

The potential impact of tunnelling through the Misbourne valley

Haydon Bailey BSc PhD CGeol FGS

Geological Adviser, The Chiltern Society

At the present time HS2 have an application pending with the Environment Agency (EA) seeking permission to commence tunnelling through the Chilterns. It may seem a little late to ask permission at this stage, but that is how these things appear to be done.

Since the original submissions that the Chiltern Society made to the House of Commons Select Committee in 2015 there have been a number of investigations which impact onto the HS2 tunnelling programme, including the initial Ground Investigation report, plus a new geological survey of the Misbourne valley carried out by the British Geological Survey (BGS) funded by the EA. The information that these studies have brought to light will have an impact on the engineering/tunnelling works which the contractors will have to carry out in order to complete the contracts they are undertaking on behalf of HS2. The key issues arising regarding tunnel construction are discussed briefly below, running from north to south.

The North Portal

The geology of the North Portal area caused some surprise as up to 25 metres of clay was discovered sitting on top of the Chalk between the A413 Aylesbury road and Potters Row. The clue was probably in the latter road name as there is good evidence of a local ceramics industry in medieval times almost certainly utilising this local clay deposit. This thick clay is too soft to support the architecture required surrounding the North Portal so a major series of cement piles will have to be constructed to provide additional support. This will inevitably increase construction costs.

Shardloes Lake

Shardloes lake has already caused some issues due to potential pollution as the result of trial drilling during the latter week of May 2020. A cloud of chalk fines was seen and photographed in the lake (Plate 1).



Plate 1. Chalk fines in Shardloes Lake, May 30th, 2020

There has never been an admission that this cloud of chalk sediment was generated by the borehole drilling less than a kilometre up valley and a subsequent EA report failed to account fully for its generation. However, this turbidity is believed to have been generated by the drilling.

The geology around Shardloes lake could also become a potential issue during tunnel construction. The recent BGS mapping has proven the existence of large geological faults which run southeastwards down the length of the Misbourne valley. These are illustrated on the map below (Fig.1)

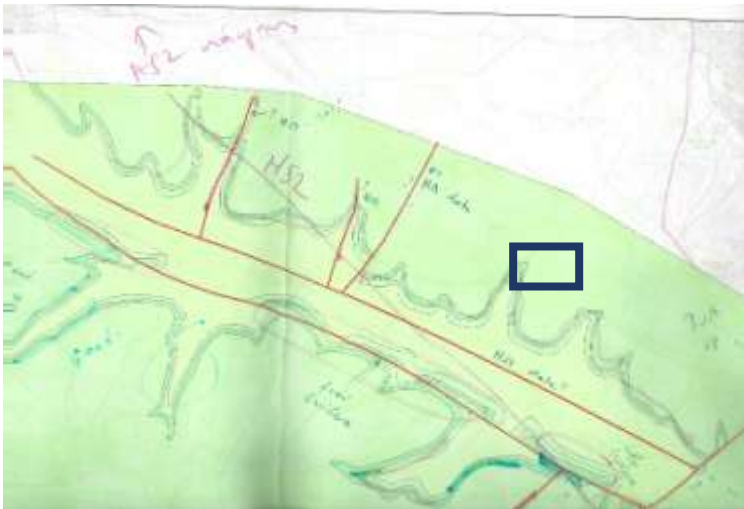


Figure 1: Draft geological map of the Misbourne valley; approximate position of Shardloes Lake shown in blue.

Note the two major faults (red lines running northwest to southeast) which are based on HS2 data and field mapping by the BGS. The line of HS2 is marked on the map.

Where faults occur in the chalk they can take the form of shatter zones within which all the expected structures such as bedding and jointing has been completely destroyed.

An example of this is shown below from the south end of Kensworth Quarry, Dunstable Downs where a shatter zone approximately 20 metres across has been mapped by the BGS (Plate 2).



Plate 2: Fault shatter zone located in southern end of Kensworth Quarry, Dunstable. Images measures just less than 20 metres across

It is highly likely that the fault shown on the map passing through the area occupied by Shardloes Lake is of a similar nature. Increased jointing in proximity to the faulting is also expected. This will not cause any problems in tunnelling; however the lake could easily drain completely should the man made clay lining be breached at any point.

Chalfont St. Giles (CSG)

A report written by the present author, entitled "*Concerns arising from the Geology and Hydrology of the ground underlying the High Speed (HS2) routes through the Chilterns*" and published on the Chiltern Society website as early as April 2010 made it clear that the area around Chalfont St. Giles has had a complex geological history. In summary the result of this is that immediately below the Misbourne valley at CSG there is a layer of unconsolidated chalk approximately 20 metres thick. Solid Chalk is not recorded until below this depth. At the House of Commons Select Committee hearing Tim Smart (HS2 Chief engineer) maintained that the tunnel depth below Chalfont St. Giles would be no less than two tunnel diameters i.e. 19.6 metres. At this depth, the crowns of the tunnels will be cutting through into unconsolidated chalk. Whilst this will not hinder tunnel progress, it may well impact on the River Misbourne, which has the potential to disappear completely.

Affinity have built a pipeline from the CSG pumping station to Amersham in order that water can be purified should there be evidence of turbidity (chalk fines) in water from the CSG boreholes. This strongly suggests that Affinity expects there to be pollution and disruption of the water supply from the CSG pumping station.

The Colne Valley

The regional structural dip of the chalk beds is to the southwards from the Chilterns in towards the London Basin. It is therefore not surprising that the BGS survey of the Misbourne valley established that there is subsurface water flow from the southern part of the Misbourne valley through the chalk aquifer directly into the Colne valley area. This is a natural occurrence and to be expected. It only becomes an issue if the water within the chalk aquifer becomes polluted and under these circumstances it might affect water supplies further into the London Basin.

An example of this already exists on the route of HS2 in the Colne Valley. A report produced by the Borough of Hillingdon in 2011 designated the New Years Green Lane Landfill Site as Contaminated Land as defined by Section 78A of the Environmental Protection Act 1990. In this report it clearly states that the presence of clays in the Reading Formation at this site “may retard but is unlikely to completely prevent the passage of contaminated liquids into the chalk aquifer beneath”. As a result of contamination in the Public Water supply from leachate (ammonia and high levels of organic compounds), believed by the Environment Agency to be from this landfill site, the extraction of water at the Ickenham pumping station was ceased in May 1997.

Furthermore, it is understood that monitoring boreholes located south of the landfill site were monitored during 2004 and, at that time, were still shown to contain high levels of contamination. Further analyses carried out by the Environment Agency and reported to the Borough Council in 2008 and 2010 reconfirmed pollution leakages at the New Years Green Lane site.

Contamination of the chalk aquifer in the eastern Colne Valley section of the HS2 route is therefore already proven to exist. It is important to recognise that the Chalk aquifer, which the London Basin depends upon for its daily water supplies, is a complex and delicately balanced system which is easily damaged. Over abstraction from the chalk aquifer in the London Basin lowered the water table during the early part of the twentieth century and it is only over the last thirty – forty years that careful management of water usage and abstraction has resulted in the water table rising again to levels last seen in Victorian times.