Conceptual Model of Flooding in Colnbrook

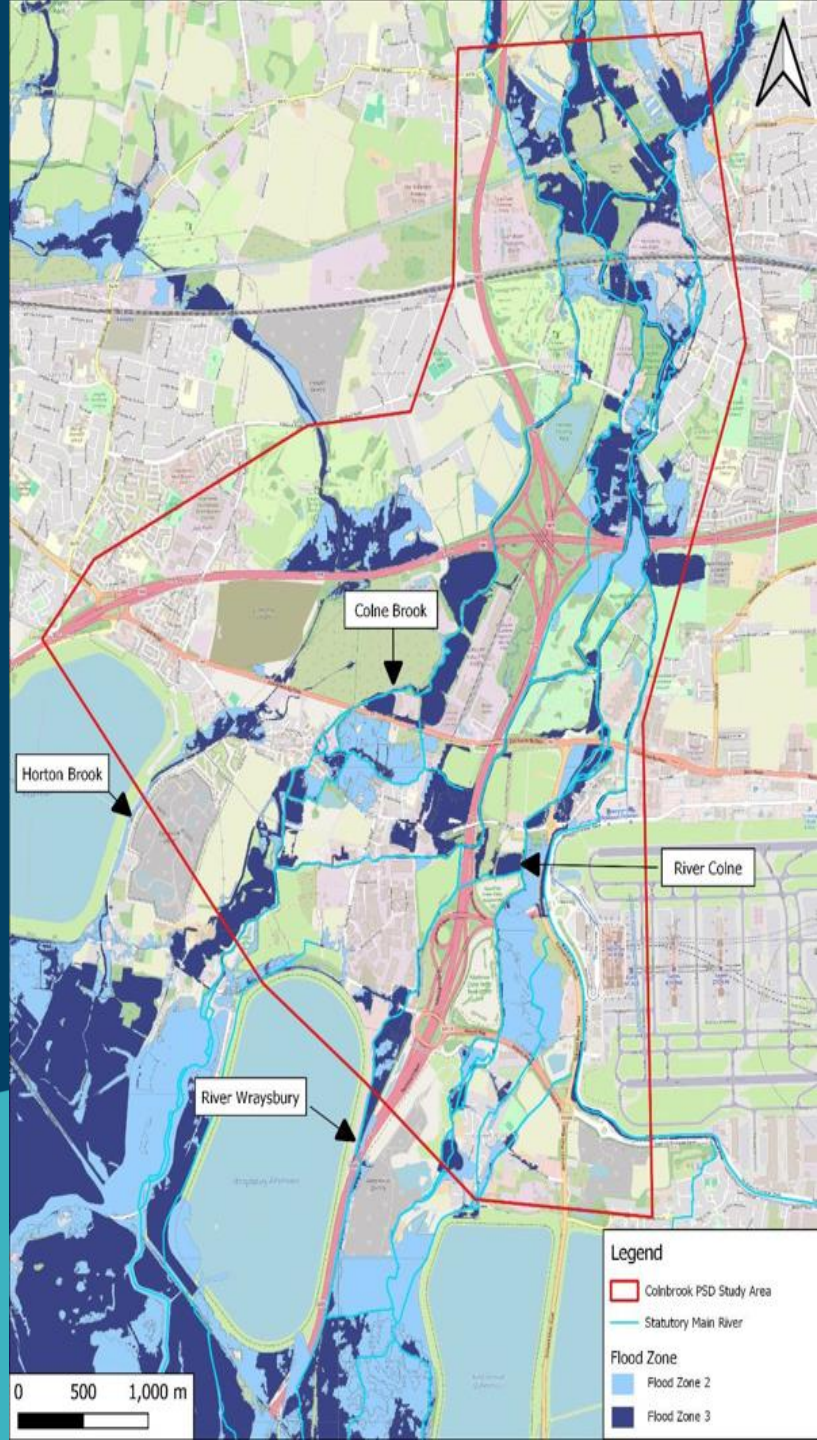
Executive Summary

Project Groundwater
Are you flood resilient?

Flooding in Colnbrook

Colnbrook, near Slough, is an area that regularly experiences flooding, particularly from high groundwater levels in the shallow gravel layers beneath the town. Using existing data sources and feedback from residents, the *Conceptual Model of Flooding in Colnbrook* report was written to provide context for the groundwater monitoring, mapping and modelling and the development of an early warning service within Colnbrook.

It explores why flooding happens in this location, how water moves through the area and what happened during previous flood events. It uses this information to model how and where flooding may happen in the future, identify information that is still missing to fully understand the risks of future groundwater flooding and how that might be addressed. This summary gives an overview of these findings - full details of the data used can be found in the report. The image to the right shows the study area.



Why Colnbrook Floods (1)

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Colnbrook sits in a low-lying river valley between Horton Brook and Colne Brook. The area is prone to groundwater flooding as the ground beneath the village is made up of very permeable sand and gravel deposits.

These act as aquifers, holding and allowing water to pass through them. The deposits easily absorb water, fill up quickly during wet periods and allow groundwater to rise close to the surface if it cannot run away.

Below them is London Clay, which does not let water pass through. This means that when the gravel layer becomes saturated, water has limited opportunity to drain deeper into the ground, which can contribute to groundwater levels rising towards the surface.

Because the rivers and the gravel aquifer are connected, high river levels can be one of the contributors to rising groundwater levels. When both rise during long periods of rain, water can spill onto the surface, causing both river (fluvial) and groundwater flooding.

Why Colnbrook Floods (2)

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The area is also full of:

- Man-made ponds and old gravel pits that have become lakes
- Landfill sites that disrupt natural groundwater pathways
- Artificial drainage channels and control structures (penstocks or control gates, weirs, ditches).

All these human alterations affect how water moves around during and after heavy rain.

Historically Colnbrook experienced flooding in 2000, 2001, 2003 (although the sources of this flooding are not certain) and most notably in 2014, where more information was recorded. However, although groundwater level data is available from 2004 onwards, data for the Colne Brook is only available from 2018.

Limited work has been undertaken to address flooding in the Colnbrook area, both for river and groundwater flooding. The majority of the work focuses on the ditch network around Poyle and Colnbrook where flooding is recorded to be an issue.

Main Sources of Flooding (1)

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The report identifies three major types of flooding in Colnbrook, namely:

- Fluvial flooding – from rivers and ditches overtopping into the floodplain, including in built-up areas.
- Groundwater flooding – from groundwater rising to the surface due to its strong connection with river levels and the limited ability for water to drain downwards into the clay.
- Surface water and sewer flooding – due to soakaway limitations, high groundwater levels and infiltration of groundwater into foul sewers.

These sources of flooding often happen together, increasing overall impact and making determining the cause of the flooding difficult to pinpoint.

Whilst there is limited information available on flood events in Colnbrook, and only the 2014 flood can be analysed in any meaningful way, the report notes that all known events have occurred in the winter months, when rainfall tends to be higher.

Main Sources of Flooding (2)

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Drawing on the data and evidence that is available, the report found that fluvial flooding occurs from a number of watercourses including Horton Brook, Colne Brook, Poyle Channel and various ditches.

When these watercourses overtop, they flood the floodplain which in some cases causes flooding in residential areas, especially in Western Colnbrook.

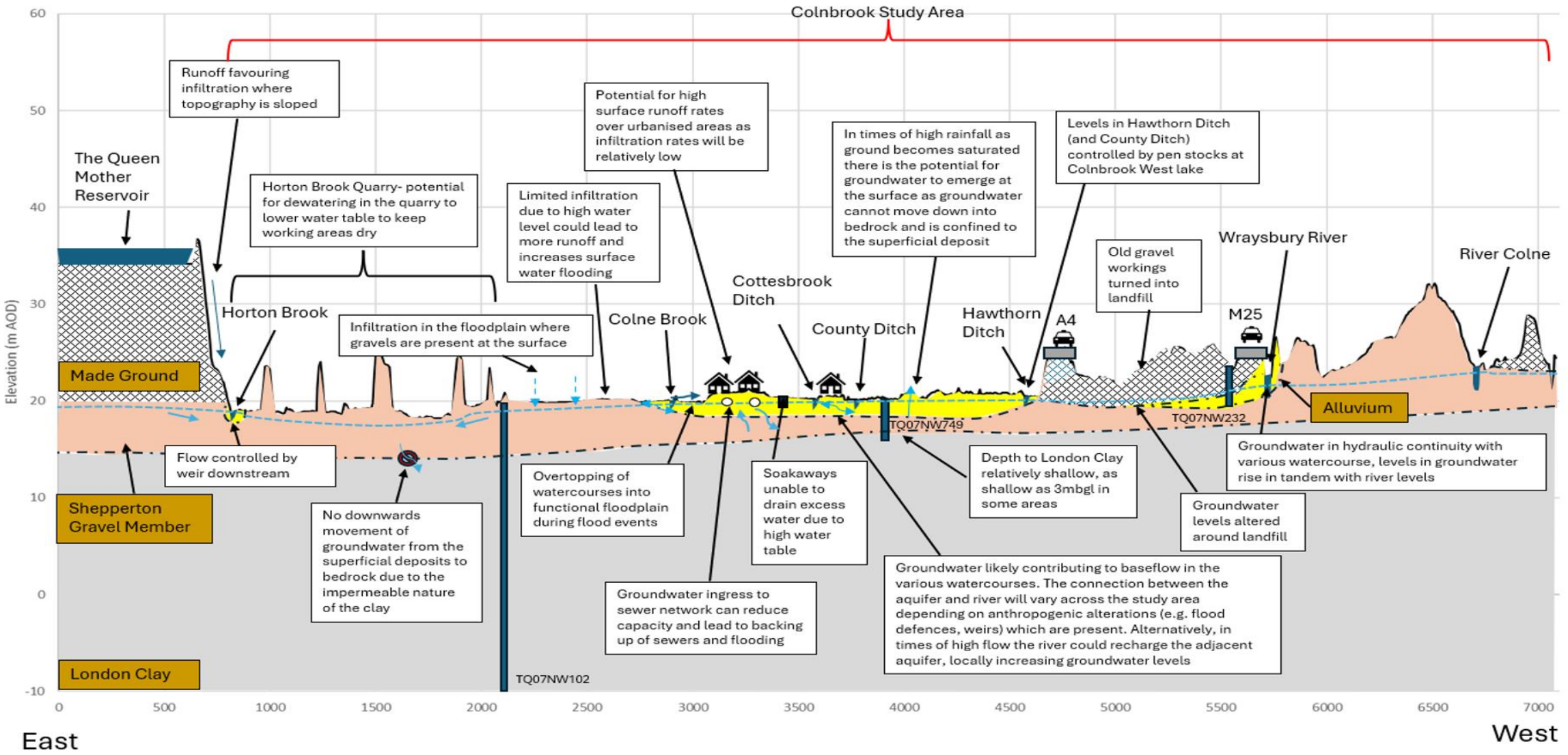
Control measures are in place at:

- Hawthorn Ditch,
- Poyle Channel and
- downstream at Horton Brook.

However, these can be overwhelmed in times of flooding and in some cases, if not functioning correctly, can contribute to flooding upstream of them.

Conceptualising Flooding in Colnbrook

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The Sequence of Flooding and Knowledge Gaps (1)

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Only the flood event in 2014 within the Study Area gives any details on the series of events which led to flooding and so the report noted that it was difficult to comment on the events that would cause a typical flood in Colnbrook.

However, it is likely that the main cause is rainfall, which leads to higher river levels in watercourses, causing overtopping and flooding.

Given the highly permeable nature of the gravels, a rise in river levels may mean water flow paths are reversed. This drives groundwater levels up as the water cannot flow through the London Clay and it therefore emerges on the surface.

It is therefore likely that groundwater levels would remain high until river levels reduce, allowing groundwater to flow back into the river.

The Sequence of Flooding and Knowledge Gaps (2)

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

- How groundwater in the gravels acts during flood events.
- The location of local flooding “hotspots” identified by residents.
- The sequencing of events when a flood occurs in addition to the information from 2014.
- Lag times between river level rises and groundwater level rises.
- 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 and groundwater levels in areas known for flooding. This could help improve the understanding of the relationship between surface and groundwater. Also, a monitoring network specifically looking at levels during flooding could be used to determine threshold levels for a flood alert scheme.
- Establish a monitoring network in the gravels to understand how they respond in flood events and enable contour mapping to identify the flow direction of the groundwater in this geology.
- Undertake more engagement with local residents to document past flood events and locations, listen to first-hand accounts of impacts.
- Gather information on groundwater abstractions from gravels in the area to understand if these play a part in reducing groundwater levels/risk of groundwater flooding in Colnbrook. Also, from historical landfills and water treatment works upstream of the Study area to determine their influence on water and groundwater levels.

Recommendations (2)

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- Collect more information on the sewerage and stormwater systems as well as soakaways in the area to understand impacts of flooding to and from these.
- Improve understanding of any mitigations that are in place to address groundwater flooding.
- Use higher-resolution LiDAR (light detection and ranging) surveys to better map surface water flow routes.
- Improve understanding of the penstock triggers at the southern end of Colnbrook West Lake.

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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.