TECHNICAL NOTE

JBA Project Code	2020s0744
Contract	Solihull Level 2 SFRA
Client	Solihull Metropolitan Borough Council
Day, Date and Time	17th August 2020
Author	Jenni Essex
Reviewer / Sign-off	David Kearney
Subject	Hydrology update

1 Introduction

JBA Consulting was commissioned by Solihull Metropolitan Borough Council (SMBC) to undertake a Level 2 strategic flood risk assessment (SFRA) for 12 sites around Solihull, West Midlands. There is an existing hydraulic model covering one of these sites (Site 12 – South of Dog Kennel Lane), which can be used to better understand fluvial flood risk at the site. At the start of the commission a recommendation was made that, due to uncertainties in the model inflows, the hydrology should be updated to use latest methods and datasets. The hydraulic model would be rerun with the new inflows to produce updated flood risk datasets for the site.

This technical note documents investigations into the existing hydrological assessment / model inflows and available hydrometric gauge data. These investigations were undertaken to determine what would be required to produce model inflows in which there is more confidence than the existing inflows.

2 Model chronology

The hydraulic model of the River Blythe and its tributary, Mount Brook (which borders the south-western boundary of Site 12), has been updated and extended on several occasions over the past eight years. Table 2-1 provides the project report reference for each of these iterations and summarises the model extent and any changes in that extent from the previous iteration.

Table 2-1: Summary of model revisions

Model version & report reference	Details

JBA Consulting. May 2012 Cheswick Green Hazard Mapping Study. Final Report	- Focused on Cheswick Green village.
	- Modelled reaches:
	  - Short reach of River Blythe adjacent to Cheswick Green from ~180m upstream of Tanworth Lane to ~340m downstream of Creynold's Lane.
	  - Mount Brook from B4102 Tanworth Lane to confluence with River Blythe.
	- Urban ReFH used to derive model inflows.

JBA Consulting. March 2015 Mount Dairy Farm, Cheswick Green Options Modelling Report. Final Report	- Focused on Cheswick Green village. - No change to previous model extent; modifications made to the baseline model to improve accuracy and make the model more suitable for detailed flood risk assessment at the Mount Dairy Farm development site. - FEH Statistical method flows used. These are stated to be more conservative than the Urban ReFH flows used in 2012 and thought to be provide a 'worst-case scenario' for flood risk at the site and elsewhere.
WSP. November 2016 Blythe Valley Hydraulic Modelling Report	- Focused on Blythe Valley Business Park, downstream of Cheswick Green. - Model extended to include the River Blythe to the M42 and two right-bank tributaries.

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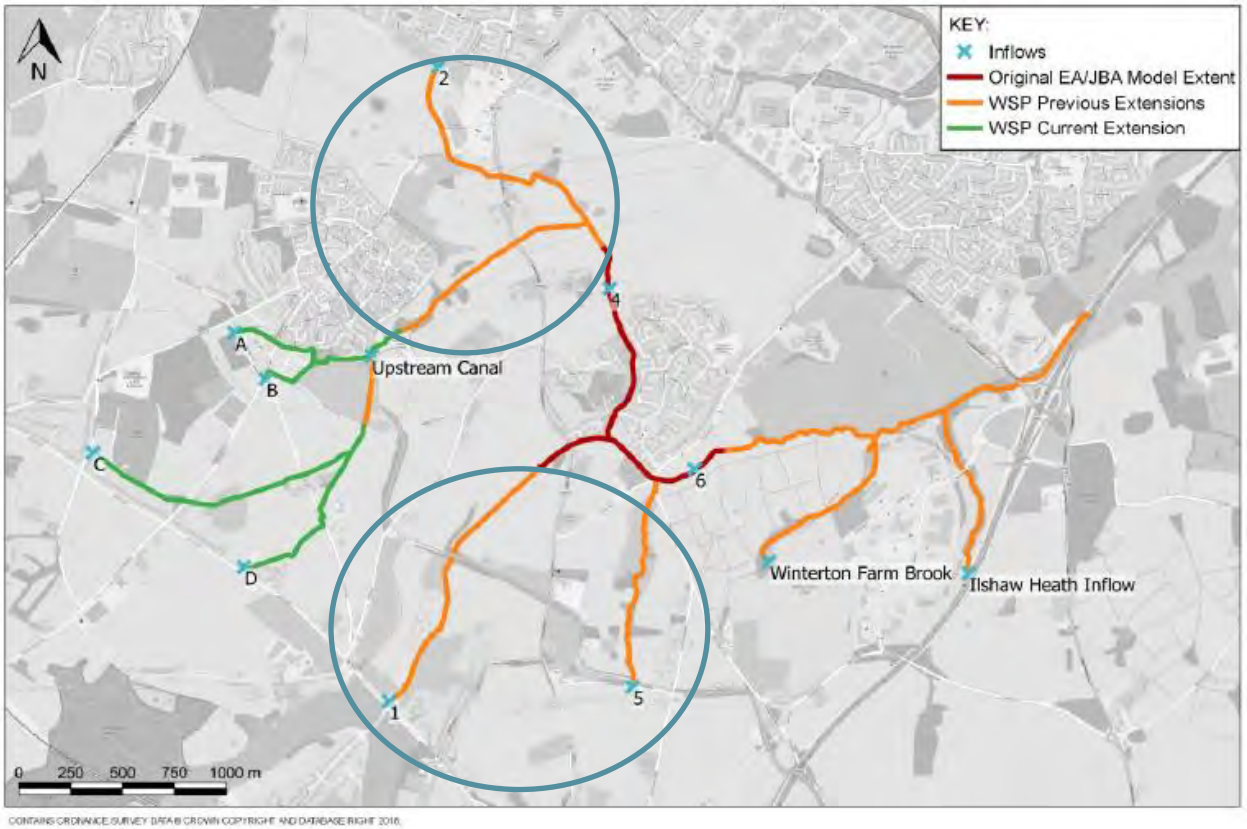
	- FEH Statistical method flows used for consistency with the 2015 model. Inflows from the 2015 model used plus new inflows derived for the extended sections.
WSP. August 2019 Technical note – Mount Brook	- Focused on Dickens Heath village. - The screenshot below from the technical note shows the model extensions. - The green lines indicate where the model was extended in 2019, i.e. the upper part of the tributary to the south of Dickens Heath, which joins Mount Brook. - Flows were scaled from the 2015 model inflow 3, located at the confluence of the tributary with Mount Brook. - Microdrainage was used to estimate flows through the Dickens Heath attenuation pond. - The orange lines circled in blue on the figure are extensions to the model for which no reporting has been received as part of this commission. - It is not known how flows for these extensions were derived, but presumably using a similar scaling approach to that used in the 2019 update.



Screenshot from WSP (August 2019) Technical Note – Figure 3 Model extents

3 Gauge Data

SMBC has installed several flow gauges across the catchment since 2019. Two of these are relevant to the Mount Brook:

- Dickens Heath, located at the footbridge downstream of the canal on the Mount Brook tributary
- Tanworth Lane, located just upstream of Tanworth Lane on Mount Brook.

The data for these two gauges was plotted in Excel and briefly reviewed. No information has been provided on the gauges, for example, type, any issues with the gauge locations, or perceived quality of the data. The peak flow event hydrographs look reasonable. However, the data record only extends from March 2019 and is too short to confidently use in improving design peak flow estimates.

4 Conclusions & Recommendations

A new hydrological assessment could be carried out for the Mount Brook around Site 12, using the latest datasets and methods. ReFH2 is the most recent rainfall-runoff method and uses FEH 2013 rainfall statistics instead of FEH 1999 rainfall statistics. Although the Statistical method has not been updated recently, the National River Flow Archive (NRFA) dataset used in the application of the method, has been revised several times since 2012, the latest version being v8 (September 2019). There have also been updates to the Environment Agency Flood Estimation Guidelines, the latest version of which is v7 (June 2020).

In theory, using the most recent methods and datasets should provide more confidence in the results of the hydrological assessment. In reality, small catchments, such as the Mount Brook catchment, are not well-represented in the calibration datasets. The results for these catchments will have a higher level of uncertainty associated with them. As there is only a short period of flow gauge data available for the study watercourses at this time, there will be little improvement in confidence in the results by using this data. This means that there will be little reduction in uncertainty in the hydrological assessment results, compared to the existing results, just by applying the latest methods and datasets.

It is recommended that any updates to the hydrology are delayed until there are at least two years of data available from the flow gauges. This data could then be used to improve the QMED (index flood) estimate for the Statistical method and to derive Tp (time-to-peak) from lag analysis to improve the hydrograph shape (if suitable event rainfall data is available).

Looking at the wider modelled area than just Mount Brook, there are other factors which could result in uncertainty in the inflows, and hence the model results. The original 2012 model did not include any representation of Earlswood Lakes. The hydrological assessment also did not appear to account for any effect of the lakes on flows in the River Blythe. Rainfall-runoff methods only account for lakes / reservoirs when combined with a routing model which explicitly represents these features.

Although the subsequent studies / models used flows derived from the FEH Statistical method, which does account to some extent for lakes / reservoirs via the FARL descriptor, this is highly unlikely to accurately represent the peak flow downstream of the lakes or the shape of the hydrograph.

There is a complex system of drains into and around the lakes which feed both the River Blythe and the Stratford-Upon-Avon Canal. In order to have confidence in the flows passing downstream to Cheswick Green and beyond, it would be necessary to have a better understanding of how the lakes operate, and it may be beneficial to include representation of the canal within the model as well.

The WSP 2019 technical note also highlights issues with the representation of drainage from Dickens Heath to the attenuation pond, and potential uncertainties in flow predicted to reach the watercourse.

As a consequence of all these uncertainties, it is recommended that only a full review and subsequent update of both the hydrological assessment and the hydraulic model will provide increased confidence in the model results, and as noted above a thorough and robust update of the model inflows should occur post Spring 2021 to allow for new gauge data to be fully incorporated into the analysis.