

1 Understanding flood risk in Watford Borough

1.1 Watford Borough

Watford Borough covers an area of 21km² and has a population of 90,300¹(2011 Census). Watford is a major town in the region of South-West Hertfordshire and the borough is predominantly urban in nature. Watford is situated with the River Colne running through the central eastern region of the town and the River Gade to the west.

1.2 Hydrology

Two main rivers that flow through the Borough; these are:

- River Colne
- River Gade

The Colne is the operational catchment that covers the Watford Borough. There are numerous tributaries of the Colne in the upper catchment and lower before joining the Thames at Staines.

1.3 Topography

The Borough is relatively low-lying and elevations range from 70m to 85m AOD. Towards lower reaches of the River Colne within Watford, elevations fall to around 50m AOD. To the west of the borough along the River Gade, elevations vary between 58m and 54m near Cassiobury Park.

1.4 Geology and soils

The predominant bedrock geology in the Watford Borough is the White Chalk Subgroup. The Sedimentary Bedrock was formed in the Cretaceous Period approximately 66 to 100 million years ago. The bedrock underlays the majority of the catchment with only a small region within the south-east of the district consisting of two other distinct geologies. The Lambeth Group (Clay, Silt, Sand and Gravel) and gravel deposits of the Thames Group dating 56 to 66 million and 34 to 56 million years ago respectively.

The superficial glacial deposits formed during the Quaternary Period form the geologies of the borough. Glacial Sand Gravel overlay the majority of the bedrock within the Borough and represent the outwash of glacial conditions during the Quaternary. Deposited moraines of Till (Diamicton) are located to the north east of the borough, overlaying Bricket Wood. Alluvium deposits are located along the River Gade at Cassiobury park and the River Colne to the east of the Borough.

As a result of superficial till deposits to the north of the Borough overlaying Bricket Wood, soil is slowly permeable, seasonably wet, acid loamy and clayey soils. To the south and central regions of the Borough the soil is freely draining loamy soils where groundwater will be naturally high due to the porous Chalk bedrock underlaying the majority of the catchment. The south east of the Borough is characterised by rapid through flow to streams due to the slightly loamy and clayey soils with impeded drainage. This is due to the presence of the Lambeth Group bedrock (Clay, Silt, Sand and Gravel) where farmland and soils become waterlogged when wet.

1.5 Land use

The Borough is predominantly urban, with small pockets of woodland and farmland to the west and east of the town, towards the River Gade and River Colne. The Grand

¹ Office of National Statistics (2011). 2011 Census: Usual resident population and population density, local authorities in the United Kingdom. Available online at: <https://www.ons.gov.uk/census/2011census>. Accessed on 08/03/2018.

Union Canal also forms an important component of the Borough where it flows alongside the River Gade, before reaching the confluence with the River Colne at Rickmansworth.

Figure 1-1: Topography of Watford.

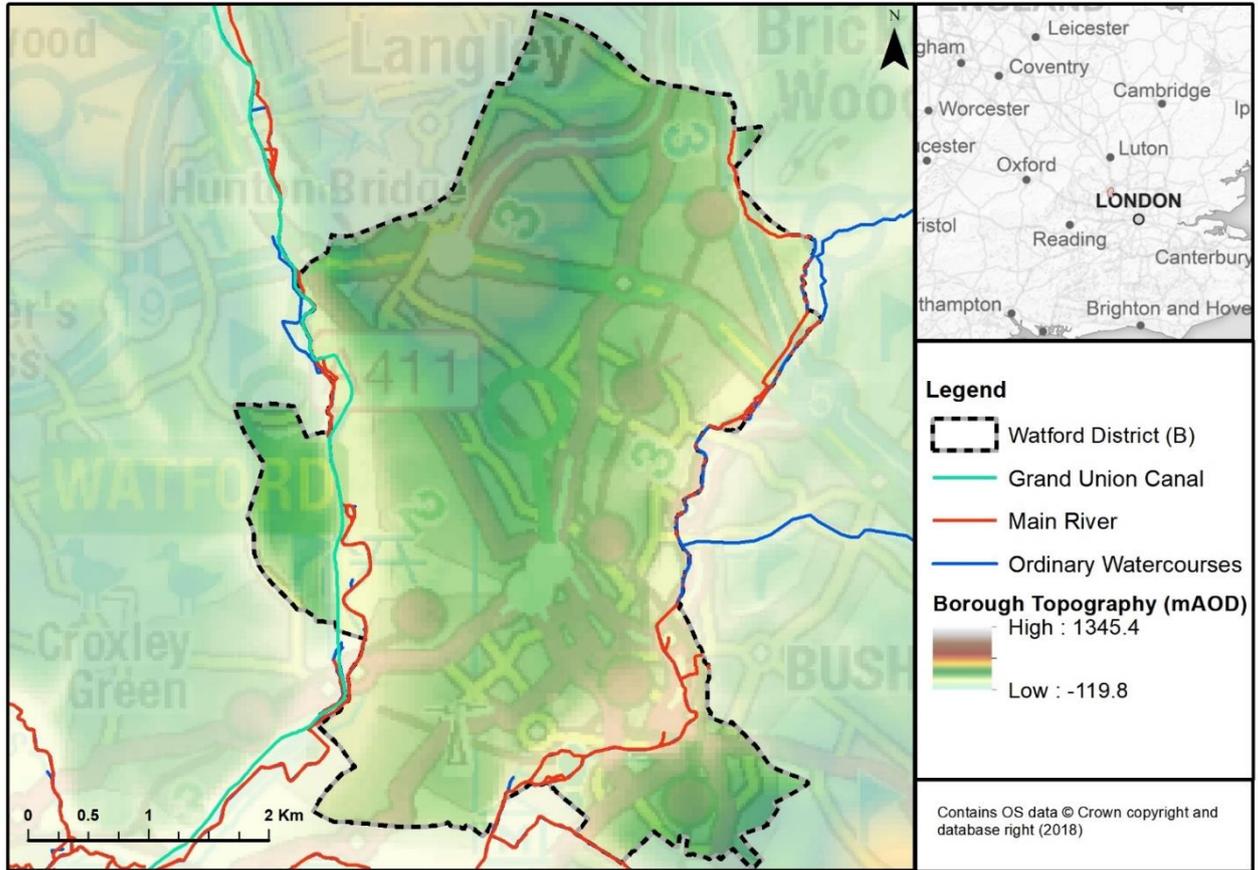


Figure 1-2: Bedrock geology of Watford

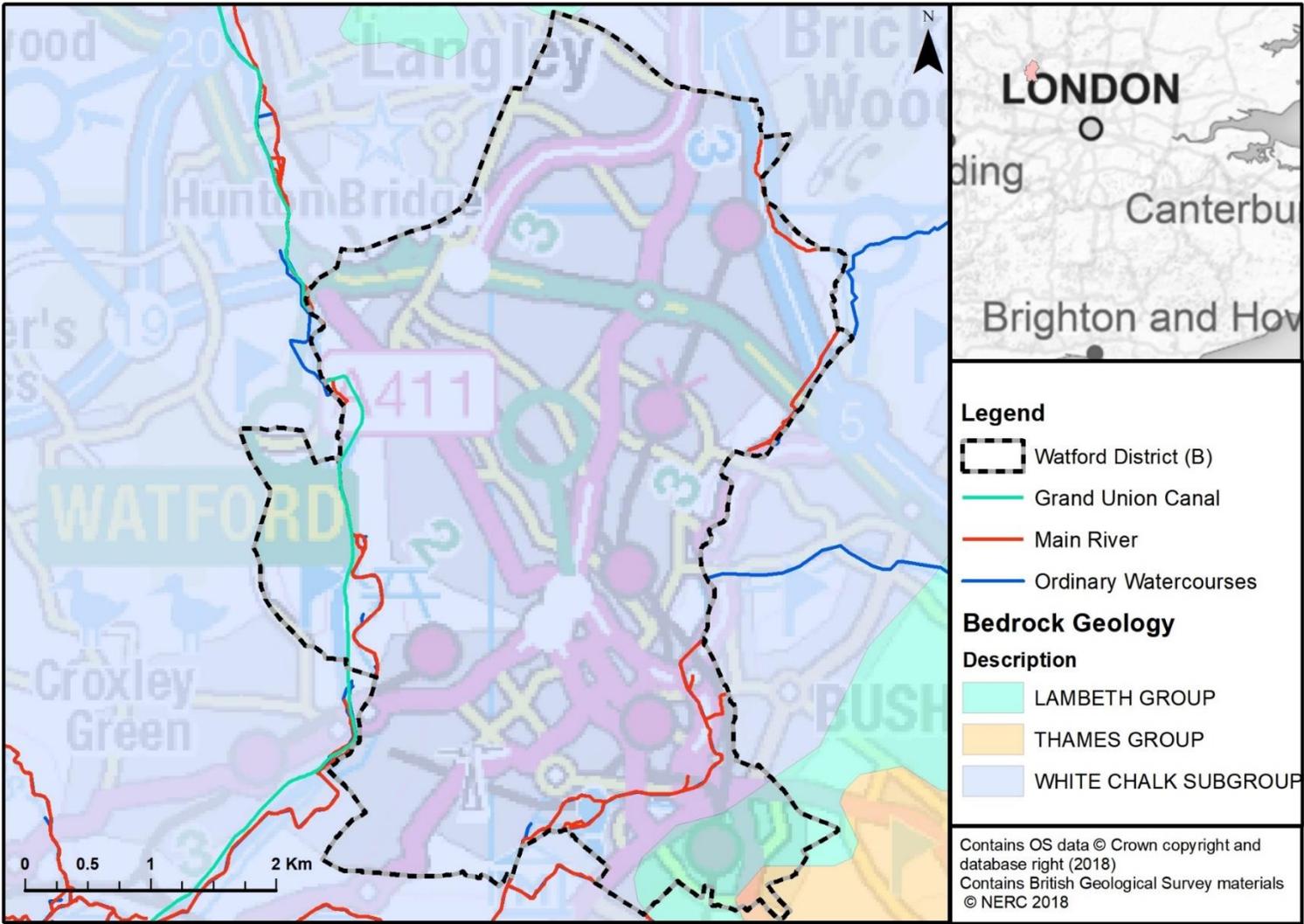
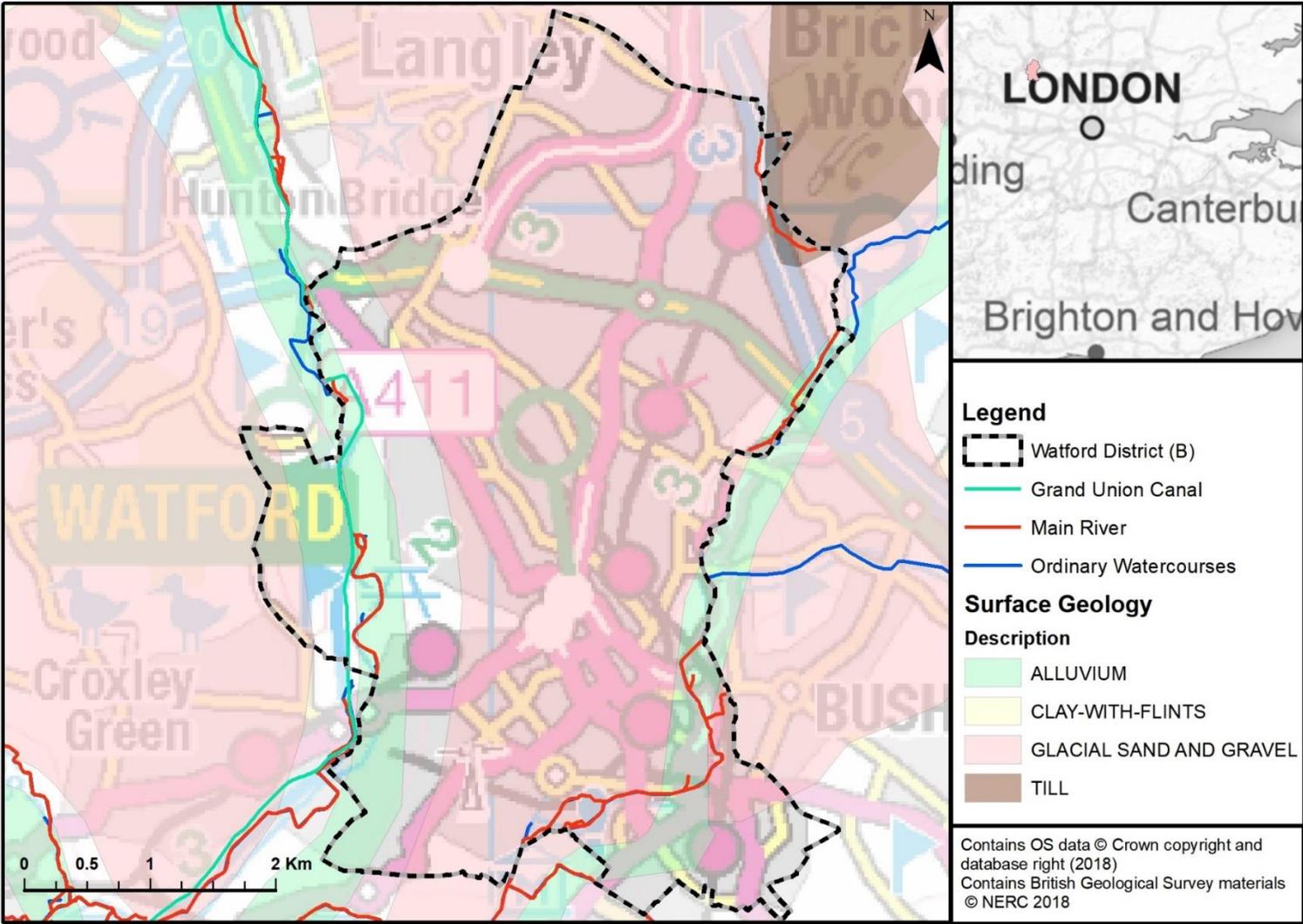


Figure 1-3: Surface geology of Watford



1.6 Flood history

A small number of flood events in Watford were available for assessment within the SFRA, and are provided in Table 1-1. Many of recorded incidents relate to flooding from the River Colne, however there are also multiple incidents of groundwater flooding, particularly during the winter of 2000/2001. Further incidents were caused by surface water flooding, due to intense rainfall or restrictions in the capacity of the drainage system.

Table 1-1: Recorded flood incidents in Watford.

Date	Settlement / location	Severity / description of incident
1997/1998	Molteno Road (off Langley Road), Watford	Significant groundwater flooding resulted in houses being demolished and residents evacuated.
Unknown	Wiggenhall Road, Watford	Properties along Wiggenhall Road regularly flood from surface water drainage. Open culvert behind estate which means when the river rises, this reaches capacity and spills over into the Industrial Estate.
Unknown	Falcon Way, Watford	Properties along road regularly flood.
Unknown	Lower High Street, Watford	Flooding from surface water and River Colne overtopping bank.
2000/2001	Lower High Street, Walter Lane and Bushey Mill Lane	Severe flooding, 20 commercial properties flooded and roads inundated for several days. EA estimated greater than a 1 in 50-year event.
2000/2001	Watford	High Groundwater conditions seen as the highest on record at 0.5m (below ground surface)
2000/2001	Riverside Road, Watford	Severe Colne flooding to properties and Industrial Estate
July 2005	Victoria Road, Watford	Groundwater flooding
February 2014	Skyline Roofing Centres, Industrial Estate.	Internal and External flooding to commercial buildings from the Colne.
February 2014	Arthur Street, Bushey Hall Rd, Stripling Way, Greatham Rd, Woolmerdine Court & Jellicoe Rd.	Extensive internal flooding to properties varying in degree and considerable road flooding.
16 th July 2015	Lower High Street, Attenborough Court, St Albans road & St Johns Road; Watford	Flooding to 8 properties internally from surface water due to heavy rainfall. Roads flooded and impassable.
23 rd June 2016	By the Wood, Harrogate Road, Eastbury Road, Davenham Avenue, Fulford Grove; Watford	Surface water flooding impacted over 30 properties. Reported 2 to 10 inches in places from heavy intense duration of rainfall.

Date	Settlement / location	Severity / description of incident
23 rd June 2016	St Joseph's Primary School, Foxgrove Path & Heysham Drive; South Oxhey	Heavy, intense rainfall led to property and school flooding from surface water.
23 rd June 2016	Batchworth Lane, Davenham Avenue, Altair Way & Eastbury Road; Northwood	Heavy intense rainfall led to over 20 properties flooded from overland surface water. Reported to be 250mm to 750mm deep in parts.

1.1 Flood Risk in Watford

1.1.1 Fluvial

The source of fluvial flood risk in Watford is the Rivers Colne and Gade, which form the eastern and western boundaries of the Borough respectively. The floodplain is relatively wide at Watford, resulting in large extents for Flood Zones 2 and 3. In the west of the Borough, the Flood Zones surrounding the River Gade coincide with open parkland, and there are few residential areas identified at risk. In the east, a number of residential properties, particularly in The Rookery and West Watford areas are located within Flood Zone 2, as well as the main roads of A41 (Watford Road) and Grove Mill Lane.

The extent of fluvial flood risk can be seen in Appendix A.

1.1.2 Surface Water

Several significant surface water flow paths are present in the Borough, particularly in the east around North Watford, Garston and Meriden, where the road network conveys runoff towards the River Colne. A number of shorter flow paths occur in the West Watford and Holywell areas, posing a risk of flooding to Hempstead Road and Rickmansworth Road during a 1 in 100-year flood event.

Surface water ponding is present on the flatter flood plains of the Rivers Colne and Gade. A large area of surface water ponding is also identified in the both of the Borough, in the Woodside area, at a 1 in 30-year rainfall event and greater return periods.

Appendix A provides the surface water flood risk mapping for Watford.

1.1.3 Groundwater

Situated between the floodplains of the Rivers Gade and Colne, there is considerable groundwater flood risk within Watford. Groundwater levels are high across the majority of the borough, at an estimated depth of between 0.025 and 5m below the ground surface.

Flood risk is highest within the floodplains of the two watercourses, particularly in southeast and western Watford. Risk of flooding from groundwater is predicted to be lower within central Watford.

The groundwater flood risk map for Watford is provided in Appendix A.

1.1.4 Sewers

Thames Water provided their sewer flooding register for Watford, which is detailed below in Table 1-2 and Figure 1-4. The largest number of incidents within a single postcode area are recorded in WD 24, which covers North Watford, followed by WD17, covering Watford town centre, Cassiobury and Nascot Wood.

The mechanism of flooding is not specified in the register, however the location of incidents away from the rivers indicates that there may be an interaction between surface water or groundwater and the sewer network, possibly resulting from ingress or misconnections.

Figure 1-4: Map of sewer flooding incidents recorded on Thames Water register.

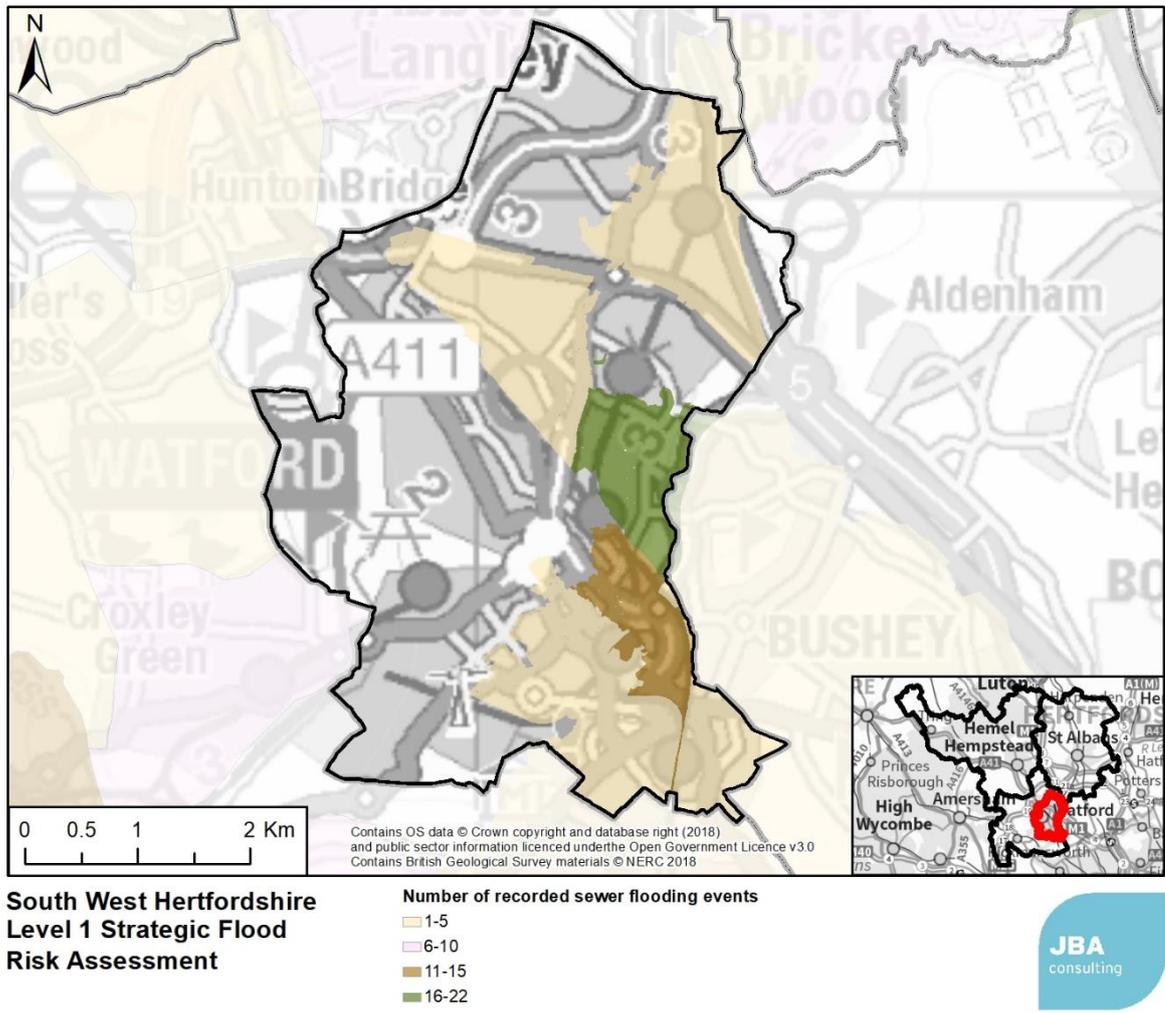


Table 1-2: Thames Water sewer flooding register for Watford.

Postcode Area	Location	Internal property flooding			External property flooding			Total
		2 in past 10-years	1 in past 10-years	1 in past 20-years	2 in past 10-years	1 in past 10-years	1 in past 20-years	
WD17 2	Watford town centre, Cassiobury, Nascot Wood	0	0	13	0	0	0	13
WD17 3		0	0	0	0	0	0	0
WD18 0	West Watford, Holywell	0	0	1	0	0	1	2
WD18 7		0	0	0	0	0	0	0
WD19 4		0	0	2	0	0	1	3
WD19 5		0	0	2	0	0	1	3
WD23 1	Bushey, Bushey Heath	0	0	1	0	0	0	1
WD23 2		0	0	1	0	0	0	1
WD23 3		0	0	0	0	1	2	3
WD23 4		0	0	0	0	1	1	2
WD24 4	North Watford	1	2	0	2	13	4	22
WD24 5		0	0	0	0	1	0	1
WD24 6		0	0	1	0	0	0	1
WD25 0	Garston	0	0	0	0	0	0	0
WD25 9		0	0	1	0	0	1	2
TOTAL		1	2	22	2	16	11	54

1.1.1 Canal

Although the Grand Union Canal forms the western boundary of the Borough, there are no incidents of canal breach or overtopping in Watford. There are however, several raised canal embankments which should be assessed from a flood risk perspective within any site-specific FRAs.

1.1.2 Reservoir

The risk of reservoir flooding is relatively low in Watford. As there are no designated reservoirs within the Borough, the flood risk originates from Willow Lake to the northeast and Hillfield Park Reservoir to the east, and is conveyed by the River Colne. The residual flood risk is largely confined to the floodplains of these watercourses.

However, it should be noted that reservoir safety is closely controlled by operators and regulators, and the likelihood of a flood event due to reservoir breach is low.