CAPITA

CHELTENHAM BOROUGH COUNCIL

Cheltenham Borough Council

Supplementary Report to the Level 2 Strategic Flood Risk Assessment

CHELTENHAM BOROUGH COUNCIL

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3	06/02/2018	V3 Additional Site and Climate change data	IC	AW	JS

Contents

1 Introduction

1.1 Purpose of the Supplementary Report

This supplement to the Level 2 Strategic Flood Risk Assessment (SFRA) will form a key part of the evidence base supporting the Cheltenham Plan (the Borough Plan). It supplements the assessment undertaken as part of the Level 1 and Level 2 SFRAs.

This supplementary report assesses flood risk to locations identified as potential development sites to be included in the Cheltenham Plan. These assessments, combined with the previous SFRA documents, will assist the Council in applying the Sequential Test to its site options and the Exception test, where required. It will also assist the Council with applying the sequential approach within sites where a flood risk has been recognised, to identify areas that will be suitable for development.

The report will also identify requirements for site specific flood risk assessments (FRAs) on sites as well as provide guidance for planners and developers.

Other documents forming the SFRA evidence base are summarised in Table 1-1.

Report	Publication Date	Description
Level 1	2008	County-wide Level 1 Report
Level 2	2011	Level 2 SFRA to support the preparation of the Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS)
Level 2	2012	Additional Level 2 assessment to support the JCS
Level 2	2016	Additional Level 2 assessment to support the JCS
Level 2 Supplementary Report	2018	Local level, site specific assessment of 13 potential development site options on land in and around Cheltenham town.

Table 1-1: Cheltenham Borough Council SFRA Documents

2 Site Assessments

2.1 Introduction

Cheltenham Borough Council have provided a number of sites to be assessed as part of this SFRA supplementary report. All of the sites were included in the 2008 Level 1 SFRA but only three were included in the Level 2 SFRA assessment. Table 2-1 summaries the site, the existing level of assessment, and whether there is a site-specific FRA available and its associated planning application reference number.

Table 2-1: Existing Level of Assessment of Sites

Site Reference	Site Name	SFRA Level	Site-Specific FRA planning reference number*
MD1	Lansdown Industrial Estate	2008 Level 1	-
MD2	Land at North Place and Portland Street	2008 Level 1	12/01612/FUL
MD3	Coronation Square	2008 Level 1	-
MD4	Royal Wells and Municipal Offices	2011 Level 2	-
MD5	Leckhampton	2011 Level 2	13/01605/OUT
HD1	Christ College B	2008 Level 1	-
HD2	Former Monkscroft Primary School	2008 Level 1	-
HD3	Bouncer's Lane	2008 Level 1	17/00929/OUT
HD4	Land of Oakhurst Rise	2008 Level 1	17/00710/OUT
HD5	Land of Stone Crescent	2008 Level 1	-
HD6	Brockhampton Lane	2008 Level 1	-
HD7	Prior's Farm Fields	2008 Level 1	14/01276/OUT
HD8	Old Gloucester Road	2011 Level 2	17/01411/OUT
E4	Land off Chelt Walk		

* Note that the FRAs may only cover part of the site or nearby areas. Depending on when the FRA was undertaken there may be more up to date information available and the information in the FRA may have been superseded

Tables summarising the risks to each site and associated planning and development implications have been prepared for this supplementary report. Each summary table includes the following information

- Site reference
- Site Area
- Current and proposed land uses
- Associated map reference number
- Proportion of the site falling within each Flood Zone

- Proportion of the site falling within each surface water flood risk event
- What category of the Areas Susceptible to Groundwater Flooding Map (AStGWf) the site comes under.
- Whether the site is at risk of inundation in the event of reservoir failure
- The flood risk compatibility of the site
- Flood risk considerations
    - Summary of flood risk
    - Whether the Sequential and Exception Test are required
    - Whether a site specific FRA is required
    - Climate change implications
    - Residual risk implications (defence overtopping / breach, bridge / culvert blockages)
    - Drainage considerations
    - Access and egress considerations

The summary tables are provided in Appendix A. Maps showing fluvial and surface water flood risk, as well as the AStGWf, for each site are provided in Appendix B. These maps are interactive and the different map layers can be turned on and off using the layers tool to the left of the map.

2.2 Data Sources

2.2.1 Fluvial flood risk

Fluvial flood risk has been based on the Environment Agency Flood Zones (publication date November 2017). Where more detailed information is available, for example site specific FRAs which have modelled ordinary watercourses, this has been referenced in the report. Proportion of the site in each flood zone is based on the Environment Agency data as GIS data was not available for the information in the previous SFRAs or in the site-specific FRAs.

Flood Zone maps from the Level 1 and Level 2 SFRAs were also assessed. However, it should be noted that these maps may have been superseded by Environment Agency modelling undertaken since the SFRAs were published. The results from blockage modelling undertaken for the Level 2 SFRA were also referenced, where required.

Table 2-2: Flood Zone definitions

Flood Zone	Definition
Flood Zone 1	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Flood Zone 3a	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Flood Zone 3b	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

2.2.2 Surface water flood risk

Surface water flood risk has been based on the Environment Agency's Risk of Flooding from Surface Water (RoFfSW) dataset (previously known as the updated Flood Map for Surface Water).

The RoFfSW map is derived from identifying topographical flow paths of existing watercourses and dry valleys that contain some isolated ponding in low lying areas. Where, available, more detailed surface water modelling undertaken by local authorities have been incorporated into the RoFfSW mapping.

Table 2-3 describes the four categories for the differing levels of surface water risk in the RoFfSW maps.

Table 2-3: RoFfSW categories

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 3.3% AEP (1 in 30-year chance in any given year).
Medium	Flooding occurring as a result of rainfall of between a 1% and 3.3% AEP (between 1 in 100-year and 1 in 30-year chance in any given year)
Low	Flooding occurring as a result of rainfall of between a 0.1% and 1% AEP (between 1 in 1,000-year and 1 in 100-year chance in any given year)
Very Low	Flooding occurring as a result of rainfall with less than a 0.1% AEP (1 in 1,000-year-year chance in any given year)

2.2.3 Groundwater flood risk

Ground water flood risk have been based on the Environment Agency's Areas Susceptible to Groundwater Flooding (AStGWf). This is a strategic scale (1 km square grid) map showing the proportion of each 1 km square which may be susceptible to groundwater emergence. It is likely that only isolated locations within the overall susceptible area actually suffer the consequences of groundwater flooding.

The dataset does not show the likelihood of groundwater flooding occurring, and it does not take into account the chance of flooding from groundwater rebound. Therefore, the AStGWf should be used in combination with other datasets for specific flood risk management, land use planning or other decision making. It can also be used to identify areas for assessment at a local scale where finer resolution datasets exist.

2.2.4 Reservoir flood risk

The Environment Agency's National Inundation Reservoir Flood Maps (as shown on the Environment Agency's Long Term Flood Risk Information website) has been used to identify sites which may be at risk of inundation in the event of reservoir failure. These maps show the extent flood water would spread from a reservoir in a worst case scenario. These maps do not take into account the structural integrity or chance of failure of the individual dam.

2.2.5 Other Sources of data

- Flood defences were checked against the Environment Agency's Spatial Flood Defences GIS layer, available through Opendata.

- Where more detailed information is available, for example through modelling undertaken for site specific FRAs, these FRAs have been referenced in the site summary tables.

2.3 Limitations

There are several limitations associated with the preparation of the site summary tables. In addition a number of assumptions had to be made in order to provide a consistent level of strategic assessment across all sites and, as a result, there is some uncertainty associated with the assessments. The assumptions, uncertainties and limitations are listed below. Users of this report should take these into consideration when using the information to satisfy themselves the information is suitable for their particular use.

2.3.1 Flood Zones, Functional Floodplain and Climate Change

There were some discrepancies between the Environment Agency's Flood Zones (as shown in the published Flood Map for Planning - accessed at time of publication of this note) and the Flood Zones provided in the mapping for the previous SFRAs.

It has been assumed that the Environment Agency's Flood Zones are the most up-to-date and accurate information as the date of publication was November 2017. However, as a result of using the Environment Agency's Flood Zones, it was not possible to identify Flood Zone 3b and climate change extents during the timeframe for the study. For sites shown to be in the Environment Agency Flood Zones, the previous SFRA maps and site specific FRAs (where available) were used to give an indication of whether the site may be affected by Flood Zone 3b. However, it was not possible to provide a figure for the proportion of the site that may be covered.

For sites shown to be within Flood Zones 2 and 3, a detailed FRA should be undertaken. This should determine the Flood Zones extents, including that of Flood Zone 3b, as well as the increase in flood risk as a result of climate change. For the avoidance of doubt Flood Zone 3b is defined in the 2008 Level 1 SFRA as land where water has to flow or be stored in times of flood (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, including water conveyance routes). Flood Zone

3b maps in the 2008 were derived from detailed hydraulic models. Where no detailed models were available, Flood Zone 3b has been shown to equal Flood Zone 3a.

Strategic climate change modelling has been undertaken using the guidance published by the Environment Agency in 2016[1], which supersedes all previous climate change guidance, including that set out in the previous SFRAs.

2.3.2 Blockage assessment

It was not possible to undertake updated blockage assessments within the timeframe for preparing the report. Therefore, the blockage modelling undertaken for the 2011 Level 2 SFRA has been used, where required. It has been assumed that this modelling is still suitable for use at this strategic scale.

2.3.3 Ordinary watercourses not shown in Environment Agency Flood Zones

Some sites have ordinary watercourses that are not shown in the Environment Agency Flood Zones either flowing through, or adjacent to, the site.

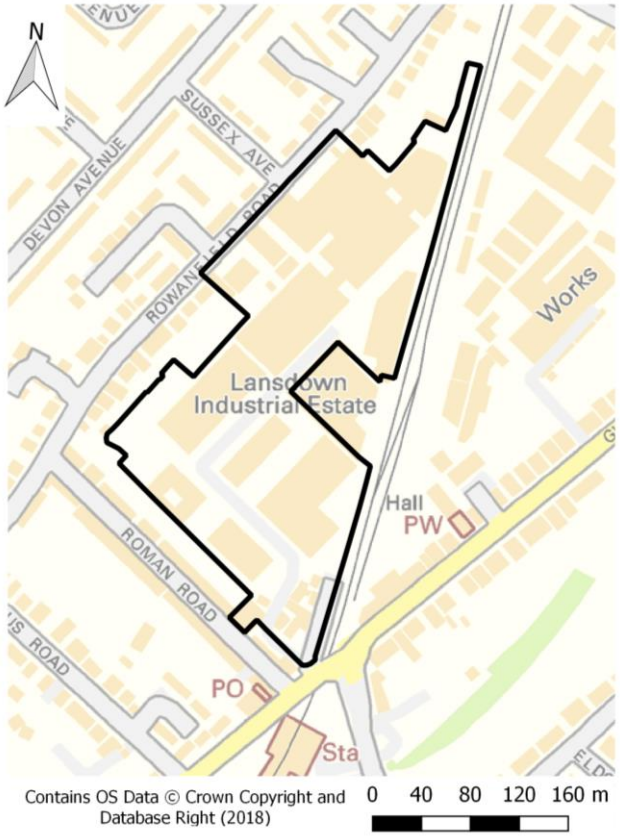
It was not possible to undertake modelling these watercourses within the timeframe for preparing the report. Therefore, the modelling undertaken for the 2011 Level 2 SFRA has been used, where required. It has been assumed that this modelling is still suitable for use at this strategic scale.

[1] Environment Agency (2016) Flood Risk Assessments: Climate Change Allowances

Appendix A – Site Assessments

A.1 Lansdown Industrial Estate

Site Details	
Reference	MD1
Area	5.8 hectares
Current Use	Brownfield
Proposed Use	Mixed Use
Map Reference	CBC_MD1.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	1%
Medium	2%
Low	34%
Other Sources	
Groundwater (AStGWf category)	>25% <50%
Reservoir Risk?	None



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The site is not at risk from fluvial flooding. Mapping shows surface water risk is predominantly located in the south west of the site.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

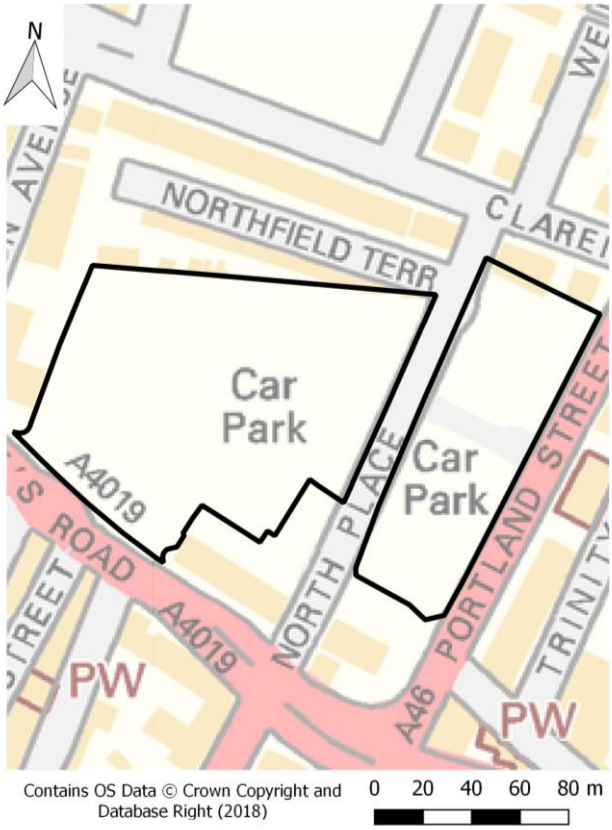
Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events.[2] The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

[2] Gloucestershire County Council (2015), Gloucestershire SuDS Design and Maintenance Guide

[3] Halcrow Group Limited (2011) Gloucester, Cheltenham & Tewkesbury Joint Core Strategy: Sustainable Drainage Systems for Local Development Framework Final Report – Volume 3

A.2 Land at North Place and Portland Street

Site Details	
Reference	MD2
Area	2.0 hectares
Current Use	Brownfield
Proposed Use	Mixed Use
Map Reference	CBC_MD2.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	0%
Low	1%
Other Sources	
Groundwater (AStGWf Category)	>=50% <75% >75%
Reservoir Risk?	None



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

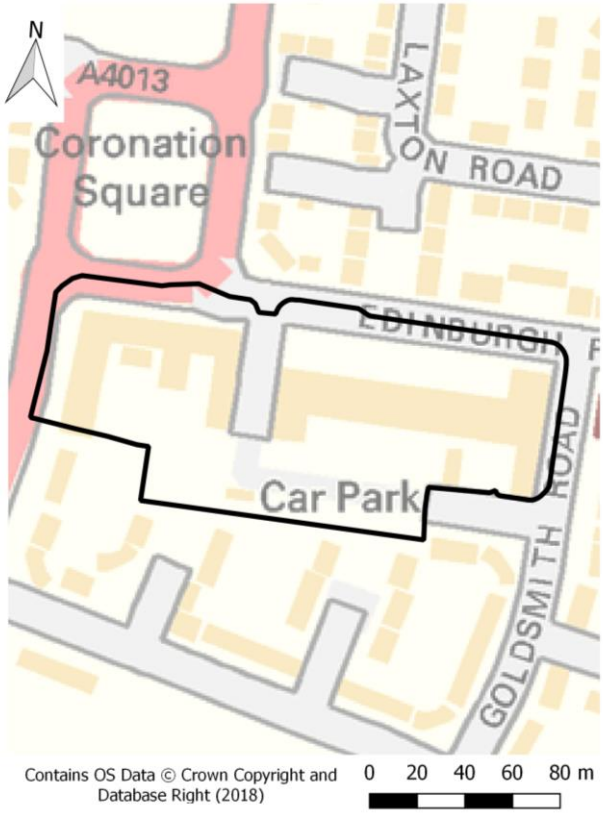
Flood Risk Considerations	
Summary of Risk	The site is not at risk from fluvial flooding. Mapping shows a small pocket of surface water flood risk in the centre of the site. A FRA undertaken in 2012 to support planning application 12/01612/FUL describes ground investigations that found the groundwater table to be sufficiently below ground level to not be a risk[4].

[4] Augur Buchler Cheltenham Ltd, Skanska RD UK Ltd (2012) North Place Cheltenham: Flood Risk and Drainage Assessment

FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1. The 2012 FRA[4] concluded that the proposed development is not considered to be at risk of flooding, that proposals do not increase the risk of flooding within or beyond the site, and is highly unlikely to have any adverse impact on the existing flood risk.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable
Drainage	Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events[2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration. The 2012 FRA for application 12/01612/FUL includes a proposed strategy for surface water drainage[4].
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

A.3 Coronation Square

Site Details	
Reference	MD3
Area	1.7 hectares
Current Use	Brownfield
Proposed Use	Mixed Use
Map Reference	CBC_MD3.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	0%
Low	7%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	None



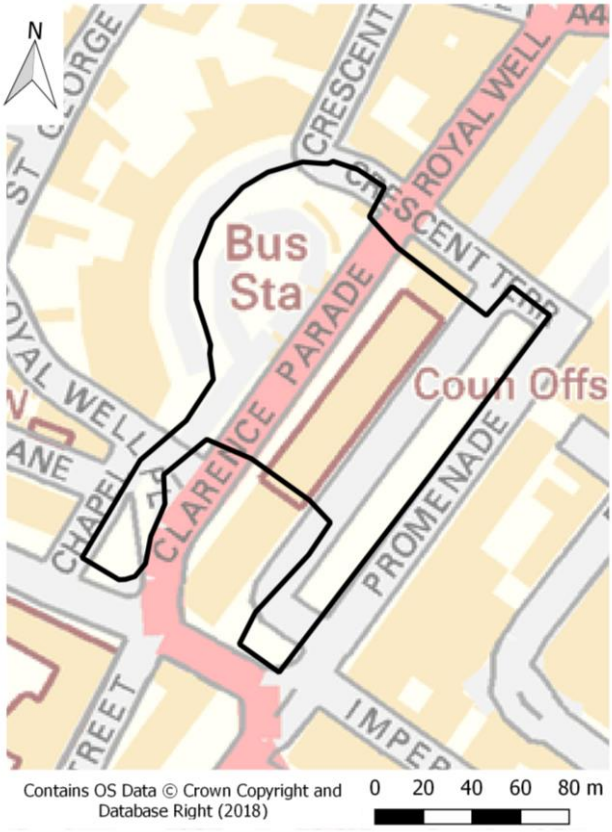
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The site is not at risk from fluvial flooding. Mapping shows surface water flood risk is mainly located in the west of the site.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

Drainage	Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events[2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

A.4 Royal Wells and Municipal Offices

Site Details	
Reference	MD4
Area	1.6 hectares
Current Use	Brownfield
Proposed Use	Mixed Use
Map Reference	CBC_MD4.PDF
Fluvial	**Proportion of site**
Zone 1	51%
Zone 2	14%
Zone 3a	35%
Zone 3b	Unknown
Surface Water	**Proportion of site**
High	1%
Medium	6%
Low	74%
Other Sources	
Groundwater (AStGWf Category)	>=50% <70%
Reservoir Risk?	Yes



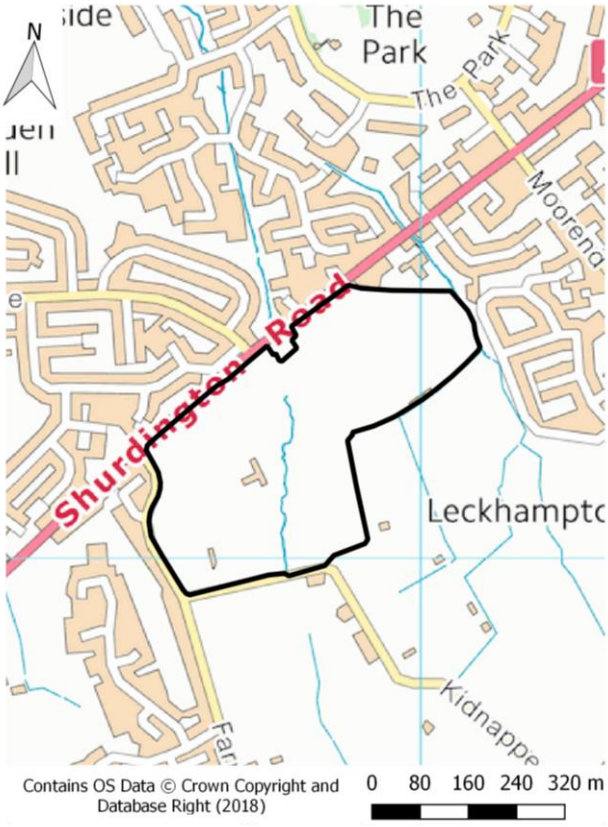
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
3b	Exception Test required	×	×	×	✓
3a	Exception Test required	×	Exception test required	✓	✓
2	✓	Exception Test required	✓	✓	✓
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	A large proportion of the site is shown to fall within Flood Zones 2 and 3. However, the River Chelt is culverted under the site (culvert entrance is at Rodney Road and exits at St George's Place. Therefore, the predominant flood risk to the site will be from surcharging of the culvert.

FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site will need to pass the Sequential Test. If the site passes the Sequential Test then the Exception Test will be required. An FRA is required to support planning applications as the site is in Flood Zones 2 and 3. The FRA will need to assess the fluvial risk, confirming the actual risk to the site from fluvial flooding including the extent of Flood Zone 3b as well as the impact of climate change in the future. The FRA will need to demonstrate that the site can be made safe and that development will not exacerbate flood risk both within and outside of the site.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change shows the site to continue to be at risk from fluvial flooding now and in the future including the impact of climate change.
Residual Risk from defence breach or overtopping	Not applicable
Blockage	The impact of blockage of the culvert under the site should be considered as part of a detailed site specific FRA.
Drainage	Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events[2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	Safe access and egress will need to be demonstrated for the site to pass the Exception Test. A number of the potential access and egress routes are shown to be in Flood Zones 2 and 3. Royal Wells and Crescent Terrance are outside of Flood Zones 2 and 3 but are shown to be at risk from surface water flooding.

A.5 Leckhampton

Site Details	
Reference	MD5
Area	15.5 hectares
Current Use	Greenfield
Proposed Use	Mixed Use
Map Reference	CBC_MD5.PDF
Fluvial	**Proportion of site**
Zone 1	97%
Zone 2	1%
Zone 3a	2%
Zone 3b	Unknown
Surface Water	**Proportion of site**
High	3%
Medium	5%
Low	13%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	None



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
3b	Exception Test required	×	×	×	✓
3a	Exception Test required	×	Exception test required	✓	✓
2	✓	Exception Test required	✓	✓	✓
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The majority of the site is located within Flood Zone 1; however, Environment Agency Flood Zones and modelling undertaken as part of the 2011 Level 2 SFRA show parts of the site are affected by Flood Zones 2, 3a and 3b (Flood Zone 3b is mainly confined to land immediately adjacent to watercourse). Surface water flood risk mapping shows the risk to mainly follow the flow paths of the east and west branches of Hatherley Brook and some smaller isolated areas of ponding. It is recommended that the identified flood risk areas are kept as open space and development directed to Flood Zone 1 and areas of lower risk.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site will need to pass the Sequential Test. If the site passes the Sequential Test then the Exception Test will be

	required. An FRA is required to support planning applications as the site is in Flood Zones 2 and 3. The FRA will need to assess the fluvial risk, confirming the actual risk to the site from fluvial flooding including the extent of Flood Zone 3b as well as the impact of climate change in the future. The watercourse flowing through the west of the site is not included within the Environment Agency Flood Zones; the risk from this watercourse will need to be assessed as part of the FRA. The FRA will need to demonstrate that the site can be made safe and that development will not exacerbate flood risk both within and outside of the site. Detailed modelling was undertaken to support planning application 13/01605/OUT[5].
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change indicates that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows). Risk of fluvial flooding is limited to land directly adjacent to the Hatherley Brook east and west watercourses running through the centre and to the east of the site.
Residual Risk from defence breach or overtopping	There are no fluvial flood defences on the watercourses flowing through the site
Blockage	The impact of blockage of the culverts should she be considered as part of an FRA. The 2011 Level 2 SFRA modelled blockages on the culverts under Shurdington Road (A46) and Kidnappers Lane. Blockage of the Hatherley Brook east branch shows blockage has an affect with a larger area in the south west corner at risk. It also causes more water to get out of bank above the site which backs up behind the farm track along the sites south east boundary. Blockage of the Hatherley Brook west branch appears to have little effect on the extent of FZ3 within the site.
Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration. This is supported by the FRA produced to support planning application 13/01605/OUT which describes infiltration tests showing negligible storage. The FRA also found local surface water sewerage to be sparse[5].
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be within Flood Zone 2 or at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

[5] THDA Consulting Engineers (2013) Flood Risk Assessment and Drainage Strategy for Proposed Mixed Development at Kidnappers Lane, Leckhampton and Farm Lane, Shurdington, Cheltenham, Gloucestershire: Volume 1 - Report

A.6 Christ College B

Site Details	
Reference	HD1
Area	2.1 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD1.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	2%
Low	11%
Other Sources	
Groundwater (AStGWf Category)	>=25% <50% >=75%
Reservoir Risk?	None

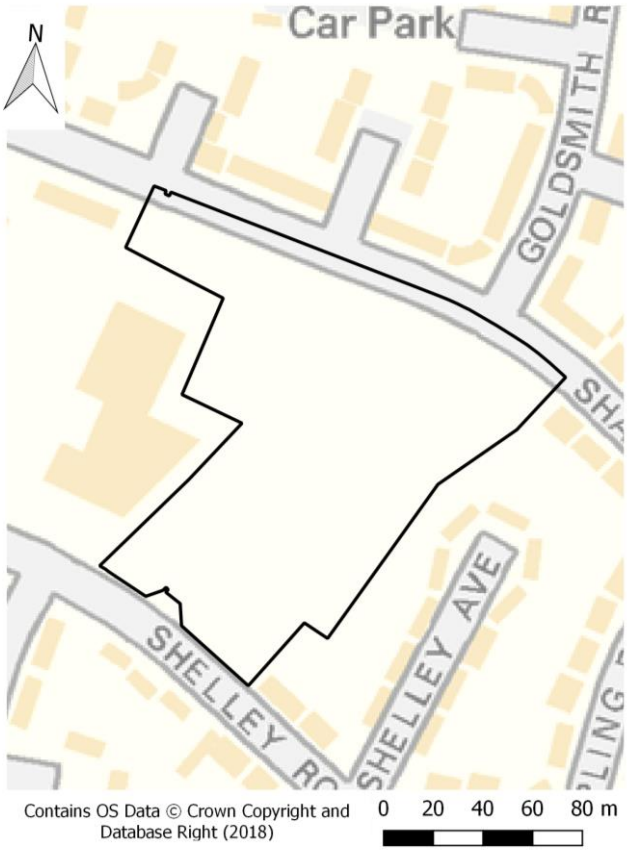
Flood Risk Vulnerability Compatibility					
Flood Risk	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The River Chelt is located approximately 200m to the north east of the site. The site is not at risk from fluvial flooding. Surface water flooding is predominantly confined to the south of the site. Surface water is also shown to pond along the railway line to the east of the site.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

A.7 Former Monkscroft Primary School

Site Details	
Reference	HD2
Area	1.8 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD2.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	0%
Low	2%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	None



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	Risk to the site is small with the site only at low risk from surface water.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

A.8 Bouncer's Lane

Site Details	
Reference	HD3
Area	0.5 hectares
Current Use	Brownfield
Proposed Use	Housing
Map Reference	CBC_HD3.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	1%
Medium	2%
Low	3%
Other Sources	
Groundwater (AStGWF category)	>=50% <75%
Reservoir Risk?	None

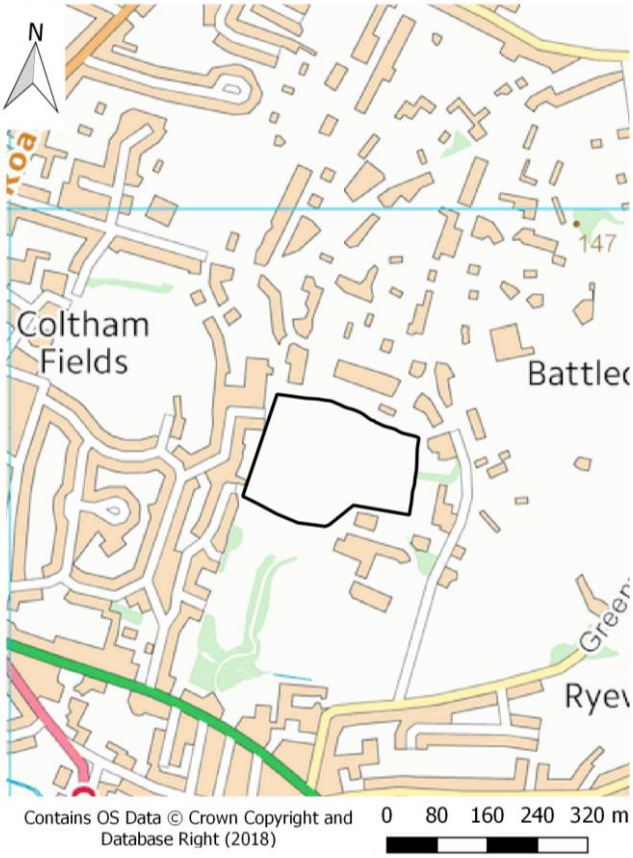
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The upper reaches of the Wyman's Brook flow along part of the southern site boundary before entering a culvert under Bouncer's Lane, flowing through the culvert until it emerges near Prestbury Road.
FRA Required	Although the site is less than 1 hectare, the Wyman's Brook in this area is not covered by the Environment Agency's Flood Zones; however, the watercourse may still pose a risk. An FRA is required to determine the potential for fluvial flooding from the watercourse. Depending on the results of the modelling, the Exception Test may need to be passed.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows). However, the effect of climate change on the Wyman's Brook culvert and site drainage will need to be considered.
Residual Risk from defence breach or overtopping	Not applicable

Blockage	The residual risk from blockage of the culvert at Bouncer's Lane will need to be considered as part of a site specific FRA. There is also another culvert sited partway along the southern site boundary which will require a blockage assessment to determine the risk.
Drainage	Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events[2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. Whilst parts of these routes are shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress should still be achievable

A.9 Land of Oakhurst Rise

Site Details	
Reference	HD4
Area	4.2 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD4.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	0%
Low	0%
Other Sources	
Groundwater (AStGWF Category)	>=25% <50%
Reservoir Risk?	None



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

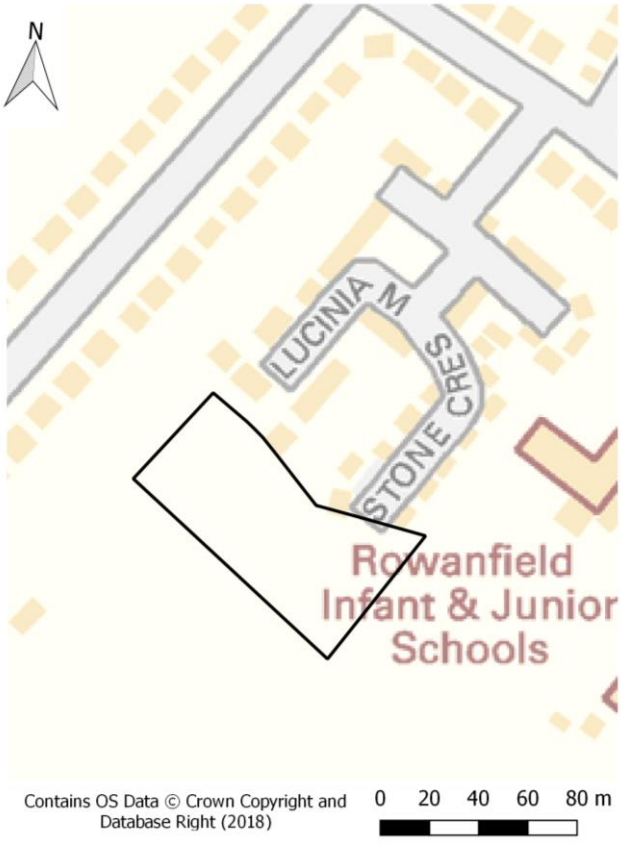
Flood Risk Considerations	
Summary of Risk	The site is not considered to be at risk from fluvial or surface water flooding.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1. A site specific FRA was undertaken in August 2017 as part of planning application reference 17/00710/OUT[6]. This FRA identified that the site is at low risk of flooding and therefore the primary flood risk is considered to be the management of surface water runoff (see 'Drainage' section below).

[6] Simpson Associates Consulting Engineers LLP (2017) Flood Risk Assessment: Land Off Oakhurst Rise, Charlton Kings, Cheltenham, Gloucestershire

Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable
Drainage	The FRA produced with application reference 17/00710/OUT[6], includes a storm water drainage strategy. This strategy identified infiltration drainage techniques as not feasible due to the impermeable nature of the soil as well as setting out options for drainage and SuDS to manage surface water flows and volumes from the site so they will not increase.
Access and Egress	There are no access or egress issues for the site

A.10 Land of Stone Crescent

Site Details	
Reference	HD5
Area	0.5 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD5.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	3%
Medium	16%
Low	72%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	None



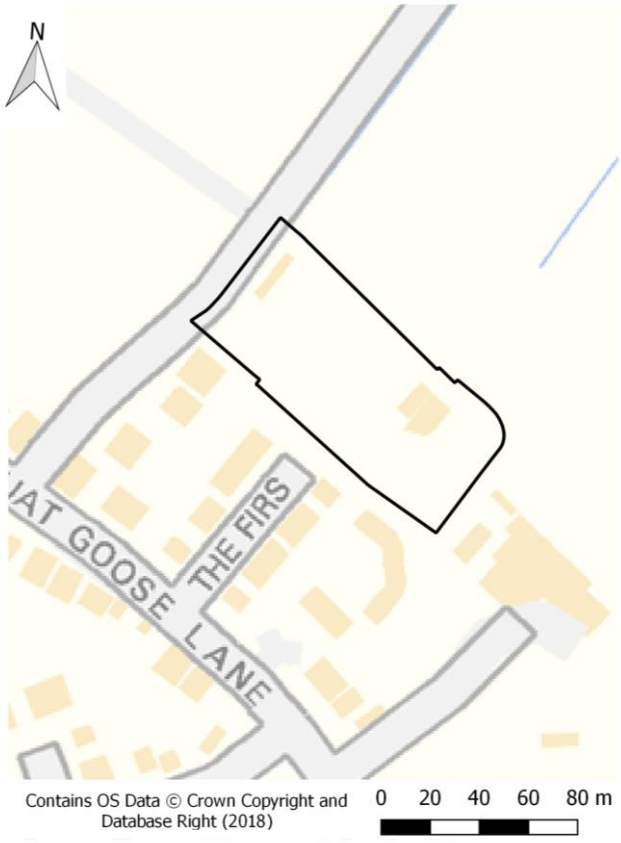
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The site is not at risk from fluvial flooding. However, a significant proportion of the site is shown to be to be at risk from surface water flooding.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. Environment Agency Standing Advice states sites less than 1 hectare in Flood Zone 1 which could be affected by flooding by sources other than rivers and the sea should be accompanied by a FRA. The site is shown to be at significant risk in the surface water mapping.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	Stone Crescent is shown to be at risk from surface water flooding. Safe access and egress to the site will need to be demonstrated.

A.11 Brockhampton Lane

Site Details	
Reference	HD6
Area	0.7 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD6.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	0%
Medium	0%
Low	0%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	None



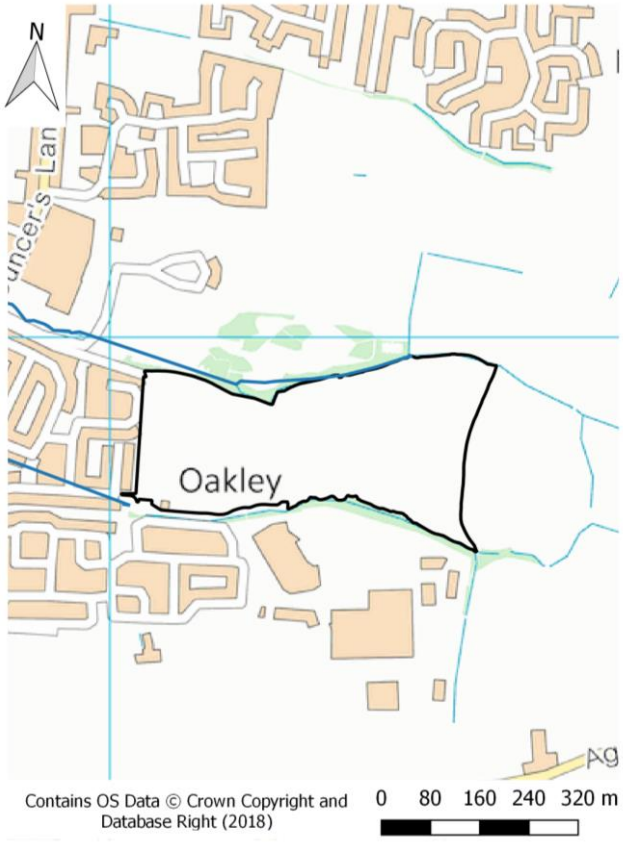
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The site is not considered to be at risk from fluvial or surface water flooding.
FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site passes the Sequential Test as it is located in Flood Zone 1. The Exception Test is not required. An FRA is not required as the site is less than 1 hectares in size and is not at risk from fluvial or surface water flooding.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change does not indicate that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows).
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable

Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	Access and egress for the site is off of Brockhampton Lane. Whilst parts of this route is shown to be at risk from surface water flooding, the risk areas are relatively small and safe access and egress is still achievable

A.12 Prior's Farm Fields

Site Details	
Reference	HD7
Area	12.0 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD7.PDF
Fluvial	**Proportion of site**
Zone 1	100%
Zone 2	0%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	2%
Medium	3%
Low	12%
Other Sources	
Groundwater (AStGWf Category)	<25%
Reservoir Risk?	Yes



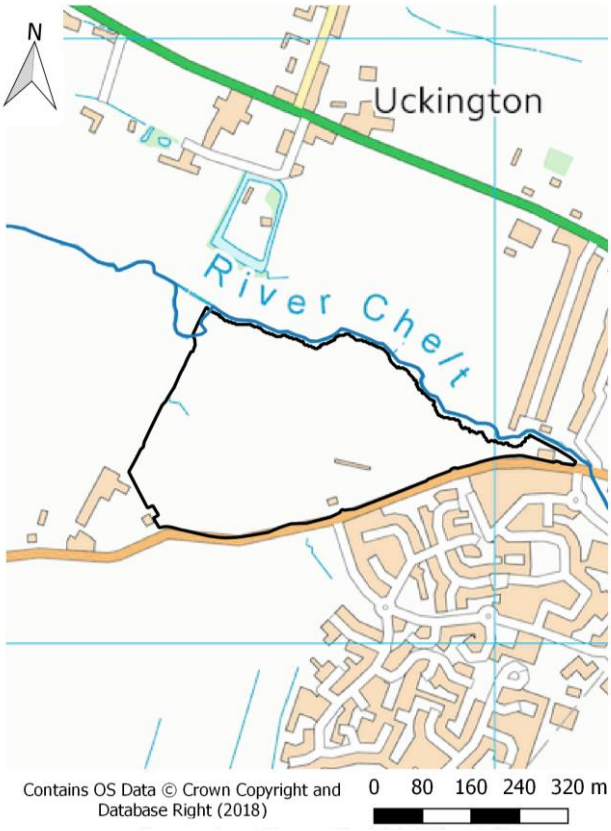
Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The upper reaches of the Wyman's Brook flow along the northern and southern site boundaries before entering two long culverts at the Gardens of Remembrance and Kimberley Drive. The site is also at risk from surface water which predominantly follows the path of the Wyman's Brook.
FRA Required	An FRA is required to support planning applications. Whilst the site is outside of Flood Zones 2 and 3, NPPF requires FRAs for sites greater than 1 ha in Flood Zone 1. Additionally, the Wyman's Brook in this area is not covered by the Environment Agency's Flood Zones; however, the watercourse may still pose a risk. Therefore, an FRA is required to determine the potential for fluvial flooding from the watercourse.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change indicates that this site will be at risk of fluvial flooding for two future climate change scenarios (+35% and +70% increase on 1% AEP present day flows). Modelling fluvial flood risk on the land immediately adjacent to the Wyman's Brook watercourse to the north of the site.
Residual Risk from defence breach or overtopping	Not applicable

Blockage	The residual risk from blockage of the culverts at the Gardens of Remembrance and Kimberley Drive will need to be considered as part of a site specific FRA.
Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes which are shown to be at significant risk from surface water flooding.

A.13 Old Gloucester Road

Site Details	
Reference	HD8
Area	14.0 hectares
Current Use	Greenfield
Proposed Use	Housing
Map Reference	CBC_HD8.PDF
Fluvial	**Proportion of site**
Zone 1	20%
Zone 2	80%
Zone 3a	0%
Zone 3b	0%
Surface Water	**Proportion of site**
High	3%
Medium	3%
Low	11%
Other Sources	
Groundwater (AStGWF Category)	>=50% <75%
Reservoir Risk?	Yes



Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
3b	Exception Test required	×	×	×	✓
3a	Exception Test required	×	Exception test required	✓	✓
2	✓	Exception Test required	✓	✓	✓
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	Environment Agency Flood Zones shows risk from Flood Zone 1 is mainly to land immediately adjacent to the River Chelt. However, Flood Zone 2 extends much further into the site. The site may potentially also be at risk from the ordinary watercourse flowing through the west of the site which has not been included within the Environment Agency's Flood Zones. Surface water flood risk largely corresponds to the path of the ordinary watercourse and an area of ponding around Arle Nursery.

FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site will need to pass the Sequential Test. If the site passes the Sequential Test then the Exception Test will be required. An FRA is required to support planning applications as the site is shown to be in Environment Agency Flood Zones 2 and 3. The FRA will need to assess the fluvial risk, confirming the actual risk to the site from fluvial flooding including the extent of Flood Zone 3b as well as the impact of climate change in the future. The risk for the ordinary watercourse flowing through the west of the site will also need to be determined. The FRA will need to demonstrate that the site can be made safe and that development will not exacerbate flood risk both within and outside of the site. An FRA was prepared as part of Planning Application reference 17/01411/OUT[7] which covers part of the site. Hydraulic modelling undertaken as part of the FRA shows the site does not flood in a range of scenarios including the 1% and 0.1% AEP and 1% plus climate change AEP events and suggests the extent of Flood Zone 2 in this area is a result of inaccurate historic flooding information which has been incorporated into Flood Zone 2.
Climate Change	Climate change modelling was undertaken as part of the FRA supporting Planning Application 17/01411/OUT and shows only a small proportion of the site is at risk from the 1% AEP plus 70% scenario (2080s Upper End), this is confirmed by the recent strategic climate change modelling commissioned by the Council.
Residual Risk from defence breach or overtopping	Not applicable
Blockage	Not applicable
Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a greenfield site, the discharge flow rate for a 1 in 1 year rainfall event should be limited to the 1 year greenfield runoff rate and the discharge flow rate for a 1 in 100 year rainfall event should be limited to the 100 year greenfield runoff rate. For Greenfield runoff rates, where long term storage is not provided, the peak runoff rate should be limited to QBar (mean annual flood) [2]. The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[3]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration. A Sustainable Drainage Statement was prepared as part of Planning Application reference 17/01411/OUT[8].
Access and Egress	The site's main access and egress route is via Old Gloucester Road which is shown to be at surface water flood risk. Safe access and egress from the site will need to be demonstrated.

[7] BWB (2017) Old Gloucester Road, Cheltenham: Flood Risk Assessment

[8] BWB (2017) Old Gloucester Road, Cheltenham: Sustainable Drainage Statement

A.14 Land off Chelt Walk

Site Details	
Reference	E4
Area	0.7 hectares
Current Use	Brownfield
Proposed Use	Employment
Map Reference	CBC_E4.PDF
Fluvial	**Proportion of site**
Zone 1	0%
Zone 2	2%
Zone 3a	98%
Zone 3b	Unknown
Surface Water	
High	8%
Medium	33%
Low	40%
Other Sources	
Groundwater (AStGWF Category)	>=50% <75%
Reservoir Risk?	Yes

Flood Risk Vulnerability Compatibility					
Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
3b	Exception Test required	×	×	×	✓
3a	Exception Test required	×	Exception test required	✓	✓
2	✓	Exception Test required	✓	✓	✓
1	✓	✓	✓	✓	✓

Flood Risk Considerations	
Summary of Risk	The site lies adjacent to the River Chelt, on its northern bank. A large proportion of the site is shown to fall within with Flood Zone 3. The site is also at risk of surface water flooding, with the majority of the site being at medium to low risk. Surface water flows in a predominantly south west direction.

FRA Required	Following Diagram 2 of PPG Flood Risk and Coastal Change the site will need to pass the Sequential Test. If the site passes the Sequential Test, the Exception Test will be required for the areas of the site within Flood Zones 3a, 2 and 1. Development should not be permitted within any areas of the site within Flood Zone 3b. An FRA is required to support planning applications as the site is shown to be in Environment Agency Flood Zones 2 and 3. The FRA will need to assess the fluvial risk, confirming the actual risk to the site from fluvial flooding including the extent of Flood Zone 3b as well as the impact of climate change in the future. The FRA will need to demonstrate that the site can be made safe and that development will not exacerbate flood risk both within and outside of the site.
Climate Change	Hydraulic modelled undertaken to understand the impact of climate change shows the site to continue to be at risk from fluvial flooding now and in the future including the impact of climate change.
Residual Risk from defence breach or overtopping	Not applicable
Blockage	The residual risk from blockage of the culvert at Royal Well Lane, blockage of the culvert just upstream of the site (culvert entrance is at Rodney Road and exit is at St George's Place), and blockage of the two footbridges off Little Bayshill Terrace, will need to be considered as part of a site specific FRA.
Drainage	A Drainage Impact Assessment will be required to demonstrate that the treatment and control of surface water runoff can provide a level of betterment, incorporating the use of various SUDS techniques, which should take into account the local geological and groundwater conditions. As a brownfield site, the SuDS systems should modify the runoff rate to achieve minimum of 40% reduction in peak discharges/volumes, but endeavour to reduce flows as close as reasonably practical to the greenfield rates for the same events.[9] The 2011 Sustainable Drainage Systems Report Map 16 shows the soils of the site are HOST Class 21[10]. The report describes these soils as being the most impermeable of the study area and as such, infiltration devices will be inefficient and will require very large volumes to encourage infiltration.
Access and Egress	The site has a number of potential access and egress routes. For instance, there are vehicular access and egress routes from Synagogue Lane and from the roundabout leading from St James' Square to Jessop Avenue, and route by foot from the footpath beside The Bayshill Public House and from the footpath and footbridge off Little Bayshill Terrace. Safe access and egress will need to be demonstrated for the site to pass the Exception Test. All potential access and egress routes are shown to be in Flood Zones 2 and 3, and at risk from surface water flooding.

[9] Gloucestershire County Council (2015), Gloucestershire SuDS Design and Maintenance Guide

[10] Halcrow Group Limited (2011) Gloucester, Cheltenham & Tewkesbury Joint Core Strategy: Sustainable Drainage Systems for Local Development Framework Final Report – Volume 3

Appendix B – Climate Change Mapping

Appendix C – Site Assessment Maps

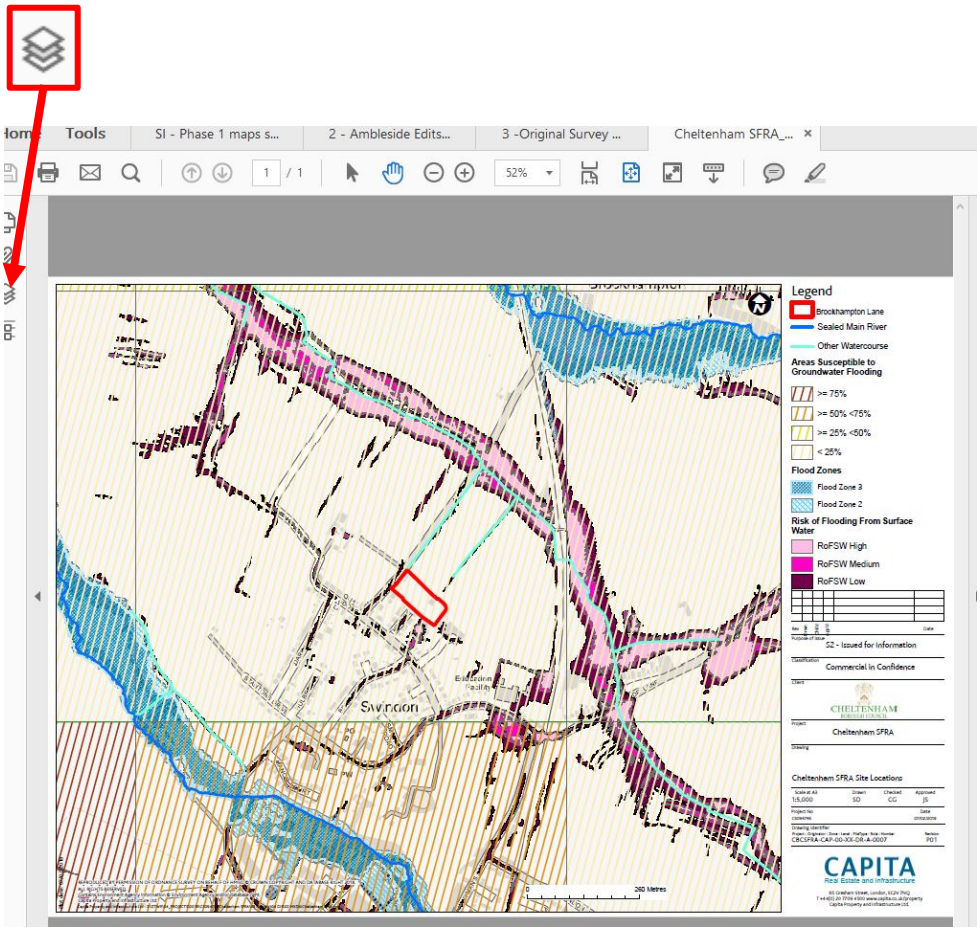
C.1 Interactive PDF User Guide

The maps for each of the sites are interactive which allows the user to turn different mapping layers on and off to display the data of interest. These are presented as PDF (portable document format) documents. The PDFs will open in standard PDF viewing software such as Acrobat Reader which is freely available. Once opened the individual risk layers can be turned on and off by manipulating the inbuilt PDF viewer layer controls.

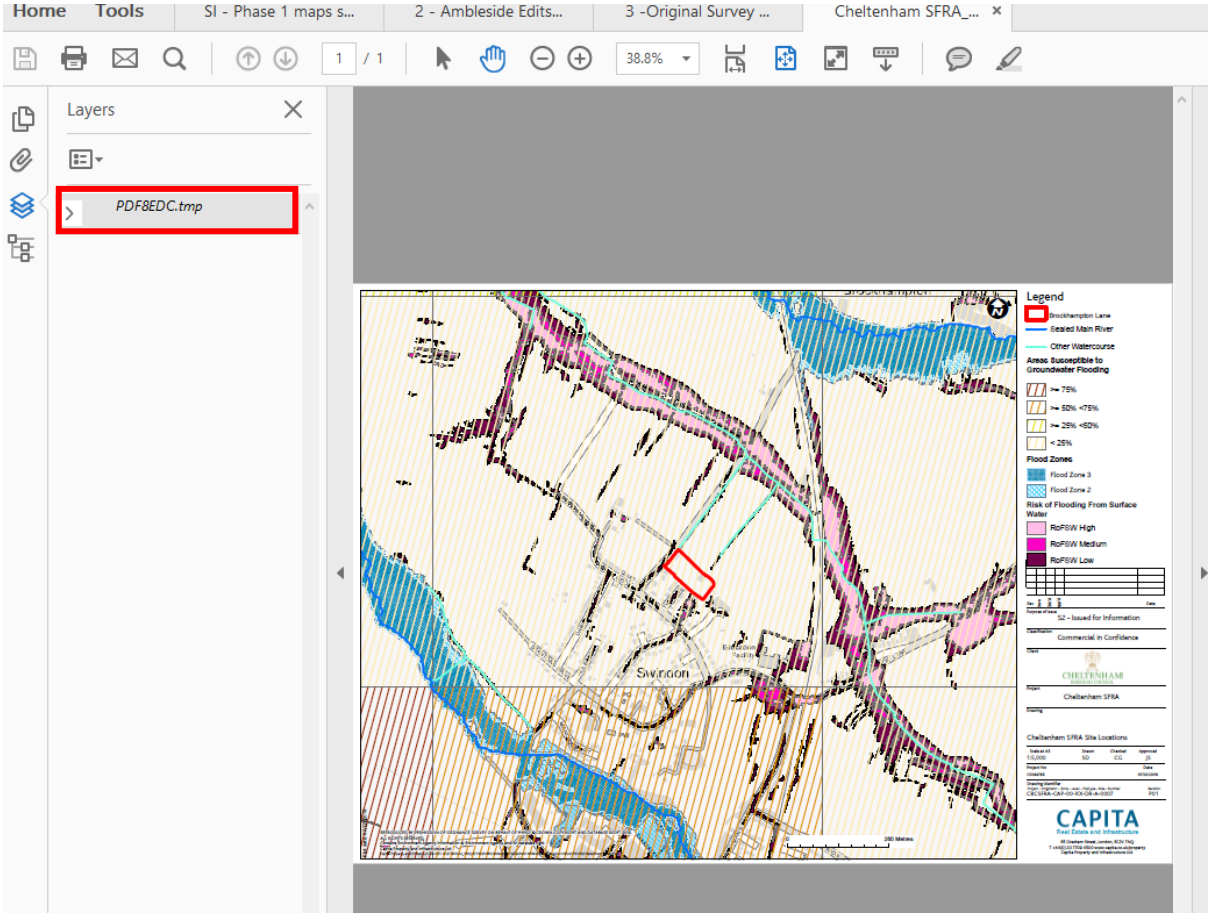
It should be noted that, to avoid visual confusion not all risk layers are displayed as default when opening the file.

The instructions below are based on use of Adobe Acrobat Reader and other PDF viewers may vary.

- Once opened the left-hand side panel there is a symbol that represents the different layers



- Selecting this symbol with expand the left-hand box to show the PDF (named in a similar format to that shown below)



- Expand the drop down menus until the list of available layers is visible. The layers can be turned on or off by checking or unchecking the box next to the name of the data layer.