenor Gardens, Belgravia, London SW1W 0AU
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FIGURE A3



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse

No. of Sewer Flood Records

- None
- 1 - 5
- 6 - 10
- 11 - 20
- 21 - 100
- 51 - 100
- 100+

Notes

1. Sewer flood records relate to internal and external flooding of properties
2. Data supplied by Thames Water Ltd and is correct as at June 2010

Luton Borough Council
Luton
Preliminary Flood Risk Assessment

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Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**Summary Map of Past Floods
Sewer Incidents**

Consultant
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE A4

Appendix B Future Floods

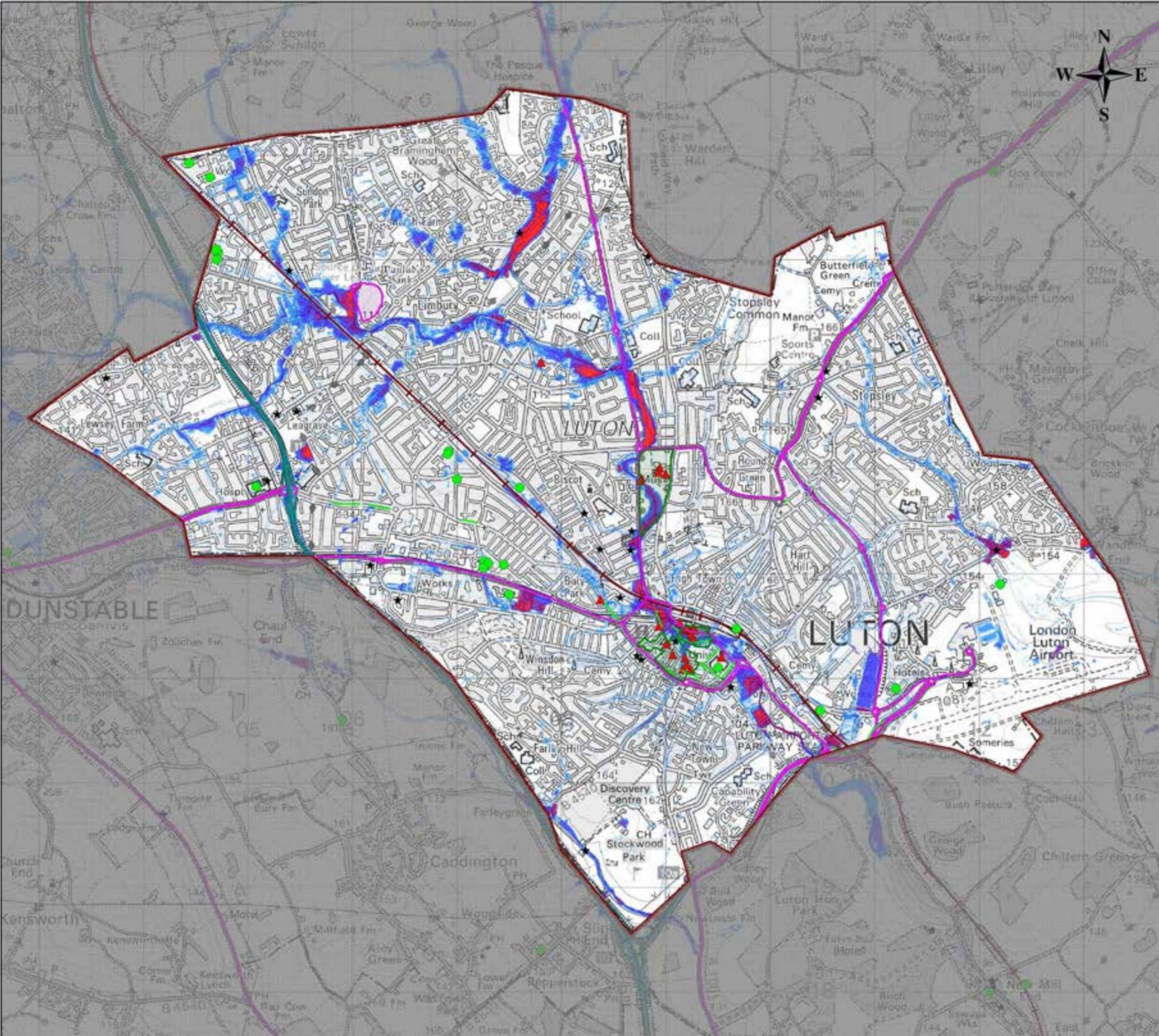
Figure B-1 Maximum Flood Depth – 1 in 100yr Rainfall Event plus Climate Change

Figure B-2 Flood Hazard & Flow Direction – 1 in 100yr Rainfall Event plus Climate Change

Figure B-3 Maximum Flood Depth – 1 in 200yr Rainfall Event

Figure B-4 Flood Hazard & Flow Direction – 1 in 200yr Rainfall Event

Figure B-5 Susceptibility to Groundwater Flooding Map



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- Motorway
- A Road
- Scheduled Monument
- Conservation Area
- ★ Critical Infrastructure
- ▲ Grade I and II Listed Buildings
- Utilities
- Railway
- Bus Lane

Flood Depth

 < 0.1m	 0.5m - 1.0m
 0.1m - 0.25m	 1.0m - 1.5m
 0.25m - 0.5m	 > 1.5m

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.

Luton Borough Council
Luton
Preliminary Flood Risk Assessment

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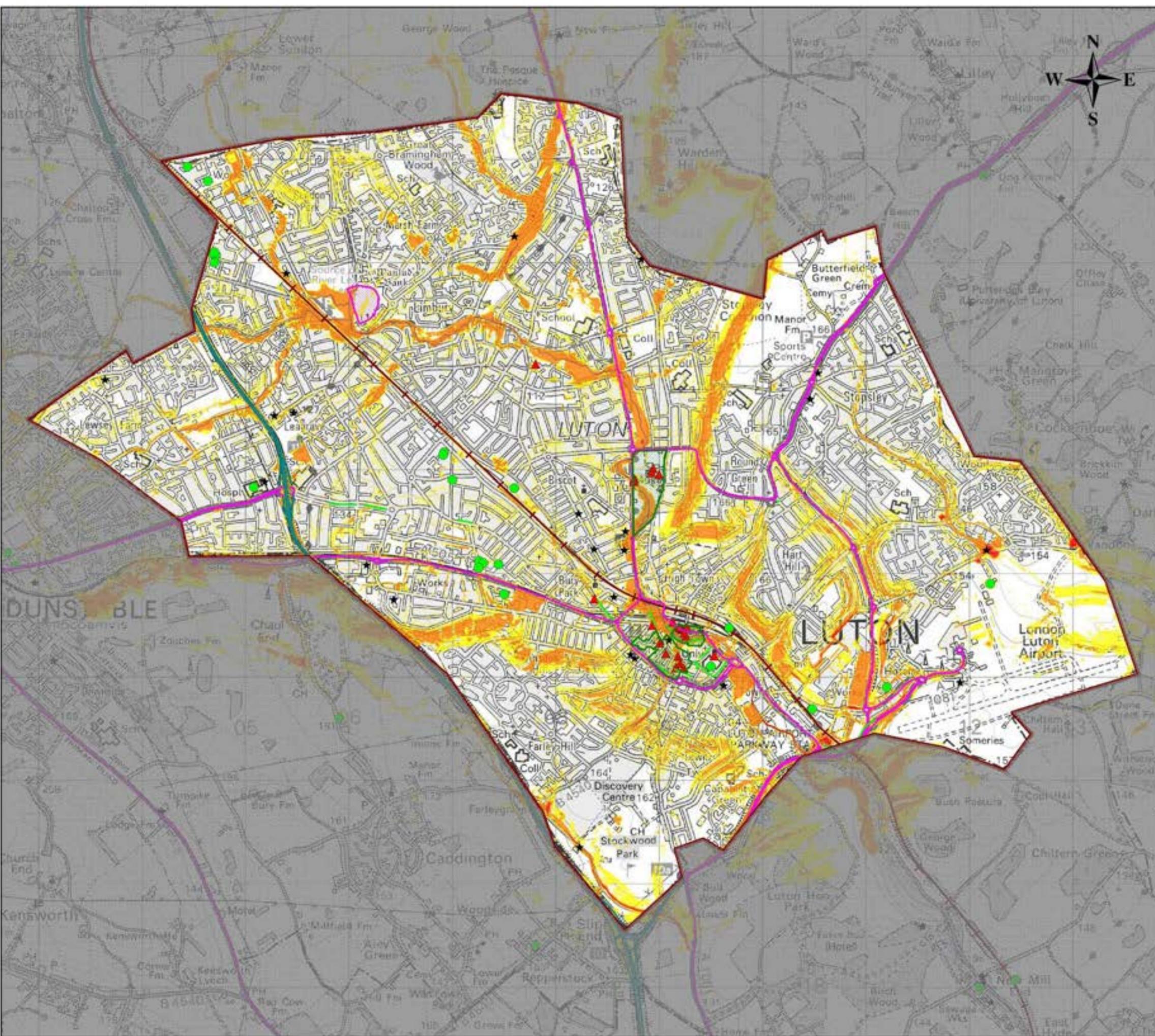
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**1 in 100 Year Rainfall Event
 Plus Climate Change
 Flood Depth Grid**

Consultant
 CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE B1



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- Motorway
- A Road
- Scheduled Monument
- Conservation Area
- ★ Critical Infrastructure
- ▲ Grade I and II Listed Buildings
- Utilities

Flood Hazard

- Caution (Very Low Hazard)
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

Notes

1. This map only shows the predicted likelihood of surface water flooding (this includes flooding from sewers, drains, small watercourses and ditches that occurs in heavy rainfall) for defined areas, and due to the coarse nature of the source data used, are not detailed enough to account for precise addresses.
2. Flood Hazard has been defined based upon the joint EA and Defra R&D Technical Report FD2320 (January 2006).
3. Degree of flood hazard can be interpreted as follows:
 - Caution: Flood zone with shallow flowing water or deep standing water
 - Moderate: Flood zone with deep or fast flowing water. Dangerous for children, the elderly and the infirm
 - Significant: Flood zone with deep fast flowing water. Dangerous for most people.
 - Extreme: Flood zone with deep fast flowing water. Dangerous for all (including emergency services)

Luton Borough Council

Luton

Preliminary Flood Risk Assessment

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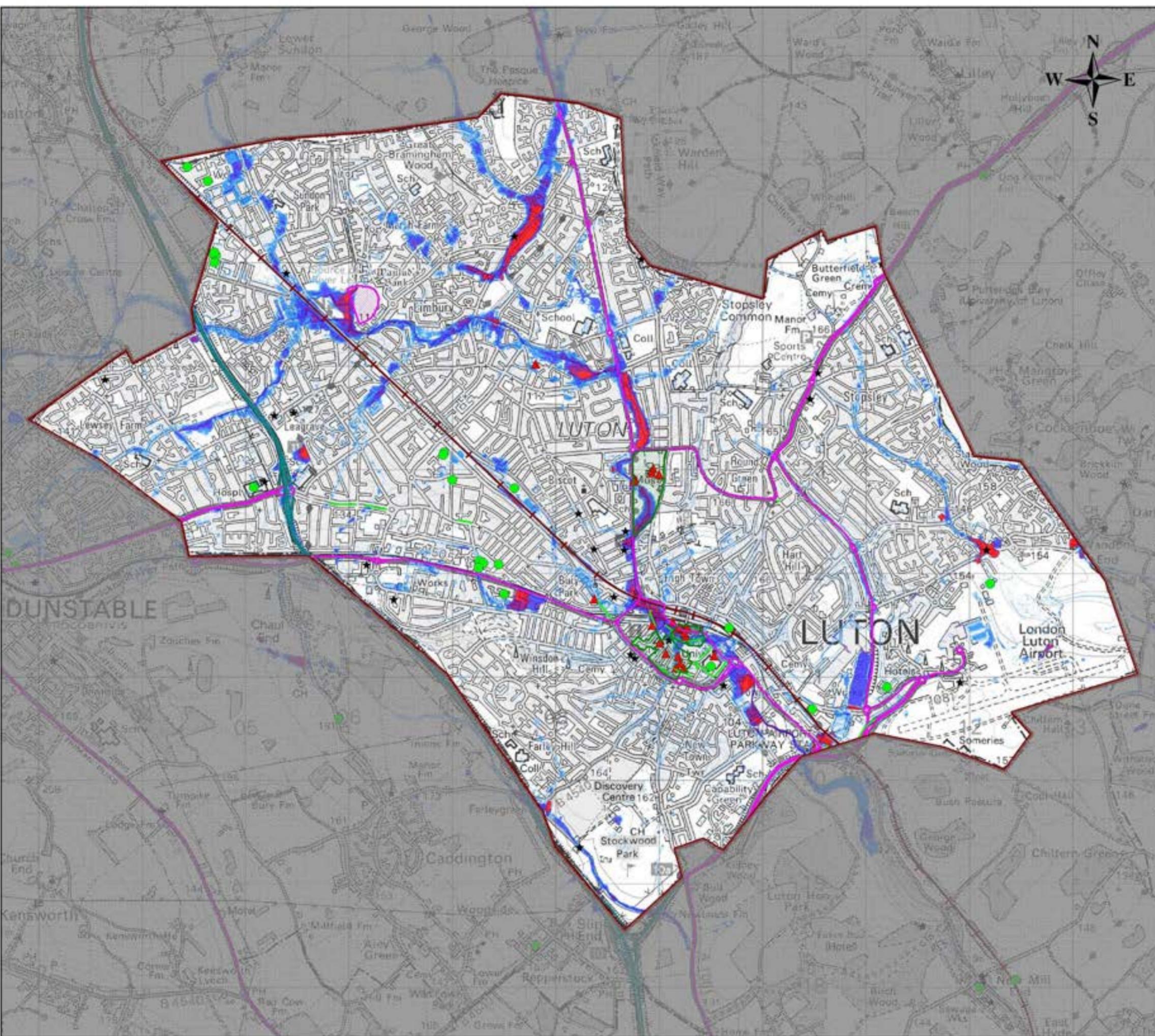
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**1 in 100 Year Rainfall Event
Plus Climate Change
Flood Hazard**

Consultant
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE B2



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- Motorway
- A Road
- Scheduled Monument
- Conservation Area
- ★ Critical Infrastructure
- ▲ Grade I and II Listed Buildings
- Utilities
- Railway
- Bus Lane

Flood Depth

	< 0.1m		0.5m - 1.0m
	0.1m - 0.25m		1.0m - 1.5m
	0.25m - 0.5m		> 1.5m

Notes

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Luton Borough Council
Luton
Preliminary Flood Risk Assessment

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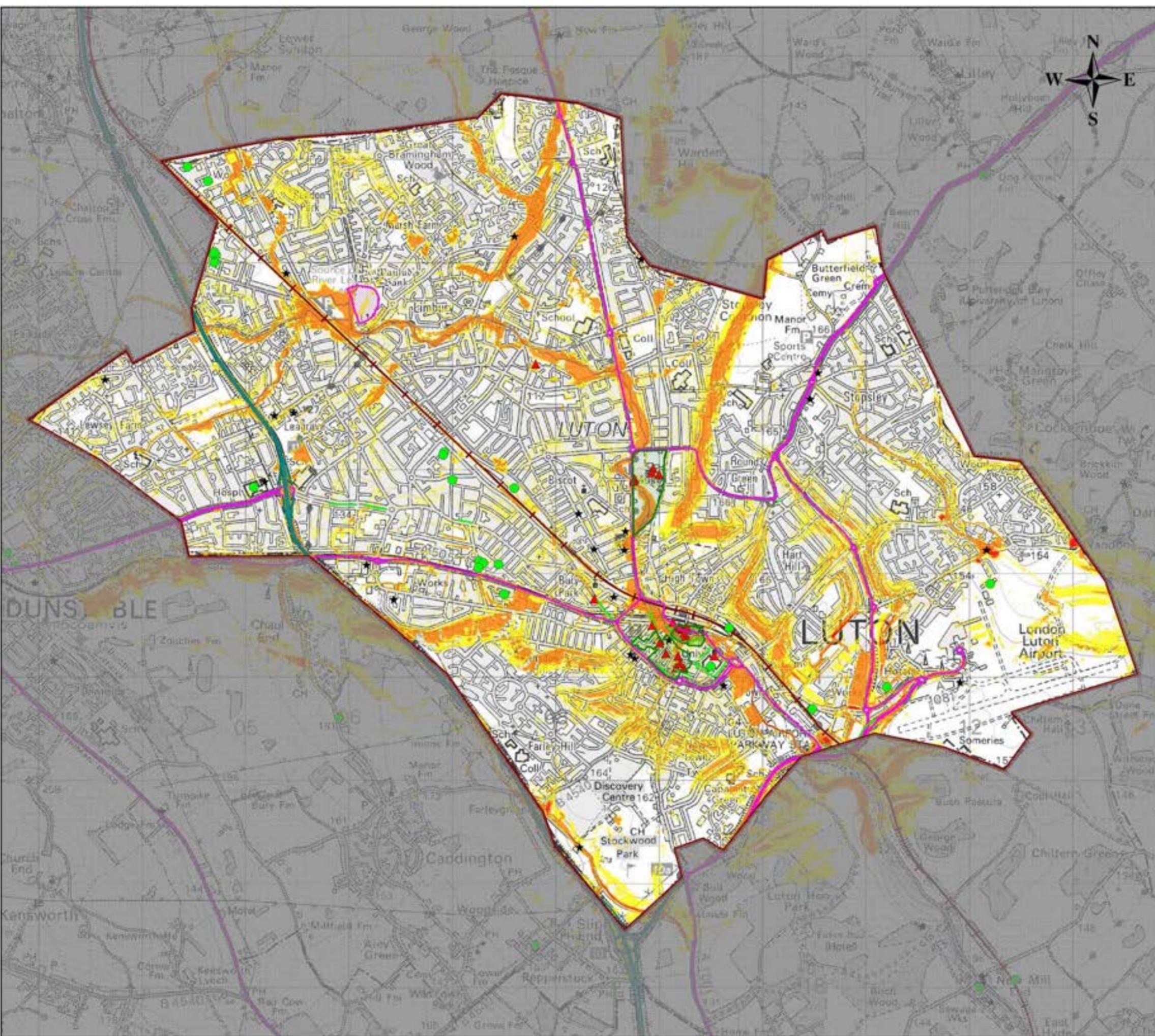
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**1 in 200 Year Rainfall Event
Flood Depth Grid**

Consultant
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE B3



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse
- Motorway
- A Road
- Railway
- Bus Lane
- Scheduled Monument
- Conservation Area
- ★ Critical Infrastructure
- ▲ Grade I and II Listed Buildings
- Utilities

Flood Hazard

- Caution (Very Low Hazard)
- Moderate (Danger for Some)
- Significant (Danger for Most)
- Extreme (Danger for All)

Notes

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Luton Borough Council
Luton
Preliminary Flood Risk Assessment

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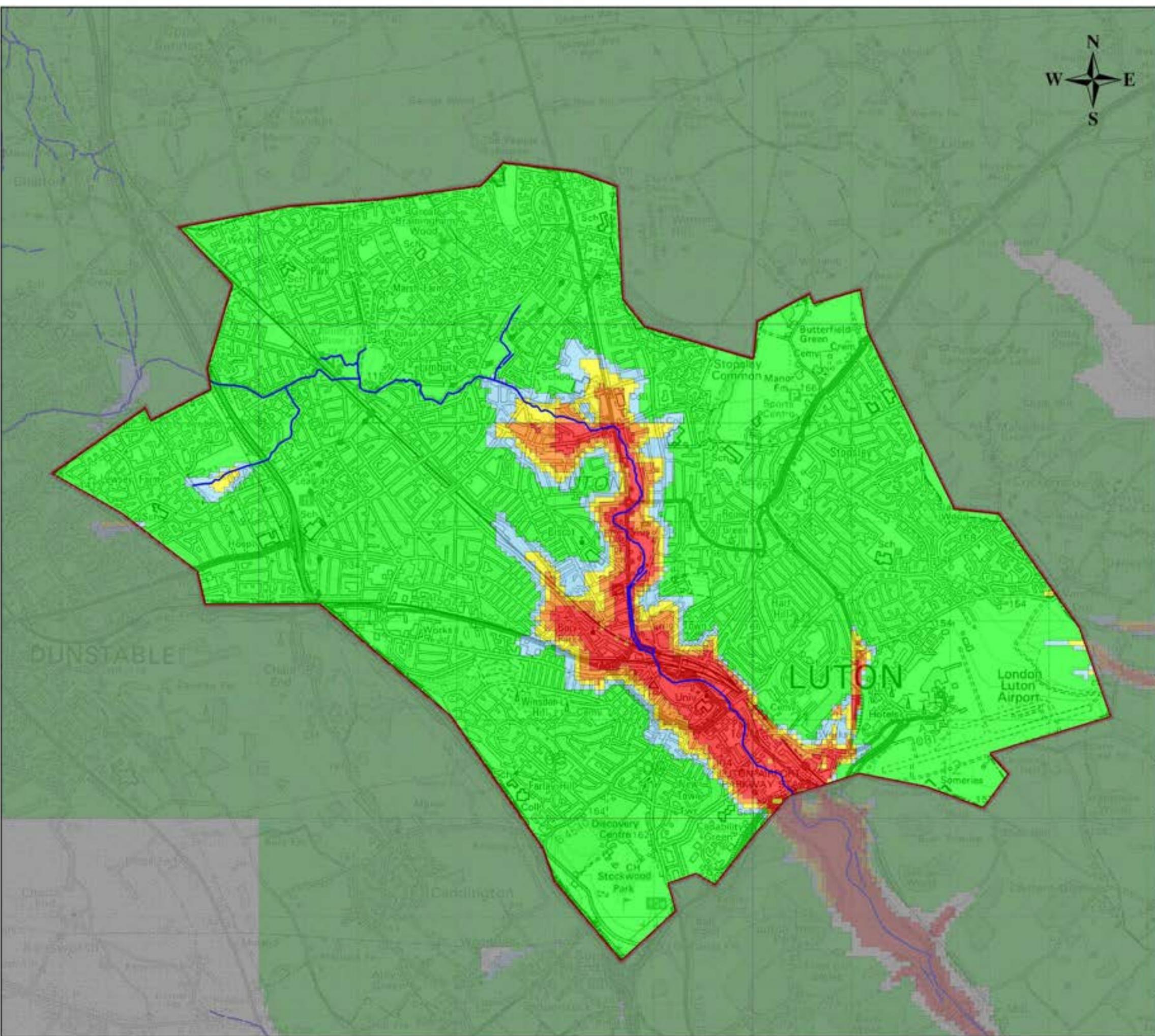
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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**1 in 200 Year Rainfall Event
Flood Hazard**

Consultant
CAPITA SYMONDS
 Flood Risk Management

Capita Symonds
 Level Seven,
 52 Grosvenor Gardens,
 Belgravia,
 London
 SW1W 0AU

FIGURE B4



Legend

- Luton Borough Council Boundary
- Main River
- Ordinary Watercourse

Groundwater Flooding Susceptibility

- Very High
- High
- Moderate
- Low
- Very Low

Notes

The susceptibility data presented on this map is only suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions

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Luton Borough Council
Luton

Preliminary Flood Risk Assessment

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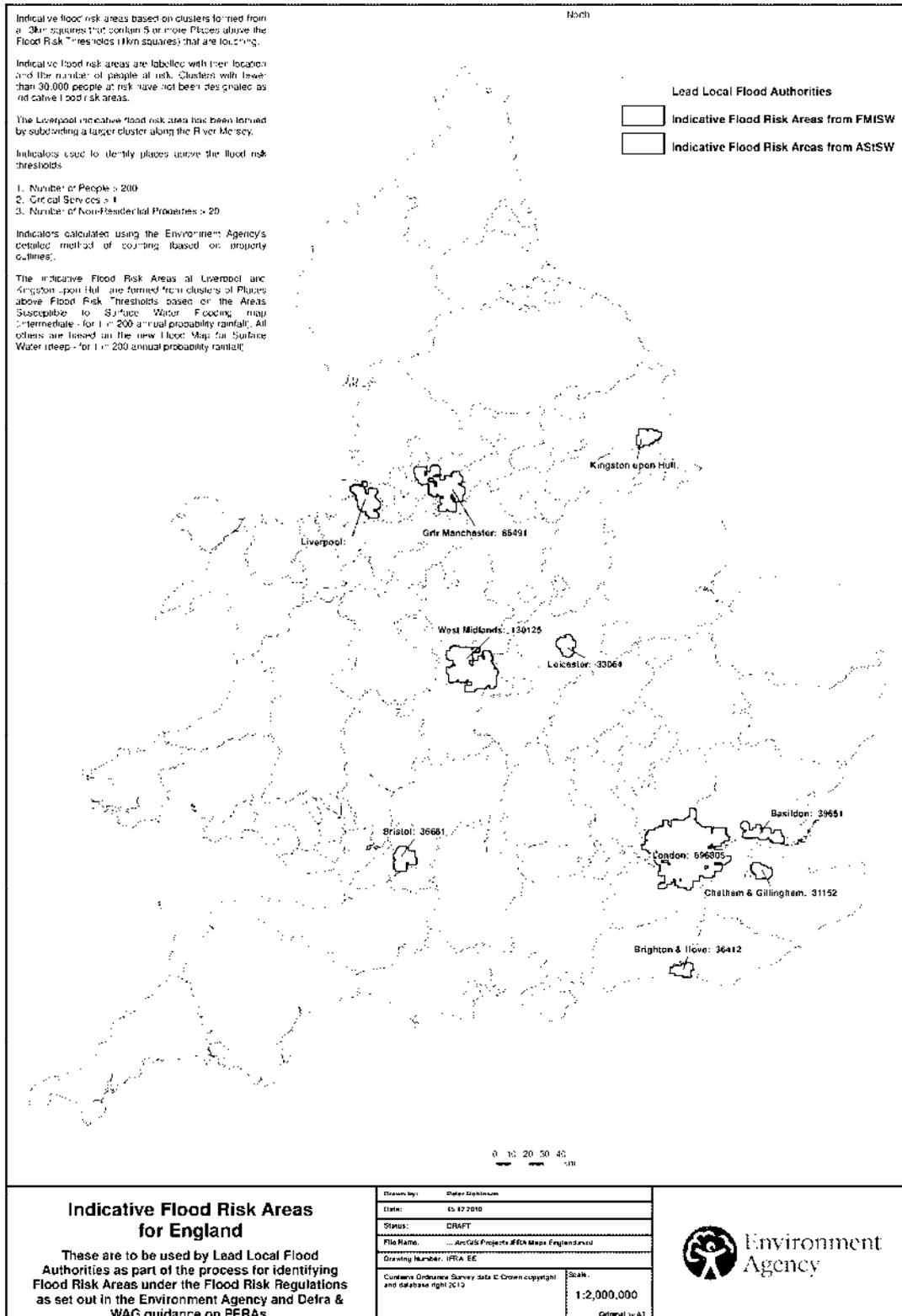
Scale at A3 1:60000	Date June/2011	Drawn by R.LAI	Approved by M. ARTHUR
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Susceptibility to Groundwater Flooding Map

Consultant CAPITA SYMONDS Flood Risk Management	Capita Symonds Level Seven, 52 Grosvenor Gardens, Belgravia, London SW1W 0AU
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FIGURE B5

Appendix C Flood Risk Areas



Appendix D Review Checklist

Refer Excel File: LutonBC_PFRA_Checklist_v1.xls

Appendix E Locally Significant Consequences

Locally Significant Consequences

Purpose

The purpose of this document is to provide a definition of 'locally significant consequences' in the context of the Luton Borough Council (LBC) Preliminary Flood Risk Assessment (PFRA).

Background

National guidance issued by Defra sets thresholds for defining areas where the flood is significant. No guidance has been issued for defining 'locally significant harmful consequences' and it is up to each LLFA to set its own definition. It has been suggested by the Environment Agency that the threshold should be an order of magnitude below the significance criteria for determining flood risk areas. This document provides the baseline definition selected by LBC.

Definition

For the purpose of reporting past and future significant floods, a flood is deemed locally significant if:

in terms of Human Health, it

- 1) caused internal flooding to twelve or more residential properties, or
- 2) flooded one or more items of critical infrastructure, or

in terms of Economic Activity, it

- 3) flooded three or more business premises, or
- 4) caused a major transport link to be totally impassable or inaccessible, or

in terms of Environment, it

- 5) flooded one or more of the following nationally important heritage features - Wauluds Bank Scheduled monument, Parish Church of St Marys Grade I listed building, the Grade II listed buildings in the table overleaf, Wardown Park Registered park and garden, or
- 6) flooded parts of Plaiters Lea or Town Centre Conservation Areas,

or caused any combination of the above.

The definition of 'major transport link is':

- i) any main Network Rail station (Legrave, Luton Central and Luton Parkway) or main line connecting to these stations;
- ii) motorways and 'A' Roads;
- iii) all roads with designated bus lanes.

Justification

The reasoning behind these criteria is as follows:

- Defra set a national threshold of 200 persons or 20 businesses per one km grid square flooded to a depth of 300mm during a 1 in 100 flood (1 in 200 rainfall event).
- An order of magnitude less can be considered as 20 persons, which would average 8.5 properties (based on a national occupancy rate of 2.34 persons per property).

- An order of magnitude less can be considered as 2 businesses.
- Recognising the urban nature and generally high population density in Luton, a threshold of 12 properties is suggested (approximately 50% higher than the order of magnitude suggested by the EA).
- The number of business premises has been set at three – approximately 50% higher than the order of magnitude suggested by the EA to minimise the impact of small areas of localised flooding.
- Using the Defra km square 'grouping' criterion of 30,000 persons an order of magnitude less would result in a threshold of 3,000 persons or 1,300 properties and for Luton would likely give very few or no 'significant' past events. This is not considered appropriate.
- The definition of major transport link encompasses a large range of links as a disruption on one link can have significant knock-on consequences for the others.

Grade II Listed Buildings

Road	Name/Number	Liability
Bute Street	The Shannon Hotel, 61	Owner
"	The Great Northern, 63	Owner
"	64	Owner
"	Kashmir Restaurant & Hotel, 66	Owner
"	George II Public House, 68/70	Owner
Castle Street	5	Owner
Chapel Street	Bellini's, 9	Owner
Cheapside	53	Owner
Dunstable Road	Former Odeon Cinema (?)	Owner
George Street	Town Hall	LBC
"	21	Owner
"	32	Owner
"	63	Owner
Guildford Street	40	Owner
"	Easy Hotel, 40a	Owner
"	47	Owner
"	50	Owner
Moat Lane	Moat House	Owner
New Bedford Road	Wardown Park Lodge and Entrance Quadrant Walls & Gate Piers	LBC
"	Wardown Park House, Summer House, Entrance Gate & Outbuildings to Wardown Park House	LBC
"	7	Owner