Conceptual Model of Flooding in Marlow

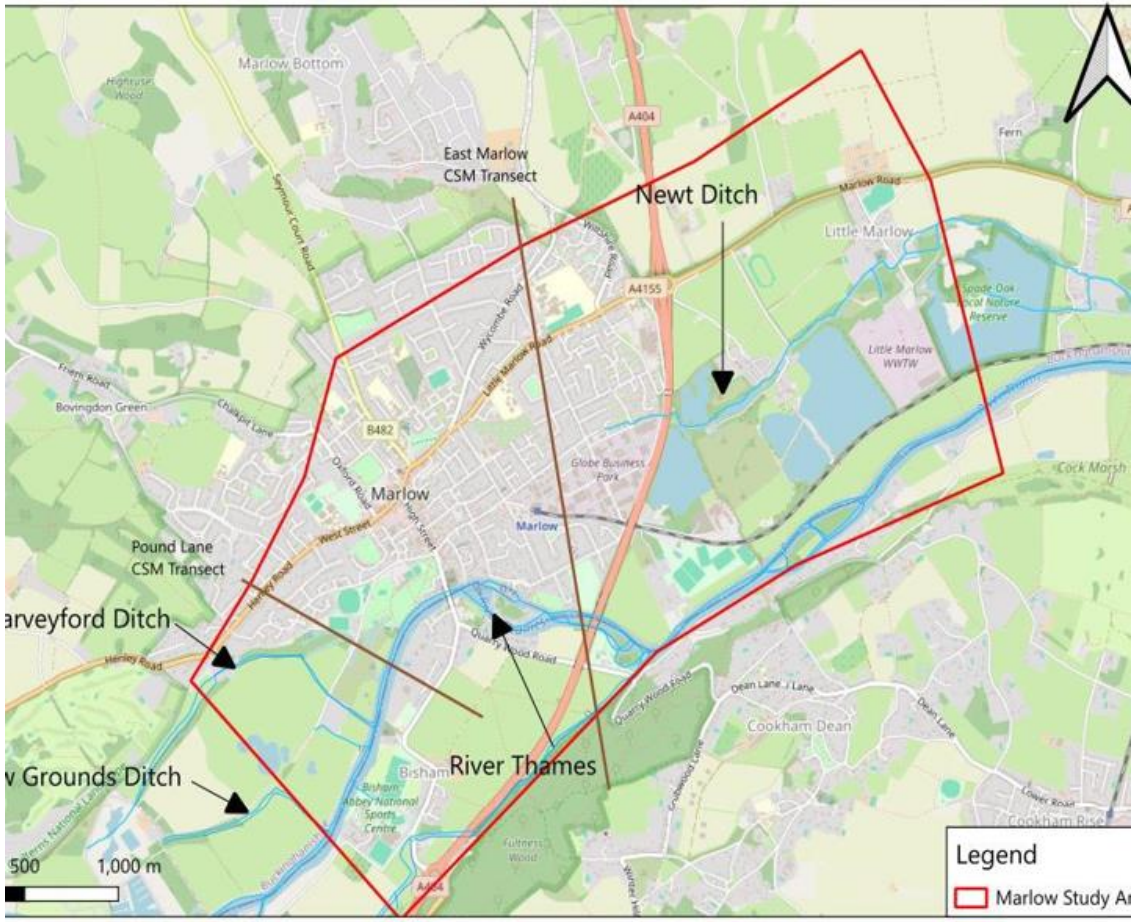
Executive Summary

Project Groundwater
Are you flood resilient?

Flooding in Marlow (1)

Marlow sits on the northern bank of the River Thames, northwest and upstream of Maidenhead, in an area where groundwater flooding is known to occur. The majority of the town and the surrounding area to the southwest and northeast sit on superficial deposits - sand, gravel and alluvium (a mix of clay, silt and sand) - that allow water to flow easily through them. Beneath these lies a chalk aquifer, an important regional groundwater system.

Because the river, the gravels and the chalk are all closely connected, rises in water level rises in one can influence levels in the others.



Flooding in Marlow (2)

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The *Conceptual Model of Flooding in Marlow* report used information from local studies, the flood history of the area, local geology, how water moves through the area, what happened during previous flood events, residents' experiences and where information is missing to develop a clearer picture of how water moves through and round the town.

It was written to provide context for the groundwater monitoring, mapping and modelling and the development of an early warning service in Marlow. This summary gives an overview of these findings - full details of the data used can be found in the report. The study area, with the conceptual model cross-section marked (CSM Transect), is shown on the previous page.

Flooding hotspots include:

- Pound Lane
- Gossmore Lane/Gossmore Park
- East Marlow (Dedmere Road, Quarrydale Drive, Fieldhouse Lane)
- Areas close to the River Thames
- A few inland areas where groundwater emerges unexpectedly.

Flooding in Marlow (3)

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To help reduce the risk of flooding in the town, several schemes have been implemented:

- Marlow Flood Alleviation Scheme, developed by the Environment Agency – built raised walls and earth embankments around Pound Lane and Firview Close. Also installed groundwater pumps at both these locations, with compensatory storage created at Lower Pound Lane.
- Clearing the culverts that drain into and along Newt Ditch as well as replacing and cleaning the pipework along the ditch to increase capacity and flow.
- New pumping wells were drilled and fitted with automatic, sensor operated pumps to manage surface water
- Public engagement and flood awareness events.

These measures can help reduce the risk of future flooding but are not able to fully prevent it.

Main sources of flooding

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Flooding in Marlow is complex and is typically caused by a combination of factors, namely:

- Heavy rainfall, particularly in the winter
- High river levels in the River Thames and Newt Ditch
- Rising groundwater in the underlying gravels and chalk
- Local drainage and sewer systems becoming overwhelmed

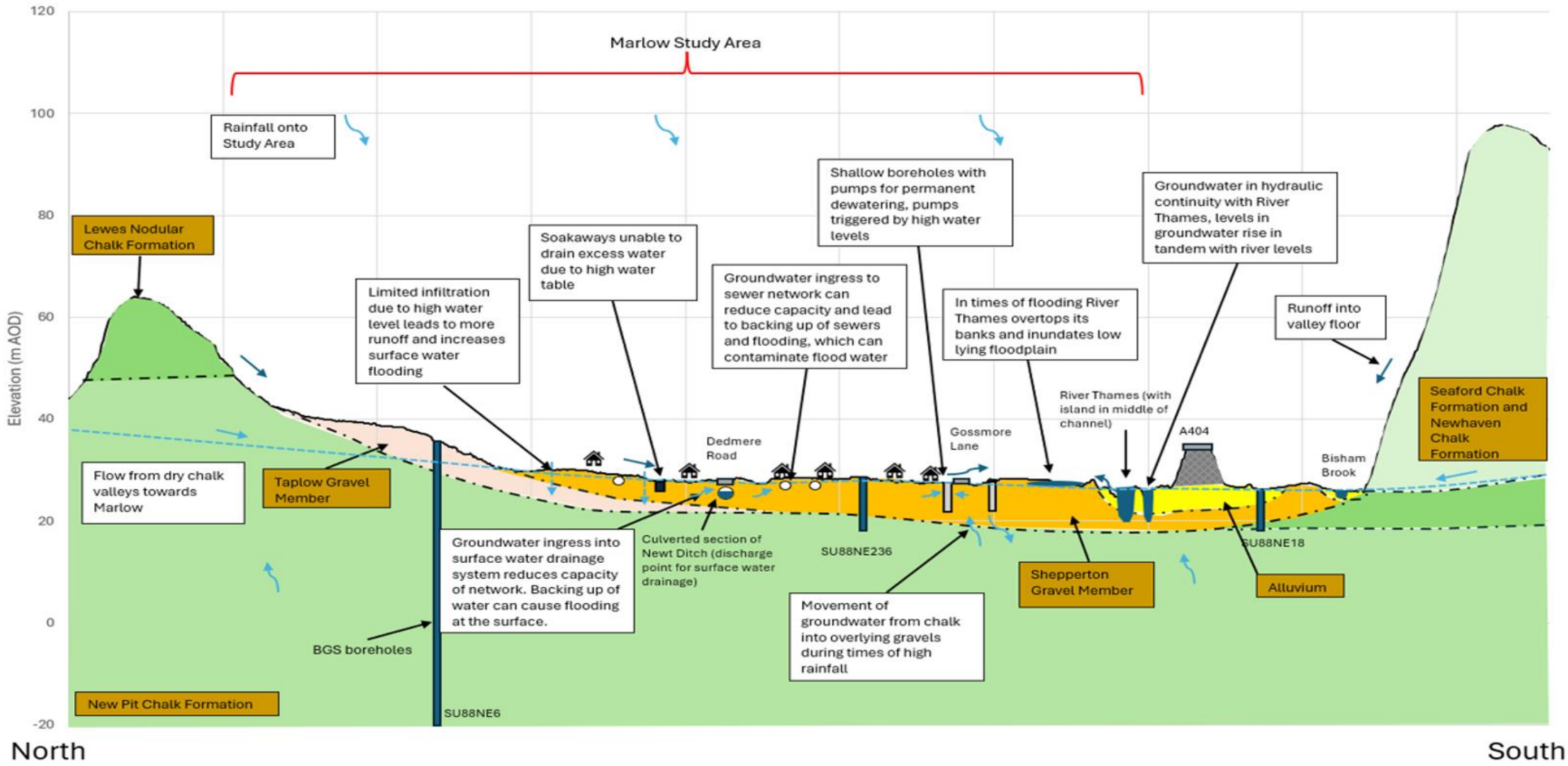
Previous flood events in 2000/01, 2007, 2009, 2010/11, 2012, and 2014 suggest that there is often a pattern.

The report identifies some major types of flooding in Marlow:

- Fluvial flooding – when the River Thames rises, it can overtop its banks, especially around Pound Lane and Gossmore Park. Newt Ditch in East Marlow can also back up, flooding nearby roads and properties.
- Groundwater flooding – during long wet periods, groundwater levels in the chalk and gravels rise. If the chalk becomes saturated, water can move upward into the gravels, causing water to emerge at the surface, soakaways no longer drain, local pumps run continuously and sewer systems can become infiltrated by groundwater.
- Surface water and drainage – blocked culverts, particularly under the A404, can worsen flooding in Dedmere Road, The Croft, Quarrydale Drive and Fieldhouse Lane.
- Sewers – high groundwater levels often enter the sewer system, leading to the sewer being overloaded, contaminated floodwater and loss of usable sewer capacity.

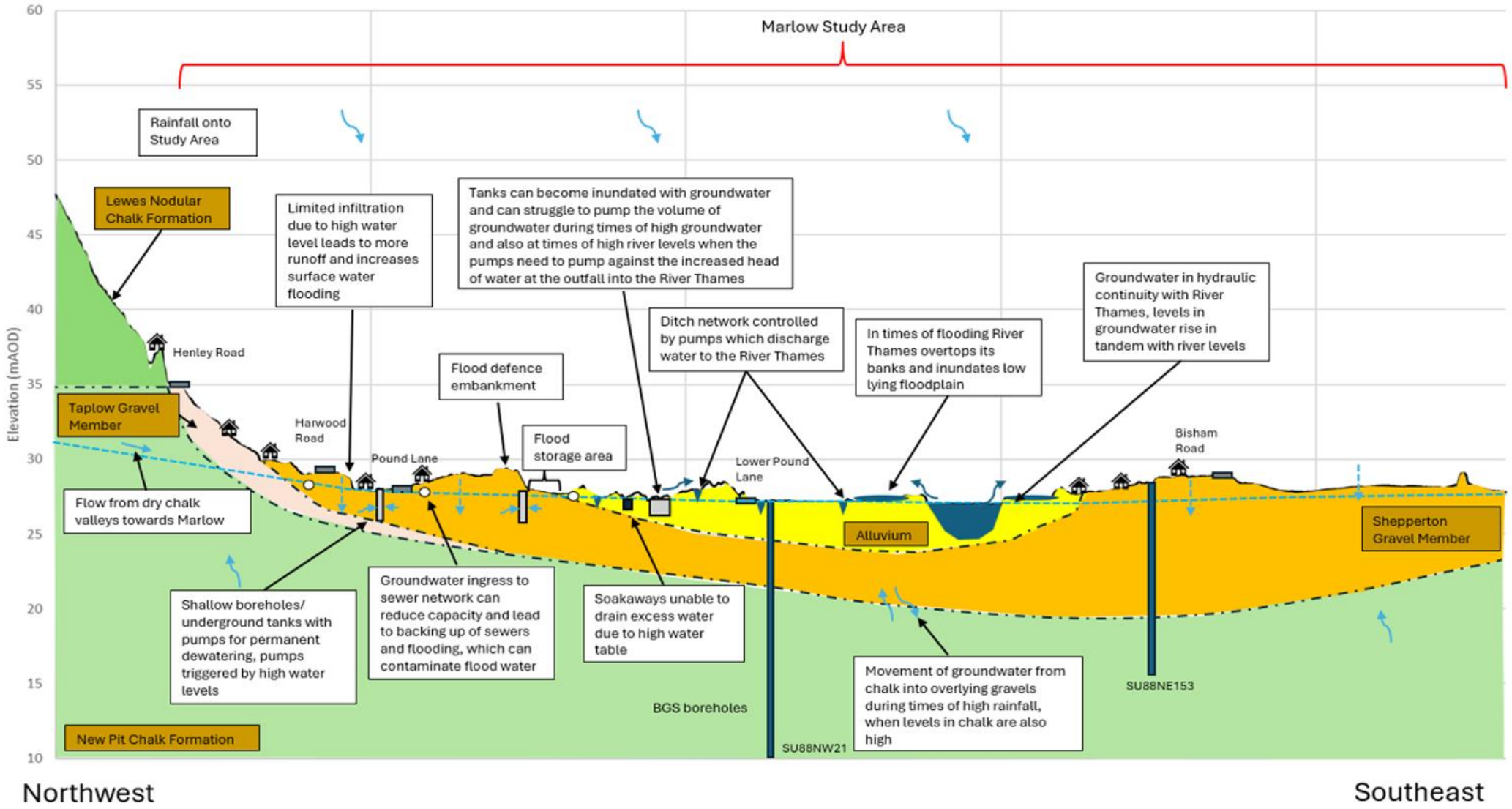
Conceptualising flooding in East Marlow

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Conceptualising flooding at Pound Lane

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Sequence of flooding and knowledge gaps

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Details on the sequencing of flood events have only been identified for one flood in 2014 within the Study Area, which made it difficult to comment on the events that would cause a typical flood in Marlow. However, from the information available, it is likely that the main cause is rainfall, which leads to water in the river overtopping into the low-lying areas of the floodplain.

Improvements in this conceptualisation of flooding in Marlow could be made by understanding:

- How groundwater in the gravels acts during flood events as the monitoring boreholes in the area target the chalk aquifer.
- The relationship between rainfall and groundwater levels in the gravels within the Marlow catchment area.
- Trigger levels for the pumps in Marlow, and how the pumps impact groundwater levels locally by having more information on pumping volumes.
- The sequencing of events during more flood events, as there is only detailed information for the event in 2014.
- Reducing uncertainties in the study area, such as lag times between river level rises and groundwater level rises, as well as how local groundwater levels respond during high rainfall events and flood events.

Recommendations (1)

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- Set up a monitoring network in the area to monitor both surface water levels (in the River Thames and Newt Ditch as well as the ditches in Pound Land) and groundwater levels in areas known for flooding. This could help in observing levels during flooding so that threshold levels for flooding events may be determined. Both deep and shallow installations should be considered to establish the connecting between the gravels and the underlying chalks.

- Establish a rainfall monitoring point within the Marlow area to understand trends between rainfall and groundwater levels there, rather than using rainfall stations which are at topographical highs and do not reflect conditions in Marlow Town.

- Increase engagement with local residents to learn more about the impacts of historical floods on the community and gather first-hand accounts of impacts. This approach would complement the understanding but would need a Risk Management Authority to co-ordinate and manage data collection, collation and analysis.

Recommendations (2)

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- Obtain data on any licensed or unlicensed groundwater abstractions in the area (likely mainly from the chalk) to understand if these play any part in reducing groundwater levels/risk of groundwater flooding within Marlow.
- Improve understanding of sewerage and the underground drainage network and how they interact with shallow groundwater.
- Explore areas away from the surface water network where flooding has been recorded to determine if they are purely groundwater driven flooding. Use higher-resolution LiDAR (light detection and ranging) surveys to better map flow pathways in Marlow.
- Improve understanding of the trigger levels for groundwater pumps in East Marlow, and the ditches in Pound Lane, as well as the impacts of flooding, especially basement flooding, which is not well understood in Marlow.

Project Groundwater

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Project Groundwater supports communities to be more resilient to groundwater flooding.

It is a six-year programme working with communities in up to nine high-risk flood areas of the Chiltern Hills and Berkshire Downs.

It is led by Buckinghamshire Council in partnership with five other local authorities and Flood Community Groups. This project is funded by Defra as part of the £150 million Flood and Coastal Innovation Programmes which is managed by the Environment Agency.

These programmes are driving innovation in flood and coastal resilience and adaptation to a changing climate.