Woods Mill, Glossop

Flood Risk Assessment

February 2015

Waterco Ltd, Eden Court, Lon Parcwr Business Park, Ruthin, Denbighshire LL15 1NJ
tel: 01824 702220 email: enquiries@waterco.co.uk web: www.waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:

Lofthouse Property Developments Ltd.

SCHEME:

Flood Risk Assessment for a development at Woods Mill, Glossop. Derbyshire, SK13 8PX. The purpose of this report is to support the Planning Application.

INSTRUCTION:

The instruction to carry out this Flood Risk Assessment was received from Mr David Fairclough of Urban Concepts, acting on behalf of the client.

REPORT FORMAT:

This Flood Risk Assessment report has been prepared in accordance with the National Planning Policy Framework (NPPF) March 2012 and the associated Technical Guidance (TG) document. References in this report to sections, or tables, will relate to the TG, unless otherwise noted.

ISSUE HISTORY:

Issue Date	Comment
08/08/2014	First issue
19/09/2014	Updated with Sequential Test
25/11/2014	Updated with revised modelling results
23/02/2015	Revised Development Layout

DOCUMENT REVIEW & APPROVAL

Prepared by Angharad Llewelyn BSc (Hons) MSc

Reviewed by Aled Williams BSc (Hons)

Contents

Appendices

List of Tables

Supporting Documents:

National Planning Policy Framework (March 2012)

High Peak Borough Council Strategic Flood Risk Assessment (September 2008)

Derbyshire Preliminary Flood Risk Assessment (May 2011)

Waterco Hydraulic Modelling Report (HMR) – Document Reference: w3138-150223-HMR

Abbreviations

AEP	*Annual Exceedance Probability*
CCA	*Climate Change Allowance*
EA	*Environment Agency*
LiDAR	*Light Detection and Ranging*
m AOD	*metres Above Ordnance Datum*
NPPF	*National Planning Policy Framework*
PFRA	*Preliminary Flood Risk Assessment*
SFRA	*Strategic Flood Risk Assessment*

1 Development Description and Vulnerability Classification

1.1 This Flood Risk Assessment (FRA) has been prepared in support of a Planning Application for a proposed residential and commercial development at Woods Mill, Glossop, Derbyshire, SK13 8PX (grid reference 403855E, 394000N). A location plan and an aerial image are included in Appendix A.

1.2 The existing site is brownfield and comprises of a disused mill and other disused industrial buildings. There is also a pond located at the north-eastern corner of the site. The site covers an area of approximately 3.8ha and is bordered by residential premises and a leisure centre to the north, Glossop Brook to the east and south and commercial premises to the west.

1.3 Site levels vary from approximately 148m AOD in the west to 155m AOD in the east. A topographical survey showing land heights and existing site use is included in Appendix B. There is a large area in the eastern portion of the development of constant level 150.58m AOD. This area is the site of the former VC Works factory and is surrounded by retaining walls (1-3m high) along the north and eastern boundaries.

1.4 The overall development area is spilt into two separate zones; the Woods Mill Development in the western portion and the VC Works Development in the east. A site boundary plan is included as Figure 1 for reference.

1.5 The Woods Mill Development will include commercial premises to the west, comprising a supermarket and other retail units with associated car parking, and residential to the east. The row of terrace dwellings parallel to the Brook in this area are to be three story with a garage on the ground floor and habitable space in the two floors above. A proposed development plan, including proposed finished floor levels (FFLs), is included in Appendix B.

1.6 Residential development is also proposed on a 0.4ha land parcel to the south of Glossop Brook along with a new access bridge.

1.7 A development layout for the VC Works Site is not yet available. This FRA supports the Woods Mill Development area only.

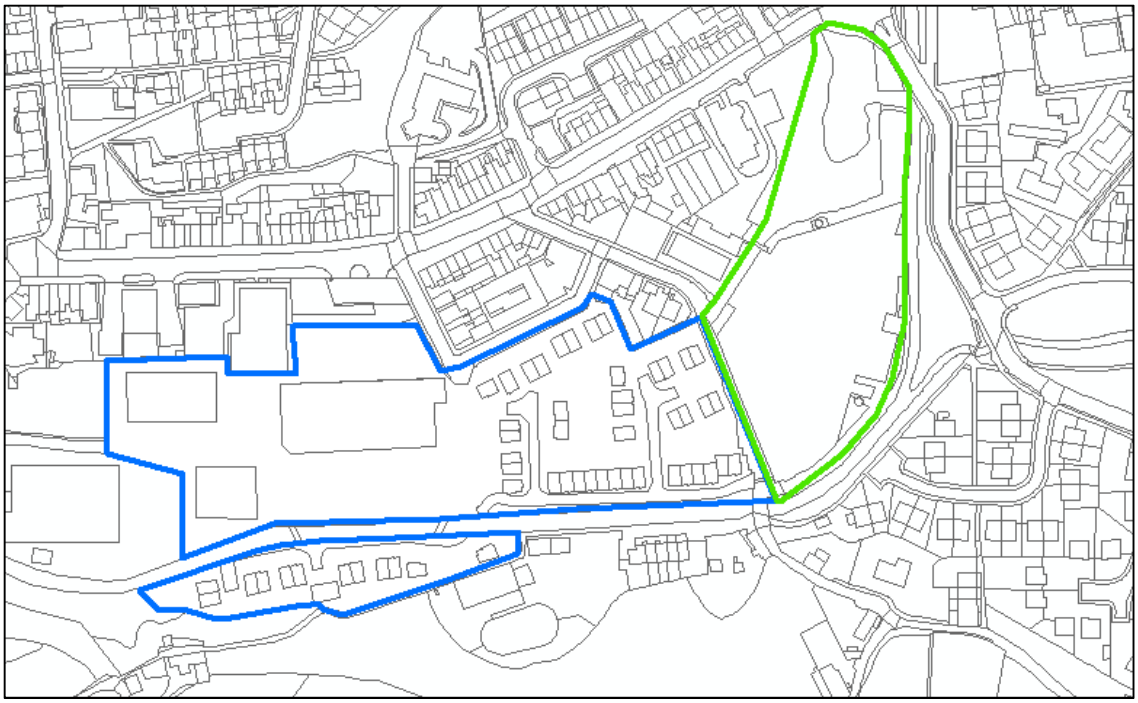


Figure 1 – Site Boundary Plan – showing Wood Mill in **blue**

1.8 The proposed residential aspect of the development is considered to be 'more vulnerable' in accordance with Table 2 of the NPPF Technical Guidance document. The proposed commercial development is considered 'less vulnerable'.

1.9 This FRA is supported by hydraulic modelling of the Glossop Brook completed by Waterco Consultants in February 2015. This report should be read in conjunction with the Hydraulic Modelling Report (document reference: w3138-150223-HMR).

2 Application of Sequential and Exception Test

2.1 In accordance with NPPF the risk-based 'Sequential Test' should firstly be applied to steer new development into areas of lower probabilities of flooding.

2.2 The site is shown predominantly within Flood Zone 2 on the EA Flood Map (Appendix C) – an area at flood risk with between a 1% (1 in 100) and 0.1% (1 in 1000) chance or greater of flooding in any given year. A small extent of the site is shown within Flood Zone 3 on the EA Flood Map – an area considered to be at flood risk with a 1% probability or greater of flooding in any given year.

2.3 The proposal is for the development of derelict land. The site has been allocated for a mixed use scheme in the High Peak Borough Council Local Plan (April 2014) with an estimated housing capacity of 104 dwellings.

2.4 Given the need for regeneration in this area, and the fact that the site is outlined in the Local Plan for residential development it is considered reasonable that the development need of the site outweighs the flood risk. Mitigation measures will be incorporated to ensure that the flood risk can be safely managed, without increasing flood risk elsewhere, and the risk to site users and properties is low.

2.5 Taking the above into consideration, it is considered appropriate for the development to be located in Flood Zone 2 and 3. In accordance with Table 3 of the NPPF Technical Guidance document the 'Exception Test' needs to be applied for 'more vulnerable' residential development in Flood Zone 3. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

2.6 It is considered that the development provides wider sustainability benefits for the community as the proposal is for the development of a derelict brownfield site. The following sections of this FRA demonstrate that the development will be safe for its lifetime, without increasing flood risk elsewhere.

3 Scope of Site Specific Flood Risk Assessment

3.1 The potential sources of flooding considered in the following sections are: Fluvial - from rivers and streams; Tidal; Pluvial – from rainfall on the surface; Rising Groundwater; Overwhelmed Sewers and Drainage Systems; Reservoirs, Canals, Lakes and Artificial sources.

3.2 The effects of climate change are taken into account, in accordance with document sections 11-15 of the NPPF Technical Guidance document.

4 Fluvial Risk - from rivers and streams

4.1 The nearest major watercourse to the site is the Glossop Brook which is located immediately east and south of the site (and north of the 0.4ha land parcel to the south of the Brook). Other watercourses in this area include the Hurst Brook which joins the Glossop Brook immediately east of the site.

4.2 Flooding could occur if the Glossop Brook overtopped its banks during or following extreme rainfall events due to lack of channel capacity.

4.3 The High Peak Borough Council Strategic Flood Risk Assessment (SFRA) (September 2008) and Derbyshire Preliminary Flood Risk Assessment (PFRA) contain no records of flooding at the site. However the southern extent of the site adjacent to Glossop Brook is known to have flooded in the past. A historic flood map provided by the EA is included in Appendix C.

Estimated Existing Flood Levels

4.4 An integrated 1-Dimensional / 2-Dimensional (1D/2D) hydrodynamic model of the Glossop Brook and the surrounding floodplain has been constructed to estimate existing flood levels for the site. The modelling results, including flood depths and water levels, are discussed below with a series of flood depth plots included in Appendix D for information.

5% AEP Fluvial Event

4.5 As shown in Figure 2, the majority of the site is shown to be flood free during the 5% AEP event (1 in 20) and is therefore not considered to be functional floodplain. The eastern extent of the 0.4ha land parcel to the south of Glossop Brook is shown at risk during the 5%

AEP event. Flood depths in this area are generally below 300mm, however increase to approximately 600mm-900mm in a topographic low point.

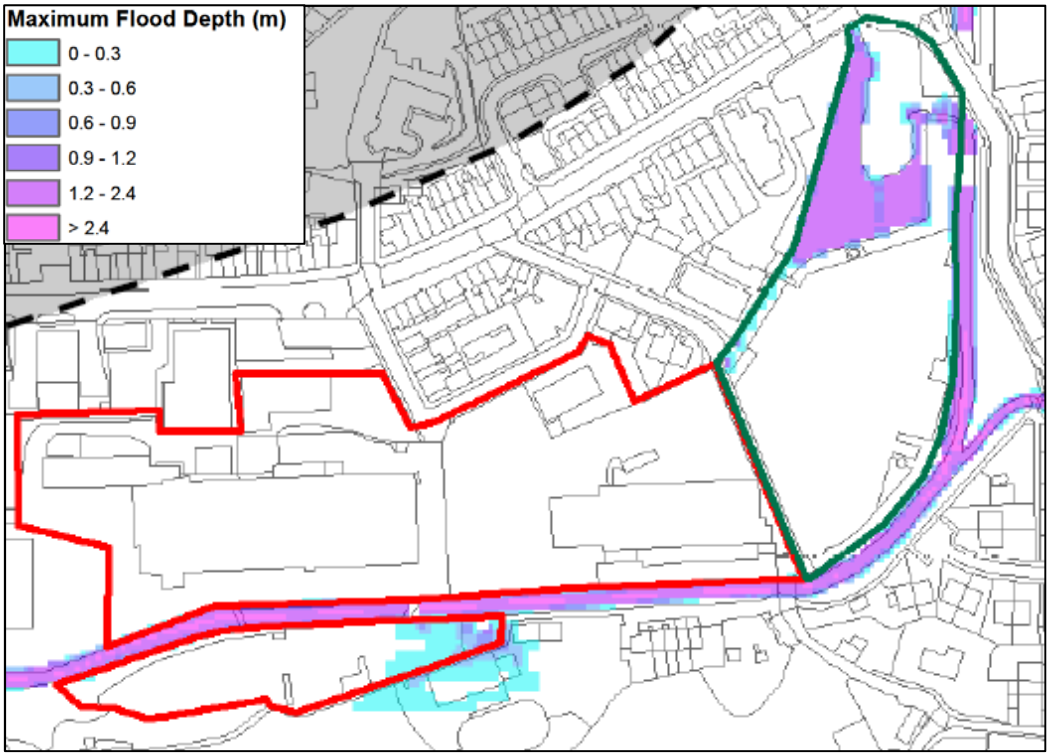


Figure 2 – Maximum Flood Depths – 5% AEP event

1% AEP Fluvial Event

4.6 As shown in Figure 3, approximately 50% of the Woods Mill site is flooded during the 1% AEP fluvial event with depths generally below 300mm, but reaching over 900mm in local low points. Maximum water levels through this area vary from 150.43m AOD to the east to 148.63m AOD in the west.

4.7 The VC Works site is shown to remain flood free throughout.

4.8 The north-eastern extent of the site, including the Mill Pond is shown to be flood free.

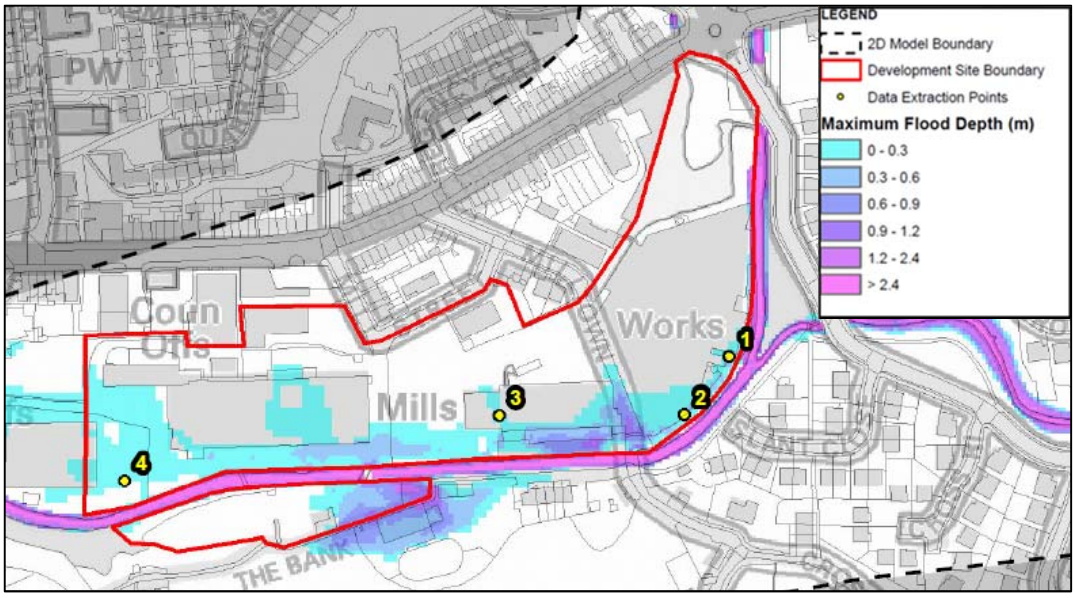


Figure 3 – Maximum Flood Depths – 1% AEP event

1% AEP + CCA Fluvial Event

4.9 When the impact of future climate change is taken into account during the 1% AEP event, the extent of flooding through the Woods Mill site remains largely unchanged from the 'present day' event, however flood depth are shown to increase by approximately 200mm – see Figure 4. Maximum water levels through this area vary from 150.72m AOD to the east to 148.76m AOD in the west.

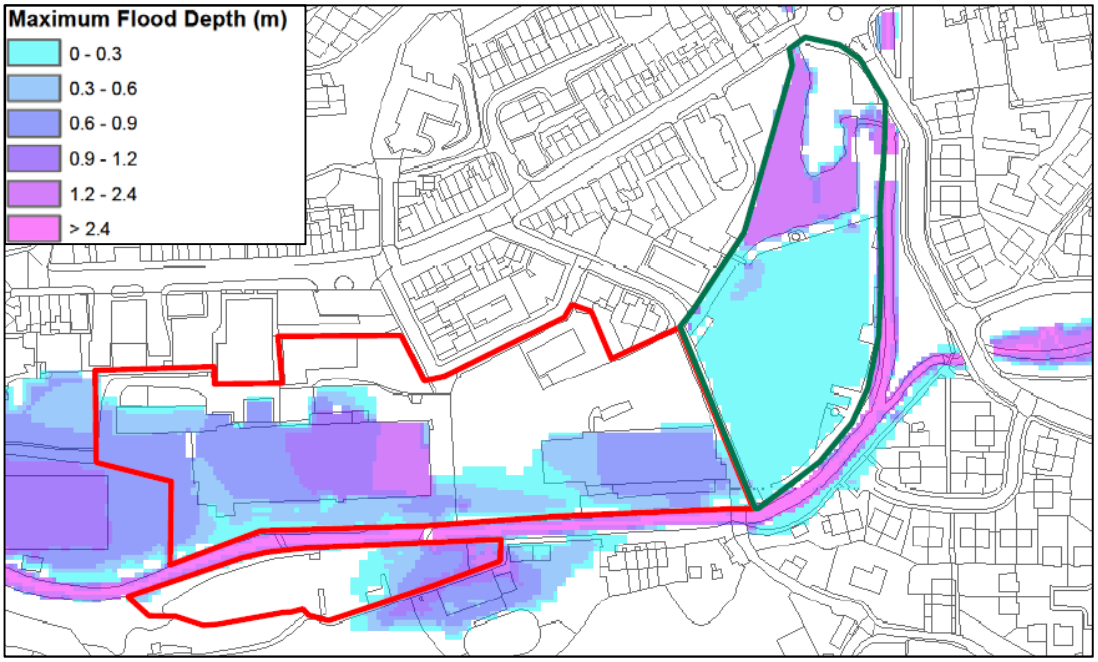


Figure 4 – Maximum Flood Depths – 1% AEP + CCA event

4.10 The northern extent of the site is flood free during this flood event.

4.11 The VC Works site is shown to experience wide spread flooding as the large area of constant level (150.58m AOD) is inundated with depth of 200mm; a maximum water level of 150.78m AOD.

0.1% AEP + CCA Fluvial Event

4.12 During the extreme 0.1% AEP event, flooding through the Woods Mill site is significant and is shown to affect approximately 70% of the area – see Figure 5. Depths generally reach between 1.0 to 2.0m. Maximum water levels through this area vary from 151.93m AOD to the east to 149.3m AOD in the west.

4.13 Flood depths within the VC Works site increase significantly during this event to 2.2m – a maximum water level of 152.8m AOD.

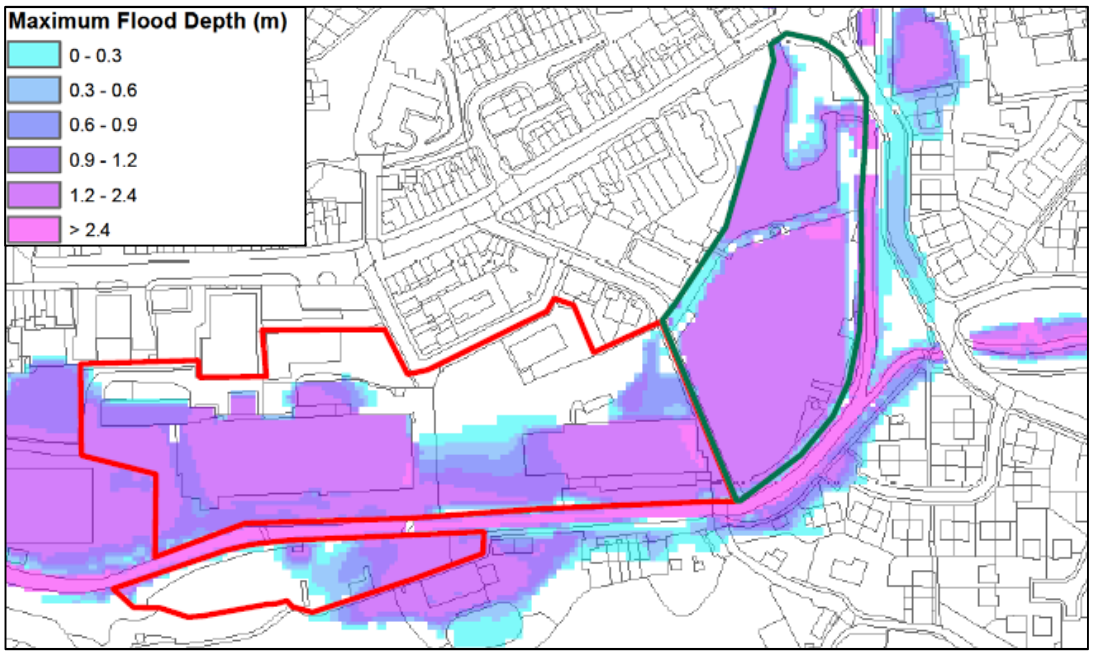


Figure 5 – Maximum Flood Depths – 0.1% AEP event

4.14 It can be concluded that the southern extent of the Woods Mill site is at risk of fluvial flooding during the 1%, 1% + CCA and 0.1% AEP flood events. The northern extent of the site is shown to be flood free during all events.

5 Tidal Risk

5.1 The site is located approximately 55km from the coastline and is significantly above sea level (minimum site level = 148m AOD). Therefore the site is not at risk of tidal flooding.

6 Pluvial Risk – From Rainfall on the Surface

6.1 Pluvial flooding is defined as local flooding in areas not normally associated with natural or manmade watercourses that results from rainfall generated overland flow, before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow, where the ground is saturated, frozen or developed resulting in overland flow and ponding in depressions in the topography. Pluvial flooding is unpredictable, to the extent that localised heavy rainfall can occur anywhere without any warning. However, flow paths and depths can be determined by consideration of contours and relative levels.

6.2 The Environment Agency (EA) 'Flooding from Surface Water' map included in Appendix C shows that the majority of the site is not at risk of surface water flooding. A review of the SFRA states that surface water flooding within the High Peak Borough is a significant problem due to the underlying geology and topography. However there are no records of surface water flooding affecting the site.

6.3 It can be concluded that the risk of pluvial flooding is relatively low.

7 Risk of Rising Groundwater

7.1 Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

7.2 A review of the SFRA states that 'there are no known problems with flooding from groundwater within the study area. However, peat deposits are found which are typically waterlogged and may breach the surface.' The Cranfield University 'Soilscapes' map shows that the site is not underlain by peat deposits. It can therefore be concluded that the risk of groundwater flooding is low.

8 Sewer Flooding

8.1 Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged or is of inadequate capacity. This is mostly applicable to combined and surface water sewers.

8.2 The SFRA contains no records of sewer flooding occurring on site. The SFRA states that the level of sewer flooding risk to the area is 'low'. Therefore it can be concluded that the risk of sewer flooding is low.

9 Risks from Reservoirs, Canals, Lakes and Artificial Sources

9.1 There are no canals in this area. The EA Flooding from Reservoirs Map (included in Appendix C) shows the site is at risk of flooding from the following reservoirs:

Table 1 – EA flooding from reservoirs

Name	Location	Owner
Lower Swineshaw (Glossop)	404402E 395671N	United Utilities Water plc
Hurst	405459E 393840N	United Utilities Water plc

9.2 The EA reservoirs flood map states that reservoir flooding is extremely unlikely and that reservoir safety legislation ensures that reservoirs are well maintained. Therefore the risk associated with reservoir failure (consequences x likelihood) is considered to be very low.

10 Summary of Site Specific Flood Risk Assessment

10.1 From the preceding sections is can be concluded that all other potential sources of flooding are 'low' risk and fluvial flooding from Glossop Brook is the only source of flood risk that needs to be considered further for this site.

11 Proposed Mitigation Measures

11.1 To assess the change in fluvial flood risk throughout the site and wider floodplain associated with the proposed Woods Mill development, the hydraulic modelling study considered a series of post-development models for comparison against the existing models. The results extracted from these models are given in Appendix D. The results of this model and implications on proposed flood mitigation measures are discussed below.

Commercial Zone

11.2 Within the commercial zone, the FFLs of the proposed superstore and retail units are shown above the maximum 1% AEP + CCA water levels and are dry throughout. The access and egress routes to these units are also shown to remain dry throughout. This area of development is therefore shown to be compliant with NPPF during this event.

11.3 During the extreme 0.1% AEP fluvial event, the retail units are shown to experience flooding. A summary of the depths experienced during this event is provided in Table 3.

Table 2 – Commercial Zone Maximum Water Level Data – 0.1% AEP Event

Retail Unit Ref	Proposed FFL (m AOD)	0.1% AEP Maximum Water Level (m AOD)	0.1% AEP Flood Depth (m)
Unit A	148.44	149.34	0.90
Unit B	148.69	149.47	0.78
Unit C (Superstore)	148.82	149.46	0.64

11.4 It is recommended that the final FFLs of the retail buildings should be set to ensure flood depths experienced during this extreme event are a maximum of 600mm. The recommendations included in the RIBA publication 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' dated May 2007 should be incorporated to minimise damage to property during the extreme 0.1% AEP event.

Woods Mill Residential Zone

11.5 During the 1% AEP + CCA event, the majority of the proposed properties are shown to be flood free throughout, with the exception of the row of three storey properties adjacent to the watercourse. However, although these properties are shown to experience flooding (up to 600mm) during this event, it is proposed by the Developer, that the ground floor will be used as non-habitable space only i.e. habitable space on the first and second floor only. Subject

to a raised access/egress route being provided, all habitable space in the residential zone would then be compliant with NPPF.

11.6 The flood mapping in Appendix D shows that, although there is shallow depth flooding to some vehicular access routes adjacent to the watercourse, an emergency access/egress route is available to all properties during this event.

11.7 It is recommended that the final FFLs of all habitable space are a minimum of 300mm above the maximum 1% AEP + CCA water level. The RIBA flood resilience recommendations (detailed above) should also be incorporated to minimise damage to property during the extreme 0.1% AEP event.

11.8 A new road bridge over the Glossop Bridge is proposed. The soffit level of this bridge should be set at a minimum of 150.3m AOD. This level provides a 600mm freeboard above the 1% AEP + CCA flood level.

12 Managing Residual Risks

12.1 The Environment Agency's Floodline Warnings Direct Service covers this area. Floodline Warnings Direct is a free service that provides flood warnings direct by telephone, mobile, email, SMS text message and fax. It is recommended that residents and managers of commercial premises register for this free service. This would give site users prior warning of a fluvial flood event.

12.2 The property owners should prepare a flood plan to inform residents / site users of the flood risk to the site and provide advice on what to do in the event of a flood. This would need to include details of a safe access/egress route. Upon receiving a flood warning, site users should head north onto the A57 High Street (East) - an area of higher ground outside of the extreme flood extent. Residents on the land to the south of Glossop Brook should head south-west along Bank Street and onto Gladstone Street, an area shown outside of the extreme flood extent. A safe/access egress route plan is included in Appendix E.

13 Surface Water Management

13.1 The existing site is approximately 83% impermeable consisting of a former mill and other industrial properties.

13.2 As shown on the Topographical Survey (Appendix B) surface water runoff currently discharges from building areas directly to Glossop Brook. The existing buildings cover an area of approximately 1.6ha. The pond at the north-eastern extent of the site is not part of the site's drainage system. It is proposed to infill the pond as part of the development.

13.3 The pre and post-development surface water runoff rates and volumes have been estimated using a spreadsheet calculation in accordance with current best practice (see Appendix F). The additional surface water runoff resulting from a 30% increase for climate change has been taken into account in the calculations. Only building areas known to be served by a formal drainage system have been classified as impermeable in the pre-development calculation. A summary of the runoff rates and volumes is provided in Tables 3 and 4 below and overleaf:

Table 3 – Pre and post-development (with CCA) runoff rates

Peak Flow (l/s)	1 yr	30 yr	100 yr
Pre-development Peak Flow	139.82	342.02	431.83
Post-development Peak Flow	238.74	589.08	744.79
Increase	98.92	247.06	312.96

Table 4 – Pre and post-development (with CCA) runoff volumes

Volume (m^3)	100 yr
Pre-development	1949.23
Post-development	2788.90
Increase	839.67

13.4 As shown in Table 4 and 5, the peak rate of runoff increases as a result of the development. In order to ensure this increase will not have an impact elsewhere runoff rates should be restricted to the pre-development 1 in 1 year runoff rate. An estimated runoff rate is 140l/s.

13.5 The most practical option for surface water disposal from the site is discharge into the Glossop Brook. Reducing runoff rates to the pre-development 1 in 1 year rate will provide significant betterment to flood risk downstream during extreme storm events i.e. the 1 in 100 year event.

13.6 In order to restrict discharge to 140l/s attenuation will be required. Attenuation could be provided in the form of oversized pipes or an attenuation tank. Geocellular attenuation could be provided below car parking areas. An attenuation volume of 767m³ has been estimated for the site (see Appendix G). The attenuation volume is provided for the 1 in 100 year storm event including an allowance for climate change. The volume is based on a limited discharge rate of 140l/s and an impermeable drainage area of 22,040m² which accounts for all buildings, roads and hard standing.

14 Offsite Impacts

14.1 The effects of raising site levels above flood levels has been modelled to determine the impacts of site raising on flood risk elsewhere. Water level difference maps showing the depth variations during the site raised scenario are included in Appendix D.

14.2 The proposed modifications to the Woods Mill development levels (commercial and residential areas) are shown to have limited effect on flood risk elsewhere. During the 1% AEP + CCA event the proposed development arrangement is shown to largely reduce flood risk across the Woods Mill site; particularly the commercial zone. Water levels in the residential area reach a maximum of 150.65m AOD.

14.3 Throughout much of the wider floodplain the change in fluvial flood risk relative to the existing layout is minimal. Downstream of the development site there is a small increase in flow through the Market Place culvert, through which Glossop Brook flows, from 69m³/s during the ‘existing’ scenario to 71.4m³/s during the ‘proposed’. This results in a small increase (+50mm) of maximum water levels downstream of this structure.

14.4 During the extreme 0.1% AEP event, again the proposed changes to the Woods Mill levels is shown to have minimal impact on flood depths throughout much of the wider floodplain during this event. Throughout the Woods Mill site flood risk is largely reduced relative to the ‘existing’ situation and maximum depth within the VC Works area is shown to decrease by 280mm.

14.5 Downstream of the development site there is a small decrease in flow through the Market Place culvert, through which Glossop Brook flows, from 117m³/s during the 'existing' scenario to 114.2m³/s during the 'proposed'. This results in a small decrease (-50mm) on maximum water levels downstream of this structure.

15 Other Considerations

15.1 Flood defence consent from the Environment Agency (EA) will need to be established for any works within 8m from the top bank of Glossop Brook.

16 Summary and Conclusions

16.1 The proposed development at Woods Mill, Glossop, Derbyshire is located in Flood Zones 2 and 3 as identified on the Environment Agency Flood map. The existing site consists of large disused industrial units. The proposed mixed development is for commercial premises (including a supermarket) and residential dwellings. The residential development is considered 'more vulnerable' in accordance with NPPF. The proposed commercial development is considered 'less vulnerable'.

16.2 Given the need for regeneration in this area, and the fact that the site is outlined in the Local Plan for residential development it is considered reasonable that the development need of the site outweighs the flood risk. The flood risk to the site can be safely managed without increasing flood risk elsewhere.

16.3 The principal source of potential flooding at this site is from the Glossop Brook. Detailed hydraulic modelling has been undertaken to fully understand flood depths, velocities and extents. The southern extent of the site is shown to be at risk of flooding during the 1% AEP, 1% AEP + CCA, and the 0.1% AEP events, with flood depths averaging 0.3m during the 1% AEP event.

16.4 The flood risk to the site will be mitigated by raising floor and site levels. Hydraulic modelling has shown that the proposed development levels, if implemented, would provide a NPPF compliant development whilst having minimal impact on flood risk elsewhere during the 1% AEP + CCA event.

16.5 Safe access/egress routes have been identified for site users in the event of a flood.

16.6 Surface water runoff will be dealt with using Sustainable Drainage Systems. Runoff rates will be restricted to the pre-development 1 in 1 year rate. This will provide betterment and significant flow reduction during extreme storm events i.e. the 1 in 100 year event.

17 Recommendations

17.1 The finished floor levels of all residential buildings should be set a minimum of 300mm above the 1% AEP + CCA flood levels. The ground floor of the three storey block should be non-habitable rooms only and a raised access / egress route incorporated to provide a dry access egress route in a 0.1% AEP event.

17.2 The finished floor levels of the retail buildings should be set to be 300mm above the 1% AEP + CCA flood levels, or such that the flood depth during a 0.1% AEP event is limited to a maximum of 600mm; whichever is the higher.

17.3 The soffit level of the proposed new bridge should be set so as to provide 600mm freeboard above the 1% AEP + CCA flood level. The present estimated soffit level is 150.3m AOD.

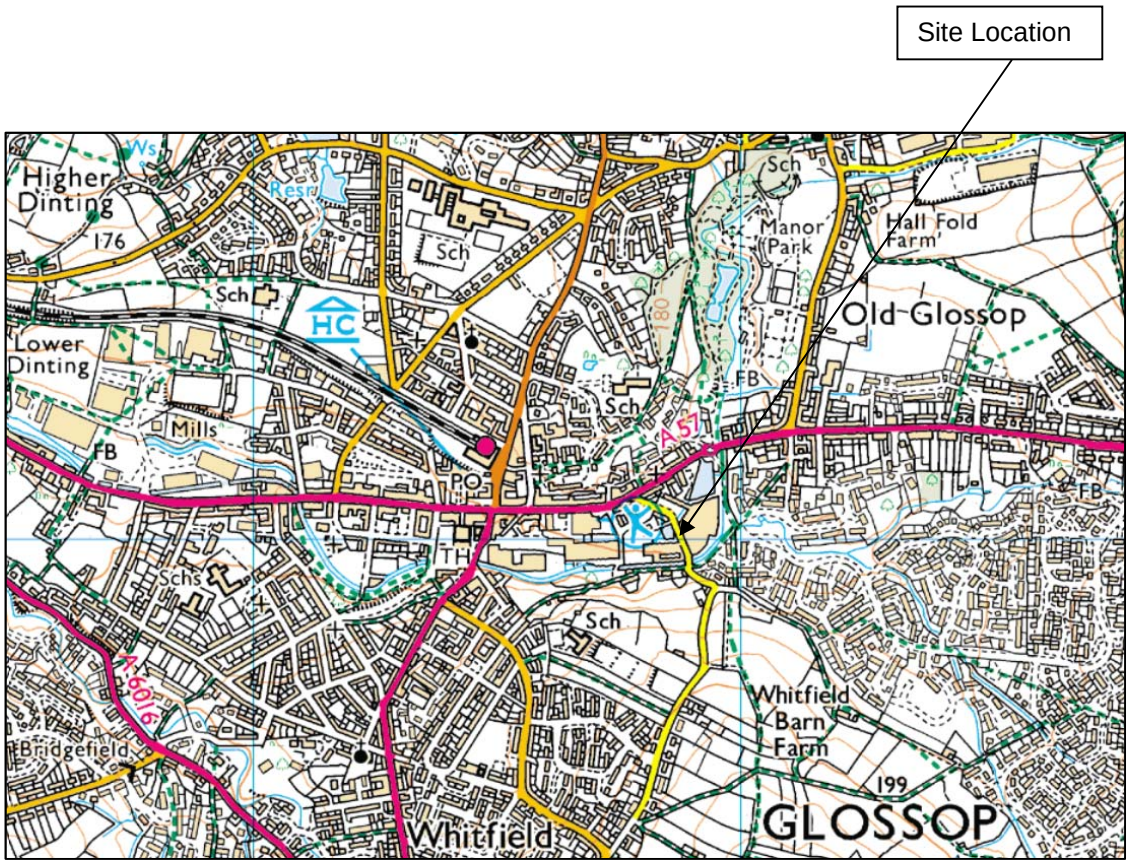
17.4 The recommendations included in the RIBA publication 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' dated May 2007 should be adopted.

17.5 Property owners should register on the EA Floodline Warnings Direct service and the Developer should prepare a flood plan to inform users of the flood risk to the site and provide advice on what to do in the event of a flood.

17.6 This Flood Risk Assessment should be submitted to the Planning Authority in support of the Planning Application.

17.7 Flood Defence Consent from the Environment Agency (EA) will need to be established for any works within 8m from the top bank of Glossop Brook.

Appendix A – Location Plan and Aerial Image



Site Location Plan

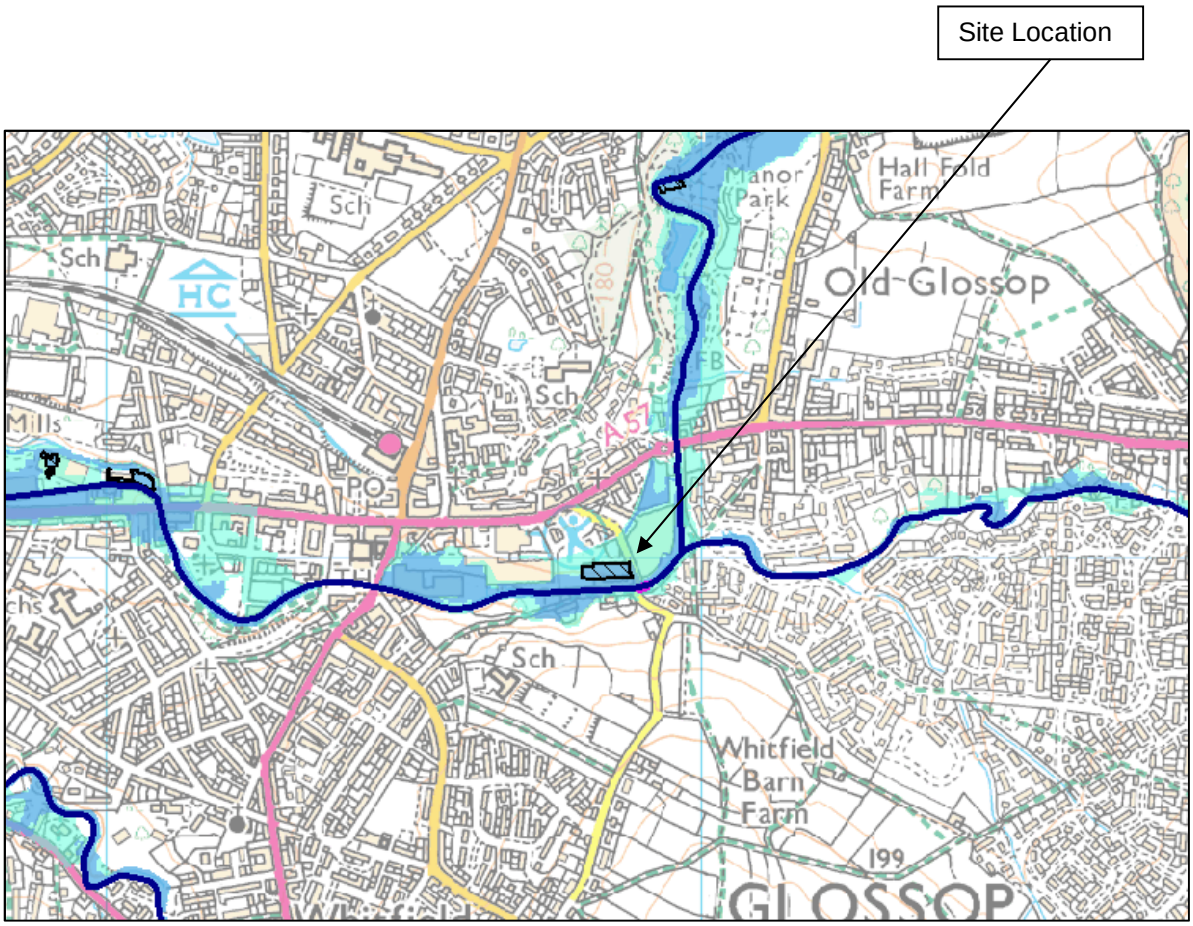
(Source: Street Map)

Aerial Photograph

(Source: Google Maps)

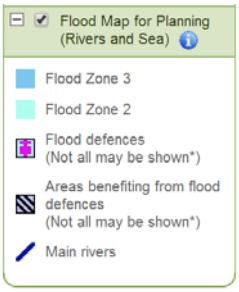
Appendix B – Proposed Development Plan and Topographical Survey

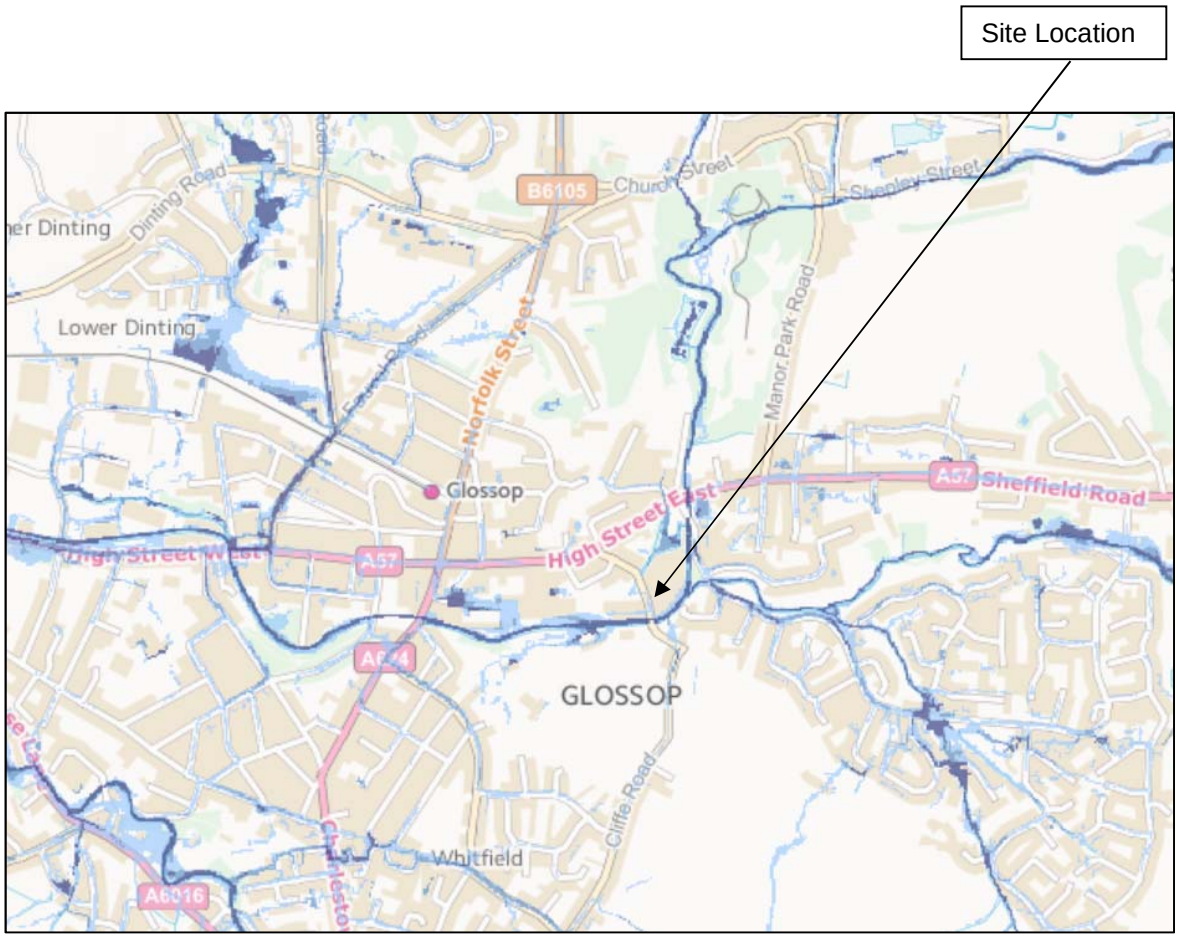
Appendix C – EA Flood Maps



Environment Agency Flood Map

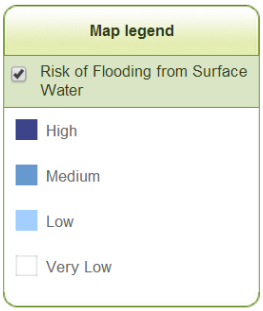
(November 2014)

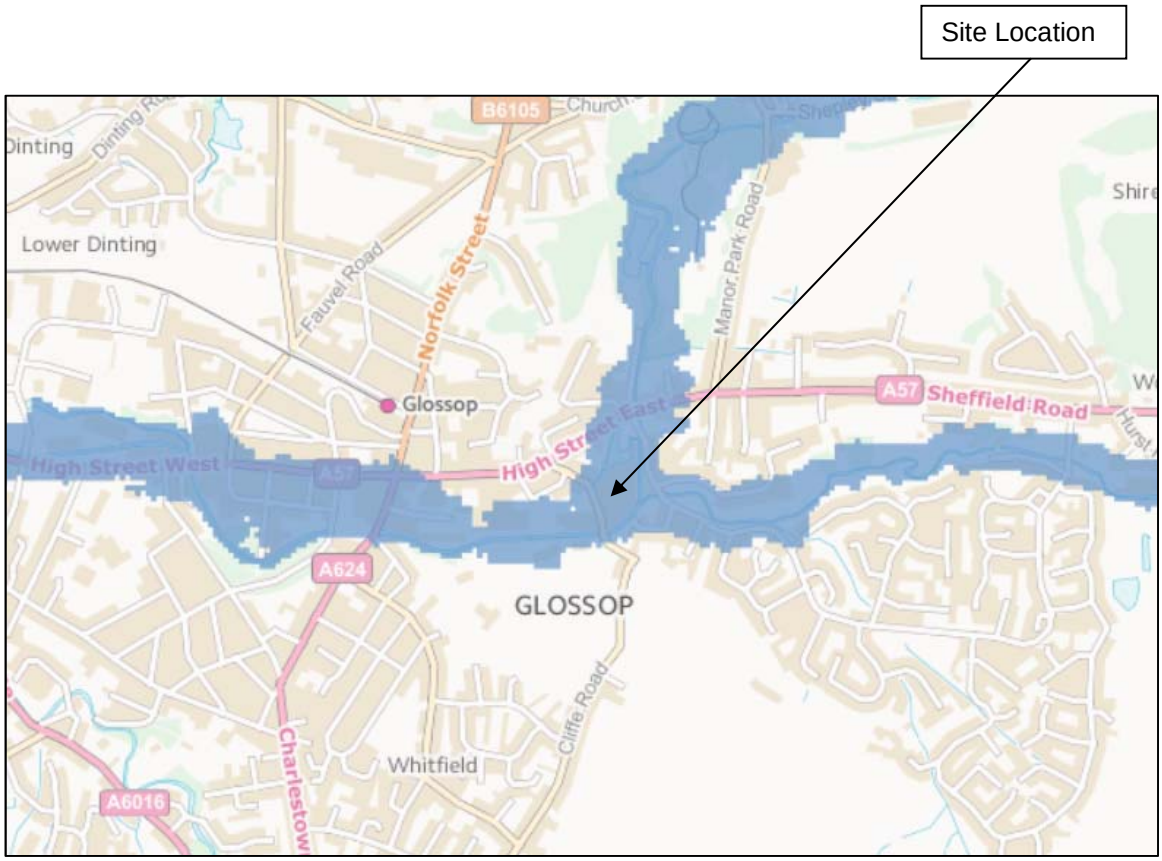




Environment Agency Flooding from Surface Water Map

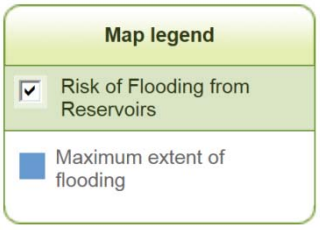
(November 2014)





Environment Agency Flooding from Reservoirs Map

(November 2014)



Appendix D – Hydraulic Modelling Results

Appendix E – Safe Access/Egress Route Plan

Appendix F – Surface Water Runoff Calculations

Appendix G – Storm Water Storage Calculations