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Calculations:	Flood Risk Assessment
Project:	Proposed Residential Development
Client:	ONE17 Ltd /
	Mr Allan Pogson & Mr Shaune Lockwood
Location:	Land at Station Road,
	Meltham, Huddersfield,
	HD9 4NL
Job Reference:	R2708
Revision:	22-07-14

Introduction

It is proposed to construct two new dwellings on land at Station Road in Meltham Huddersfield. As part of the development proposals surfacing widening and lighting is to be provided along Station Road which is used to access the site. Circulation access and parking would also be provided within the site.

The site is currently undeveloped with soft landscaping and is therefore considered as greenfield for the purposes of this assessment.

The site has an overall area of approximately 0.578ha and length of Station Road included in the application is approximately 0.105ha giving an overall development size of 0.683ha. The site and surrounding areas are generally not within fluvial flood zone extents according to the online EA Flood Map. However the south east corner of the site and adjacent road area are shown to be in medium to high risk flood zone extents where the Meltham Dike crosses Station Road.

The net effect of changes across the site between pre and post development conditions is potentially significant in terms of the extent of rainwater runoff areas that is to be provided. The methods of storm water collection, distribution and disposal to ground is an issue that is discussed in detail in the proceeding as it has the potential to be the key element of flood risk.

Preliminary foul water and surface water drainage has been considered for the development and details are contained in a separate document.

Size and Scope of FRA

This is intended to be a site specific flood risk assessment to support planning application for residential development.

Therefore it will be in line with the guidelines of the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance for Flood Risk and Coastal Change (PPG-FRCC)[1].

The principle aims of this assessment are:

- To assess potential sources of flooding at the site and consider whether there is an associated flood risk present both to and arising from redevelopment of the site;
- To take the impacts of climate change into account;
- To consider the vulnerability and safety of occupants relative to flood risk;
- To identify any opportunity for flood risk reduction and subsequently identify whether residual risk management should be considered;

[1] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

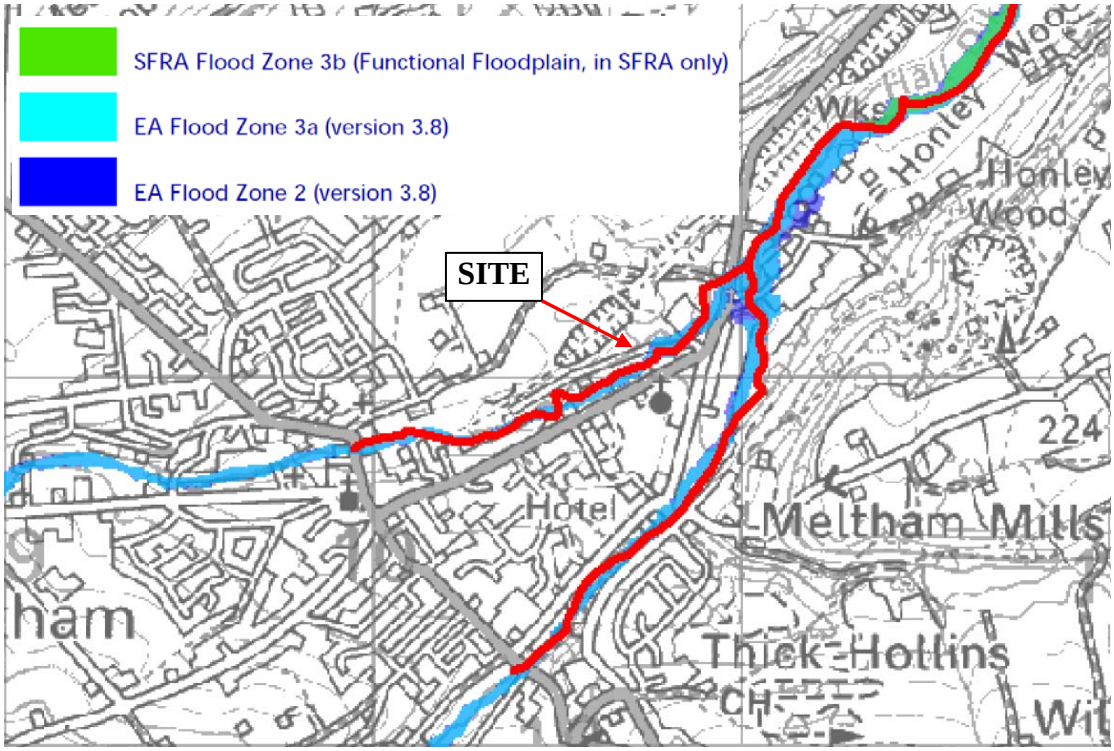
- To discuss existing and proposed methods of surface water runoff management with a view to establishing a sustainable strategy for drainage of the development.

Typical sources of information will include the Environment Agency Flood Map and Standing Advice together with the Calder Valley Strategic Flood Risk Assessment (SFRA) documents.

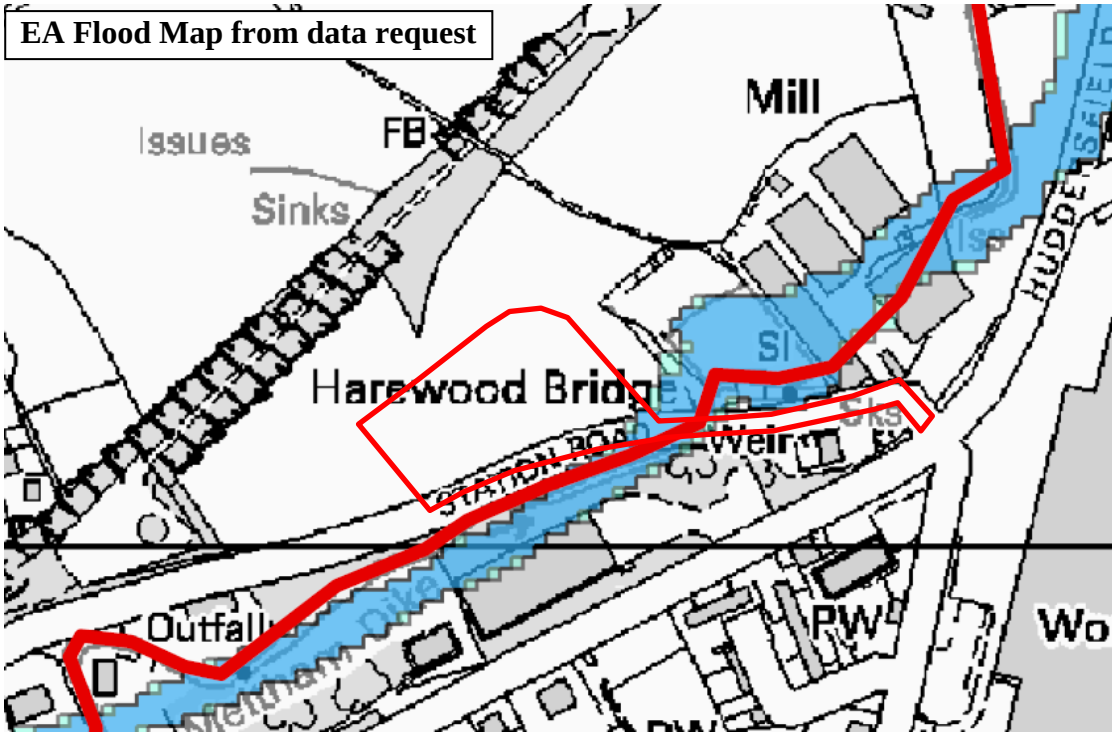
Sources of Flooding

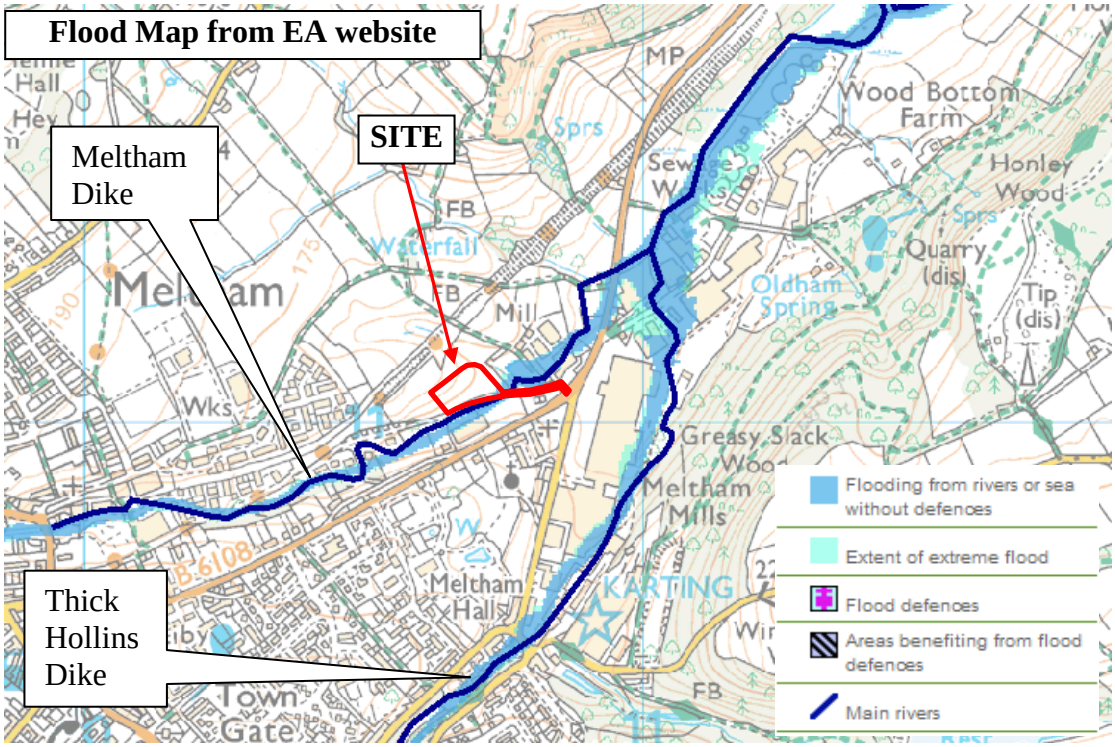
Fluvial Flood Risk Zone (Streams and Rivers)

A joint Level 1 SFRA was undertaken by JBA on behalf of Calderdale and Kirklees Metropolitan Borough Council and the City of Wakefield Metropolitan District Council and published in November 2008. An etract of figure A 2-1 from the SFRA is presented below. This shows the delineation of flood zone 3 into functional flood plain (fz3b) and high risk (fz3a). This suggests that the site and Station Road are not within the functional flood plain.



The online Environment Agency Flood Map has also been examined together as the best available information. The EA have also provided an extract of their flood map (RFI/2014/29661) which shows the flood extents slightly clearer:



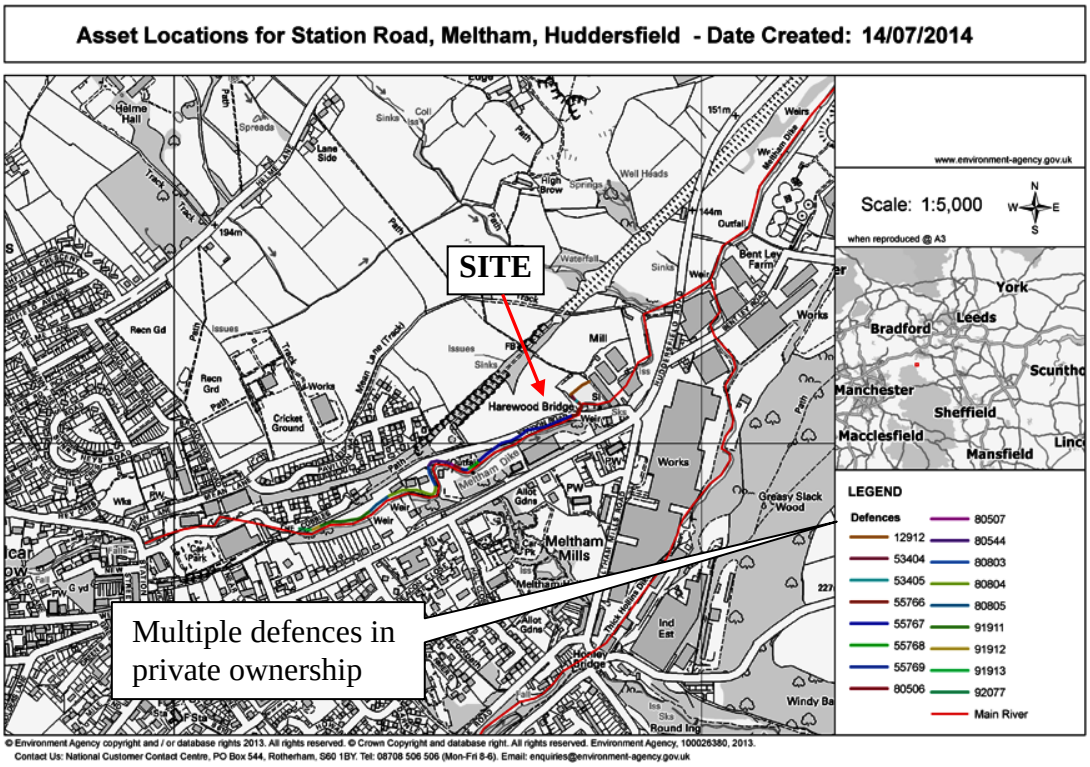


The flood maps do not provide information on flooding from other sources such as groundwater, direct runoff from fields or overflowing sewers. They do not show the effect of flood defences or climate change on the extent of flooding.

Inspection of the flood maps would suggest that the site is generally within flood zone 1. However as the lower south eastern portion appears to occupy flood zones 2 and 3 the site can be classified as having a **High Probability of**

Fluvial Flood Risk (*land having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding*) in accordance with Table 1 of NPPF technical guidance).

The EA have provided records of flood defence assets in the vicinity of the site relating to Metham Dike as shown on the following key plan. However as they are in multiple private ownership there is limited information in terms of standard of protection, condition, etc.



The EA do not hold records of any hydraulic modelling for the watercourses in the vicinity of the site. Flood levels relating to the dike are therefore not available. It is not clear what level of hydraulic modelling was undertaken for the SFRA by JBA to inform the delineation of functional floodplain and effect of climate change on the 'main river' dikes.

It is not considered necessary to undertake detailed hydraulic modelling to inform this flood risk assessment in relation to the proposed dwellings as the site is predominantly in a low risk flood zone. The cost of such modelling would not be commensurate to the scale of development. However in the absence of certainty of flood level data it would be prudent to ensure that the proposed dwellings are constructed in line with resilient construction guidance.

Paragraph 060 of the PPG-FRCC advises that where it is not possible to avoid flood risk, a building and its surrounds (at site level) may be constructed to avoid it being flooded (e.g. by raising it above the design flood level). Comparison of the flood outlines with a site topographical survey suggests extreme flood water levels may vary between 147.00 and 147.50m AOD. Proposed finished floor levels are noted to be 150.00m AOD with immediate

adjacent ground levels of 149.85m AOD. Therefore it is unlikely that flood water would enter the buildings and the principle method of Flood Avoidance in the first instance is achieved.

However the provision of Flood Resistance following a Water Exclusion Strategy can be implemented in the design of the building substructure (i.e. everything below the FFL). All below ground services where required (eg water, gas, electricity, telecoms, sewerage, etc) will need a well detailed point of entry to the building to ensure that a pathway for floodwater is not inadvertently created. Furthermore it is advisable that the meters for services and in particular the distribution boards for electrical supplies are placed at high level.

Coastal and Estuarine Flood Risk

The nearest main watercourse to the site is the Meltham Dike which is classified as a critical ordinary watercourse (COW) from where it crosses Station Street (B6107) circa 800metres west of the site.

Meltam Dike flows to the south of Station Road which forms the southern boundary of the site. The dike then crosses below Station Road and is culverted below Spinks Mire Mill. The course of the dike is then in a north easterly direction where it combines with Thick Hollins Dike to Hall Dike which subsequently flows eastwards as Mag Brook until its confluence with the River Holme circa 3.5km to the north east of the site. The River Holme flows northwards where it meets the River Colne at Huddersfield.

The nearest watercourses to the site are inland and therefore not affected by tidal influences.

Therefore the site can be classifies as having **no coastal or estuarine flood risk**.

Groundwater Flood Risk

An assessment of groundwater flooding was not apparently undertaken as part of the SFRA which simply describes what, how and why groundwater flooding is and occurs. Presumably there were limited or no records of historical flood events available to report or direct further investigation.

The Environment Agency Groundwater Vulnerability Map shows that the site is not located within a source protection zone. It shows that the underlying aquifer is minor but with high leaching potential. A ground investigation has not been undertaken for development proposals at the site and therefore it is not possible to determine in-situ groundwater levels.

An indication of the type of soil that may be encountered in the vicinity of the site can be determined via the Soilscapes Viewer online that is part of the Land Information System at Cranfield University. This shows that the site

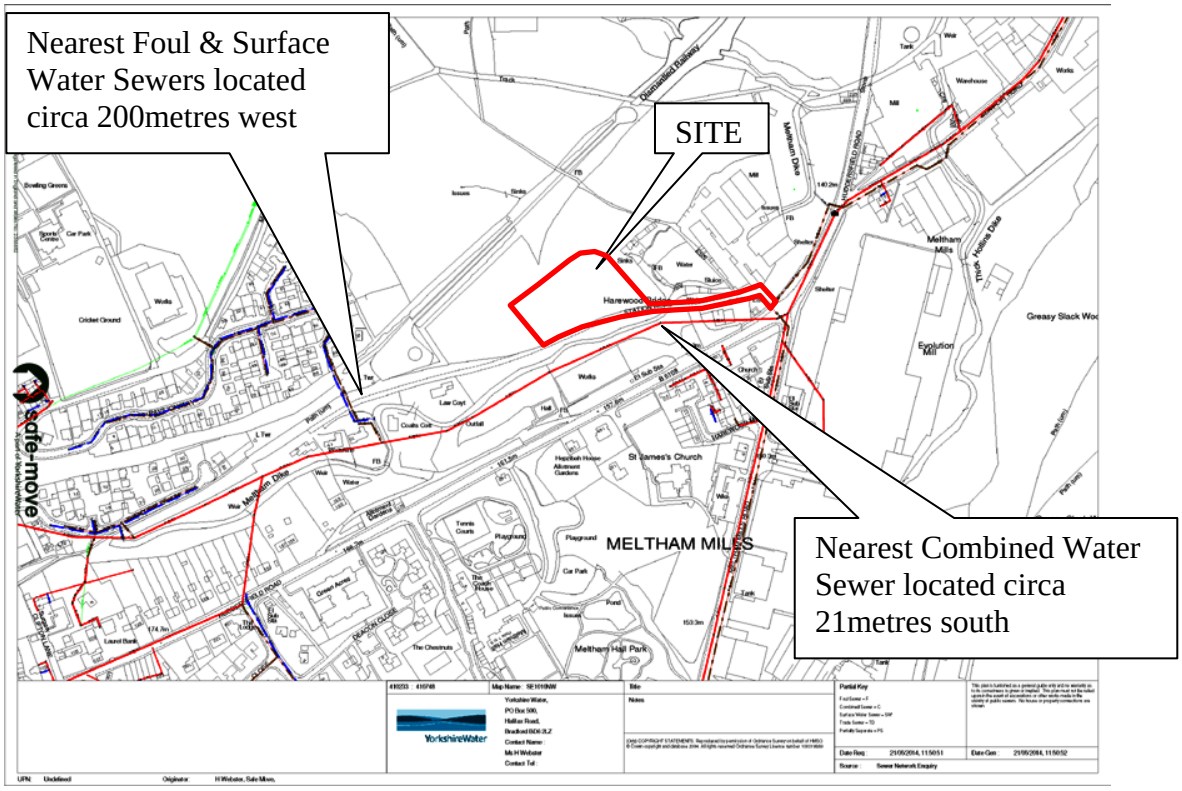
would have '*Freely draining slightly acid loamy soils*'. British Geological Survey maps suggest that superficial soil material in the vicinity of the site is likely to be alluvium of clay sand and gravel. This would overly sandstone bedrock geology of the Huddersfield White Rock.

Groundwater vulnerability relates to the potential for contamination of groundwater and thus is a useful tool to determine the potential suitability of sustainable drainage (SuDS) techniques but conversely how a reverse movement of groundwater could emerge on site. The likely good permeability of cover over the aquifer suggest that infiltration drainage techniques will be feasible at the site. The minor nature of the underlying aquifer suggests a low risk of groundwater emergence and thus flooding potential.

It follows that **the risk of groundwater flooding to the site is low**.

Sewer and Highway Drain Flood Risk

An extract of the local sewer map has been obtained by others from Yorkshire Water Ltd (YWL) which shows that the nearest public sewer to the site is located approximately 21 metres south of the southeast site corner. The nearest separated foul and surface water sewers are approximately 200metres westwards serving residential housing (Pavillion Way). The surface water sewer discharges to Meltham Dike and the foul drainage connects to the combined sewer.



The SFRA does not highlight any areas of significant sewer or highway drainage flooding. This does not necessarily mean that such flooding can be ruled out. Station Road immediately to the southern boundary of the site is not

an adopted (public) highway. It is unknown whether there is a formal drainage system in place in terms of road gullies or similar. The access off the main highway, Huddersfield Road, has relic stone sett paving which has been surfaced in tarmac that has in places deteriorated. The stone setts continue up to and alongside the site. It is understood that Station Road will be widened and re-surfaced and so the method of draining the finished surface will be an important consideration in respect of flood risk.

It is assume that runoff from the existing setts forming Station Road will either shed by crossfall to adjacent verges and drain to the ground or will flow to suit the longitudinal road gradient with discharge to Metham Dike at its crossing. Subsequent runoff from the road down to the main highway may again drain to verges or otherwise positive drainage may be present to prevent overland flows onto the highway. Ultimately runoff will be directed into the Dike via one of the means described above. Site levels are above the finished levels of Station Road and overland flows from the highway would be directed away from the site.

It is therefore deemed that **the risk of sewer and highway flooding to the site is low**.

Surface Water Flood Risk

The SFRA presents two sets of maps describing areas naturally vulnerable to surface water flooding. Set E relates to a 1in100year rainfall event whilst set F relates to a 1in1000year rainfall event. The site is not located within the areas examined. However the Environment Agency provide online surface water flood risk maps which show that the site is not affected. There is a low risk of flooding to Station Road near its junction with Huddersfield Road and there appears to be a medium risk of flooding where Meltham Dike crosses Station Road at the south east corner of the site.

Inspection of the topographic survey for the site suggest that for the pre-development condition runoff due to rainfall not infiltrating naturally into the ground would shed in a south easterly direction following the overall fall of the site. The resulting excess overland flood flow would shed into the mill pond and then into Meltham Dike.

The post development site plan indicates the intention to provide two new dwellings together with driveways and sufficient space off Station Road for service vehicle manoeuvring. The resultant site impermeability would be 37.1% due to new paved and roof runoff areas totalling 0.231ha (as key plan below.





Due to the likely permeable underlying soils there may be an opportunity to reduce impermeable areas by substituting infiltration SuDS devices (eg permeable parking, etc). In-situ percolation testing ideally to suit the guidance of BRE Digest 365 is required to verify the viability of such drainage methods. It is noted that there is the intention to use rainwater harvesting which combined with a similar soakaway or other outfall for exceedance flows has the potential to reduce potable water demand.

In terms of benefit to the drainage system there would clearly be a reduction in the volume of water requiring disposal per annum. However the sizing of stormwater attenuation measures would need to assume that a harvesting tank is either full or defunct due to the potential for lack of potable water demand and/or mechanical or electrical failure.

It is also understood from a review of the proposed site plan that green roofs will not be provided. However management of rainfall captured by the proposed building's roof can be ensured by collection into rainwater pipes and subsequent discharge into a balancing tank (or suitably sized soakaway device) together with runoff collected from hardstandings. If infiltration is not viable the final outflow to greenfield rates should be considered in line with best practice. There are however circumstances when a higher rate can be agreed such as to avoid the risk of blockage where low discharge rates would otherwise dictate a small orifice aperture.

It is deemed that **the risk of surface water flooding to and from the site is low** providing the post development drainage is designed in line with SuDS.

Flood Risk Due To Infrastructure Failure

Non-natural or artificial sources of flooding such as those from canals or rising groundwater from abandoned mine workings can potentially contribute to flood risk, particularly if the purpose for their creation such as industrial operations has rendered them redundant and unmanaged features. The nearest canal to the site is the Huddersfield Narrow Canal which runs alongside the River Colne circa 3.8km north to north west. Flood water resulting from a breach of the canal would not affect the site given the distance, intervening land and elevated level of site compared to canal way.

Other artificial sources include reservoirs and lakes where water is retained above the natural ground level and as such failure of the retaining structure could result in rapid inundation of the surrounding area with little or no warning. The EA have published a map to illustrate the risk of flooding from reservoirs. The map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst case scenario and is only intended as a guide. It is not a prediction of what will happen. The application site and surrounding areas are shown to be affected by a reservoir failure flood event, which has an extent exceeding that of fluvial flood zone 3.

It is likely that the main source of floodwater would be from Blackmoorfoot Reservoir which is situated circa 1.5km northwest from the site. Flood water from reservoir failure is shown to potentially affect the eastern and southern edges of the site where ground levels are lower than circa 150m AOD.

It is deemed that **the risk of flooding to the site due to infrastructure failure is low** given the low chance of occurrence.

Climate Change

Table 2 of EA guidance to support the NPPF (document ref LIT 8496 NA/EAD/Sept 2013/V12) provides sensitivity ranges for peak rainfall intensities and peak river flow. The Help pages of the EA's FRSA version 3.1 suggest that the default lifetime for residential development is 100years, and for commercial development is 75 years. The sensitivity range for 2085 to 2115 of table 2 should therefore be applied with +30% peak rainfall intensity and +20% peak river flow.

The effect of climate change on fluvial flooding is demonstrated by review of the climate change sensitivity maps (set D) in the SFRA which shows that Meltham Dike has a negligible change when a 20% increase in the volume of flood flows is allowed.

The effect of climate change on peak rainfall intensity can be considered in relation to surface water flood risk by designing drainage systems to suit the additional capacity required. The effects of climate change to peak rainfall intensity for other mechanisms of flood risk such as sewer and highway drain would be to reduce the standard of protection afforded by the sewer or highway drain. The effects of a blockage would also be more significant. However it is still considered that the risk of flooding to the site from these sources is low given the foregoing discussion.

Conclusion

The site is shown to be generally within flood zone 1 (as defined by planning policy documents) which has a low annual probability of flooding. The proposed dwellings would be sited on land in flood zone 1 which is compatible with the vulnerability of use. The portion of site shown to be at medium to high risk of flooding appears to be limited to the south eastern corner in the vicinity of the access road (Station Road) crossing over Meltham Dike.

This has the potential to present a hazard in flood conditions either for occupants leaving the site or other persons accessing the site. However the depth and velocity of flood water anticipated is likely to be low with a flood hazard rating less than 1 meaning a hazard to people classification of 'danger for some' (Table 13.1 of FD2320/TR2). The EA issue flood alerts for Meltham Dike and it is recommended that future occupants of the site should enquire if a flood warning service could also be implemented so that an Emergency Flood Plan can be developed to allow safe evacuation of the site.

This site specific flood risk assessment indicates that there is a low risk to and from the site of flooding from all sources. The medium to high risk of flooding on Station Road can potentially be mitigated via detailed drainage design with any residual risk managed via awareness of the potential and extent of flooding which as described above is limited to occuring locally for extreme events.