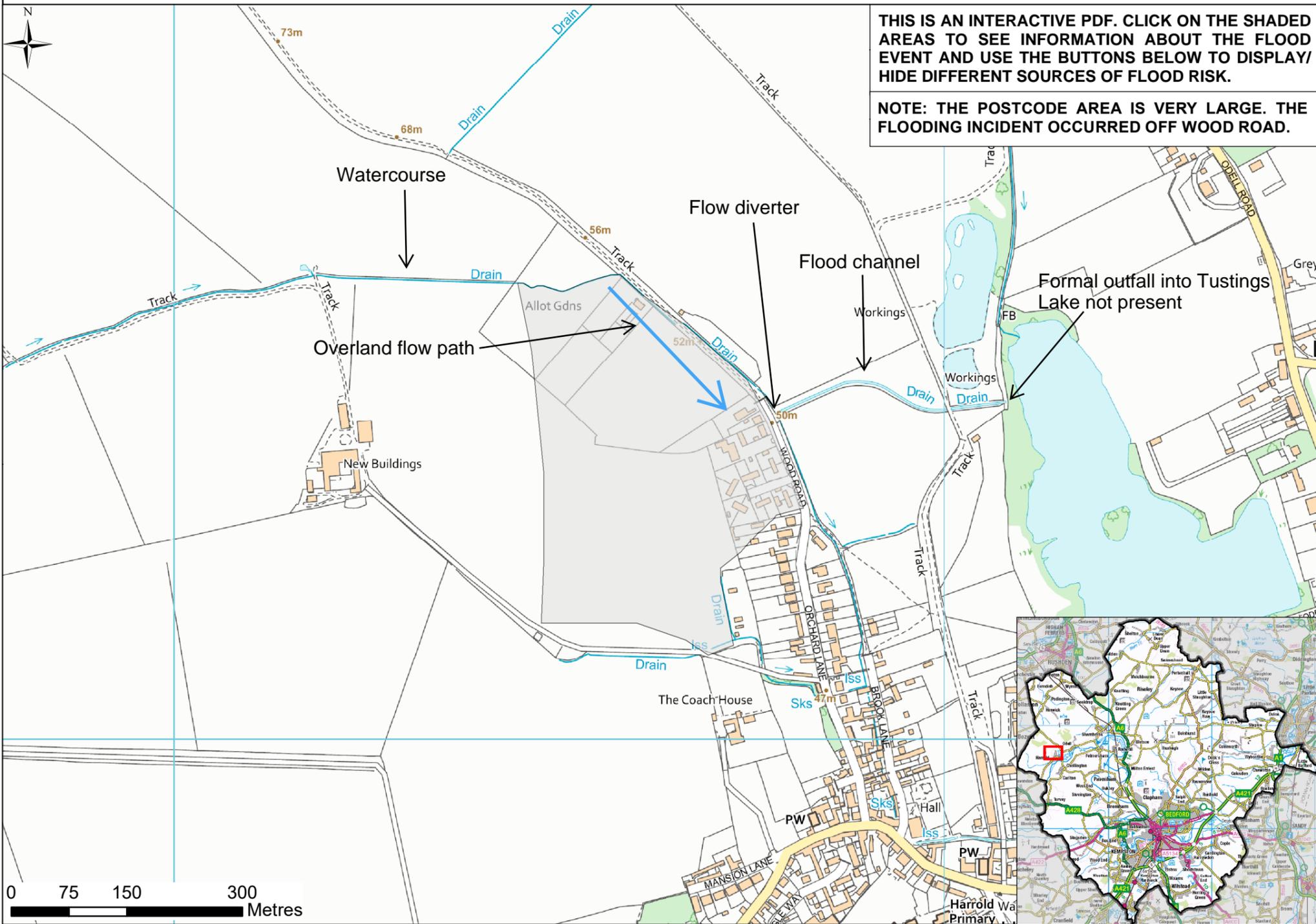


The village of Harrold suffered flooding in December 2020. Under the Flood and Water Management Act 2010, Bedford Borough Council as the Lead Local Flood Authority (LLFA) has the duty to investigate the flood event. The scope of this flood investigation is to identify the source, cause and impact of flooding from available information; identify actions completed by relevant Risk Management Authorities (RMAs) in response to the flood event; and consider actions to better understand and manage the risk of flooding in the affected area.



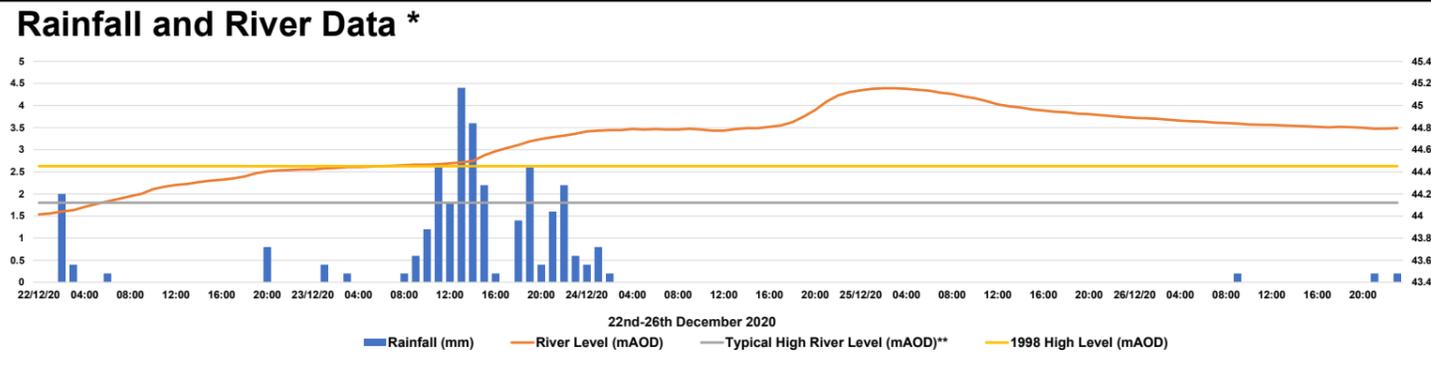
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### Legend

Postcode Boundary	<b>Flood Map for Planning</b>	<b>Risk of Flooding from Surface Water</b>
EA Flood Warning Areas	Flood Zone 3	High risk of flooding (3.3% AEP)
Flood Warning Areas	Flood Zone 2	Medium risk of flooding (1% AEP)
Areas benefitting from flood defences		Low risk of flooding (0.1% AEP)

**CLICK ON THESE BUTTONS**

FLOOD MAP FOR PLANNING	RISK OF FLOODING FROM SURFACE WATER
FLOOD WARNING AREAS	BACKGROUND MAP



### Rainfall and River Gauges

<b>Nearest Rain Gauge</b>	Olney
<b>Distance to Gauge</b>	7.69 km
<b>Nearest River Gauge</b>	Turvey
<b>Distance to Gauge</b>	4.01 km

\*Rainfall and River data was obtained from the Environment Agency (May 2021)  
 \*\*River levels below this level 90% of the time.

### Rainfall and River Data Interpretation

The graph identifies that the main rainfall event at the nearest rainfall gauge to Harrold occurred between 08:00 on December 23rd and 03:00 on December 24th. The total rainfall volume is recorded as 27mm with a peak rainfall intensity of 4.4mm/hour. This single event saw just under half of the 55mm of rainfall which is expected for the whole month of December on average.

The River Great Ouse is located approximately 890m to the south of the affected area. The graph shows that the river levels in the Great Ouse were elevated above the 'typical high river level' from the early hours of December 22nd and stayed above this level until beyond December 26th. The 'typical high river level' at the nearest gauge station is identified as 44.1m Above Ordnance Datum (AOD). River levels above this are only expected to be recorded 5% of the time. For context, the 1998 peak flood level is included, which was recorded at 44.45m AOD, and the graph shows that the December 2020 river levels exceeded the 1998 level from approximately 02:00 on December 23rd.

**SOURCE OF FLOODING:** Watercourse / Surface Water

## FLOOD EVENT & CAUSE

One residential property reported internal flooding on December 23<sup>rd</sup> from water encroaching the building from fields to the north and flooding the kitchen by several inches. There is an ordinary watercourse which flows into Harrold from the north at Wood Road, which receives flows from a catchment area of approximately 333ha<sup>1</sup> and is thought to be the source of the flood water reported. It is thought that the flow in the watercourse is closely related and responsive to rainfall.

The reported flood mechanism is consistent with the Environment Agency Flood Risk from Surface Water mapping<sup>2</sup> which identifies several overland flow paths in the vicinity of the watercourse. It appears that water would overtop the banks of the watercourse approximately 250m to the north of the affected property and form an overland flow route across the fields towards Wood Road. The overland flow route is shown to re-join the watercourse to the east of the affected property at Wood Road. It is thought that the watercourse has not been maintained for some time prior to the flood event.

In addition, there is a complex mechanism at the confluence between the overland flow route and the watercourse which is thought to have contributed to the flooding experienced. A flow diverter on the watercourse at Wood Road currently allows a controlled amount of water to pass through and continue within the watercourse towards Harrold. The rest of the water is diverted eastward into a flood channel, which does not appear to have a formal outfall. Following the heavy rainfall experienced in the area, it was reported that water backed up at the diverter and ponded on Wood Road. This may have prevented the flood flow route from the fields to the north from re-joining the watercourse, causing it to back up further onto Wood Road and towards adjacent properties.

In conclusion, December 2020 was a very wet month with an average rainfall of 108mm across East Anglia, which is 95% higher than the December average<sup>3</sup>. The three months leading up to December also saw higher than average rainfall such that by December 23<sup>rd</sup> the ground was already saturated. This, combined with the rainfall recorded during the dates in question, meant that surface water was less able to infiltrate into the ground and more likely to run off into the watercourse and form overland flood flow routes. In addition, the high river levels in the River Great Ouse located approximately 880m from the affected area would have prevented the watercourse and drainage ditches within Harrold from discharging freely, likely exacerbating the flooding experienced. Any local watercourse and highway drainage maintenance issues are likely to have contributed to the flooding experienced.

## FLOOD WARNINGS & INITIAL RESPONSE

- **23/12/2020:** Lead Local Flood Authority (LLFA) officers monitored/assessed locations based on the conditions and forecast predicted
- **23/12/2021 15:30 – 16:30:** Fire service inspected the affected property and provided flooding advice to residents.
- **24/12/2021 daytime:** LLFA officers visited those who flooded on December 23<sup>rd</sup> to gain information on the damage caused and offer assistance.
- **25/12/2020 14:30:** Flooding experienced in the wider area declared a major incident by Bedford Borough Council.
- **25/12/2020 21:32, 26/12/2020 10:17:** Fire service provided flooding advice to residents.
- **28/12/2020:** LLFA, Bedford Flood Response Team, and volunteers from the Council visited to carry out impact assessment to help with recovery and clean up.

## ACTIONS

Timescale	Action	Responsible Party
Complete	Investigate the highway drainage in the area and clear any blockages. This was completed around Orchard Lane in January 2021.	Bedford Highways
Complete	Set up a community flood group. The flood kit has now been issued and a flood plan has been written.	Lead Local Flood Authority
Ongoing	Continued engagement with and support of the community flood group. The flood group should enable access to the flood kits, flood action plans, and information about flood warnings/alerts and Property Flood Resilience (PFR).	Lead Local Flood Authority
Short-term (1-6 months)	Investigate who is responsible for the watercourse to the north of Wood Road and undertake maintenance to maximise its capacity.	Lead Local Flood Authority/ Riparian owner
Short-term (1-6 months)	Investigate who is responsible for the maintenance of the flood channel and establish an appropriate maintenance regime to ensure it retains its capacity.	Lead Local Flood Authority
Long term (2-4 years)	Assess the potential for a capital scheme and the benefit/implications of: <ul style="list-style-type: none"> <li>- adding a second pipe beneath the road to the north of Wood Road to increase the capacity of the watercourse crossing;</li> <li>- works to the diverter at Wood Road to encourage flood flows eastwards into the flood channel rather than overtopping onto Wood Road; and</li> <li>- constructing an outflow from the flood channel into Tustings Lake</li> </ul>	Lead Local Flood Authority
Long-term (2-4 years)	Investigate the potential benefits of a flood warning system for the watercourse to the north of Harrold.	Lead Local Flood Authority

**ORIGINATED:** Nora Balboni CEng C.WEM MCIWEM, Senior Engineer, 21/07/2021

**CHECKED/VERIFIED:** Matt Tandy C.WEM MCIWEM MInstLM, Principal Engineer, 23/07/2021



<sup>1</sup> Flood Estimation Handbook (FEH) web service, <https://fehweb.ceh.ac.uk/> [accessed June 2021].

<sup>2</sup> Environment Agency Flood Risk from Surface Water mapping, <https://flood-warning-information.service.gov.uk/long-term-flood-risk> [accessed June 2021].

<sup>3</sup> Environment Agency, December 2020 Flooding Great Ouse Catchment Summary.